

ภาคผนวก ค
เอกสารสอบเทียบเครื่องมือและอุปกรณ์

ภาคผนวก ค-1
เอกสารสอบเทียบเครื่องมือตรวจวัด

List of Instruments Certification for Air & Noise Quality Analysis

| No. | Instrument/Equipment | Parameter | Manufacturer | Model/Serial No. | Calibrator | Certification No. | Date of Calibration | Due date of Calibration | Remark |
|----------------|--------------------------------------|--|---------------------------|------------------------|--|-------------------|---------------------|-------------------------|--------|
| Ambient | | | | | | | | | |
| 1 | Orifice Transfer Standard Calibrator | Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM ₁₀) | Tisch Environmental, Inc. | TE-5025A 3383 | Jiranatee Associates Co., Ltd. | CL-003-65 | 26 Jul 22 | 25 Jul 24 | - |
| 2 | U-Tube Manometer | Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM ₁₀) | Dwyer | 1221-36-W/M - | Technology Promotion Association (Thailand-Japan) | 23P1401 | 9 May 23 | 8 May 24 | - |
| 3 | Mass Flow Meter | Ethylene Propylene | Alicat Scientific, Inc. | MB-5SCCM-D/5M 71015 | Miracle International Technology Co., Ltd. | L202309298-0002 | 27 Sep 23 | 26 Sep 24 | - |
| 4 | Aneroid Barometer | Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM ₁₀) Ethylene Propylene | Barigo, Germany | - | Technology Promotion Association (Thailand-Japan) | 23P1858 | 2 Jun 23 | 1 Jun 24 | - |
| 5 | Dial Thermo-Hygrometer | Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM ₁₀) Ethylene Propylene | Barigo, Germany | - | Technology Promotion Association (Thailand-Japan) | 23H1200 | 5 Jun 23 | 5 Jun 24 | - |
| 6 | Nitrogen Dioxide Analyzer | Nitrogen Dioxide | Thermo Scientific | 42i CM08130002 | UAE Consultant Co., Ltd. | 11012023 | 11 Mar 23 | 10 Jan 24 | - |
| 7 | Nitrogen Dioxide Analyzer | Nitrogen Dioxide | Thermo Scientific | 42i CM19050148 | UAE Consultant Co., Ltd. | 15022023 | 15 Feb 23 | 14 Feb 24 | - |
| 8 | Nitrogen Dioxide Analyzer | Nitrogen Dioxide | Thermo Scientific | 42i CM19050149 | UAE Consultant Co., Ltd. | 09012023 | 9 Jan 23 | 8 Jan 24 | - |
| 9 | Nitrogen Dioxide Analyzer | Nitrogen Dioxide | Thermo Scientific | 42i CM19050150 | UAE Consultant Co., Ltd. | 16012023 | 16 Jan 23 | 15 Jan 24 | - |
| 10 | Standard Gases (Mixture) | Nitrogen Dioxide | Airgas | EB0143262 2015PSIG | Airgas an Air Liquide company | E04NI99E15A01D3 | 21 Jun 21 | 21 Jun 24 | - |
| 11 | Wind Speed/Wind Direction | WS/WD | Scarlet Tech Ltd. | WL-21 2111DR0041 | Thai Meteorological Department | 143/23 | 31 Mar 23 | 30 Mar 24 | - |

List of Instruments Certification for Air & Noise Quality Analysis

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|----------------|---|-----------------------------|-------------------|---------------------|--------------------------------------|----------------------|------------------------|----------------------------|--------|
| Ambient | | | | | | | | | |
| 12 | Wind Speed/Wind Direction | WS/WD | Scarlet Tech Ltd. | WL-21 2111DR0052 | Thai Meteorological Department | 178/23 | 10 Apr 23 | 9 Apr 24 | - |
| 13 | Wind Speed/Wind Direction | WS/WD | Scarlet Tech Ltd. | WL-21 2112DR0102 | Thai Meteorological Department | 161/23 | 11 Apr 23 | 10 Apr 24 | - |
| 14 | Wind Speed/Wind Direction | WS/WD | Scarlet Tech Ltd. | WL-21 2205DT0105 | Thai Meteorological Department | 144/23 | 31 Mar 23 | 30 Mar 24 | - |
| 15 | Sound Level Calibrator (Acoustic Calibrator) | Calibrate Sound Level Meter | Svantek | SV36 107224 | Innovative Instrument Co.,Ltd. | 23-ACT-117 | 4 Aug 23 | 3 Aug 24 | - |
| 16 | Sound Level Meter | L _{Aeq} 24 hrs | Larson Davis | LxT2 0006689 | Larson Davis-A PCB Piezotronics Div. | 2022003082 | 11 Mar 22 | 10 Mar 24 | - |
| 17 | Sound Level Meter | L _{Aeq} 24 hrs | | LxT2 0006691 | | | | | |
| 18 | Sound Level Meter | L _{Aeq} 24 hrs | Larson Davis | LxT2 0006692 | Larson Davis-A PCB Piezotronics Div. | 2022003094 | 11 Mar 22 | 10 Mar 24 | - |
| 19 | Sound Level Meter | L _{Aeq} 24 hrs | | LxT2 0006693 | | | | | |
| 20 | Sound Level Meter | L _{Aeq} 24 hrs | Larson Davis | LxT2 0006694 | Larson Davis-A PCB Piezotronics Div. | 2022003098 | 11 Mar 22 | 10 Mar 24 | - |
| 21 | Sound Level Meter | L _{Aeq} 24 hrs | | LxT2 0006695 | | | | | |

List of Instruments Certification for Water Quality Analysis

| No. | Instrument/Equipment | Parameter | Manufacturer | Model/Serial No. | Calibrator | Certification No. | Date of Calibration | Due date of Calibration | Remark |
|-------|----------------------|-----------|--------------|-------------------|--|----------------------|------------------------|----------------------------|--------|
| Water | | | | | | | | | |
| 22 | pH Meter | pH | Ecosence | pH100A JC04740 | Technology Promotion Association (Thailand-Japan) | 23CH529 | 28 Apr 23 | 27 Apr 24 | - |

List of Instruments Certification for Air & Noise Quality Analysis

| No. | Instrument/Equipment | Parameter | Manufacturer | Model/Serial No. | Calibrator | Certification No. | Date of Calibration | Due date of Calibration | Remark |
|------------------|----------------------|--------------------------------------|--------------|--------------------|-----------------------------------|----------------------|------------------------|----------------------------|--------|
| Workplace | | | | | | | | | |
| 23 | Sound Level Meter | $L_{Aeq} 8 \text{ hrs}^*$ L_{Amax} | Rion, Japan | NL-42 00409023 | Sithiporn Associates Co., Ltd. | ACL23129 | 26 Apr 23 | 25 Apr 24 | - |
| 24 | Sound Level Meter | $L_{Aeq} 8 \text{ hrs}^*$ L_{Amax} | Rion, Japan | NL-42 00409176 | Sithiporn Associates Co., Ltd. | ACL23064 | 20 Jan 23 | 19 Jan 24 | - |
| 25 | Sound Level Meter | $L_{Aeq} 8 \text{ hrs}^*$ L_{Amax} | Rion, Japan | NL-42 00409050 | Sithiporn Associates Co., Ltd. | ACL23063 | 20 Jan 23 | 19 Jan 24 | - |
| 26 | Sound Level Meter | $L_{Aeq} 8 \text{ hrs}^*$ L_{Amax} | Rion, Japan | NL-42 00609500 | Sithiporn Associates Co., Ltd. | ACL23028 | 12 Jan 23 | 11 Jan 24 | - |
| 27 | Sound Level Meter | $L_{Aeq} 8 \text{ hrs}^*$ L_{Amax} | Rion, Japan | NL-42 00709651 | Sithiporn Associates Co., Ltd. | ACL23029 | 12 Jan 23 | 11 Jan 24 | - |
| 28 | Sound Level Meter | $L_{Aeq} 8 \text{ hrs}^*$ L_{Amax} | Rion, Japan | NL-42 01010780 | Sithiporn Associates Co., Ltd. | ACL23119 | 11 Apr 23 | 10 Apr 24 | - |
| 29 | Noise Dosimeter | Noise Dosimeter | Svantek | SV 104IS 106069 | Innovative Instrument Co.,Ltd. | 23-NDM-011 | 24 Jan 23 | 23 Jan 24 | - |
| 30 | Noise Dosimeter | Noise Dosimeter | Svantek | SV 104IS 128372 | Innovative Instrument Co.,Ltd. | 23-NDM-091 | 9 May 23 | 8 May 24 | - |
| 31 | Noise Dosimeter | Noise Dosimeter | Svantek | SV 104IS 128360 | Innovative Instrument Co.,Ltd. | 23-NDM-088 | 8 May 23 | 7 May 24 | - |
| 32 | Noise Dosimeter | Noise Dosimeter | Svantek | SV 104IS 128473 | Innovative Instrument Co.,Ltd. | 23-NDM-094 | 9 May 23 | 8 May 24 | - |
| 33 | Noise Dosimeter | Noise Dosimeter | Svantek | SV 104IS 67629 | Innovative Instrument Co.,Ltd. | 23-NDM-190 | 11 Aug 23 | 10 Aug 24 | - |
| 34 | Noise Dosimeter | Noise Dosimeter | Svantek | SV 104IS 128431 | Innovative Instrument Co.,Ltd. | 23-NDM-092 | 9 May 23 | 8 May 24 | - |
| 35 | Noise Dosimeter | Noise Dosimeter | Svantek | SV 104 117730 | Innovative Instrument Co.,Ltd. | 23-NDM-106 | 12 May 23 | 11 May 24 | - |

List of Instruments Certification for Air & Noise Quality Analysis

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|------------------|----------------------|-----------------|--------------|--------------------|-----------------------------------|-------------------|---------------------|-------------------------|--------|
| Workplace | | | | | | | | | |
| 36 | Noise Dosimeter | Noise Dosimeter | Svantek | SV 104IS 128367 | Innovative Instrument Co.,Ltd. | 23-NDM-090 | 8 May 23 | 7 May 24 | - |
| 37 | Noise Dosimeter | Noise Dosimeter | Svantek | SV 104 110830 | Innovative Instrument Co.,Ltd. | 23-NDM-127 | 25 May 23 | 24 May 24 | - |
| 38 | Noise Dosimeter | Noise Dosimeter | Svantek | SV 104 117694 | Innovative Instrument Co.,Ltd. | 23-NDM-110 | 15 May 23 | 14 May 24 | - |
| 39 | Noise Dosimeter | Noise Dosimeter | Svantek | SV 104 91928 | Innovative Instrument Co.,Ltd. | 23-NDM-009 | 24 Jan 23 | 23 Jan 24 | - |
| 40 | Noise Dosimeter | Noise Dosimeter | Svantek | SV 104 117688 | Innovative Instrument Co.,Ltd. | 23-NDM-108 | 12 May 23 | 11 May 24 | - |
| 41 | Noise Dosimeter | Noise Dosimeter | Svantek | SV 104 117693 | Innovative Instrument Co.,Ltd. | 23-NDM-107 | 12 May 23 | 11 May 24 | - |
| 42 | Noise Dosimeter | Noise Dosimeter | Svantek | SV 104 117696 | Innovative Instrument Co.,Ltd. | 23-NDM-105 | 12 May 23 | 11 May 24 | - |
| 43 | Noise Dosimeter | Noise Dosimeter | Svantek | SV 104 91925 | Innovative Instrument Co.,Ltd. | 23-NDM-013 | 25 Jan 23 | 24 Jan 24 | - |
| 44 | Noise Dosimeter | Noise Dosimeter | Svantek | SV 104IS 128363 | Innovative Instrument Co.,Ltd. | 23-NDM-089 | 8 May 23 | 7 May 24 | - |
| 45 | Noise Dosimeter | Noise Dosimeter | Svantek | SV 104IS 67627 | Innovative Instrument Co.,Ltd. | 23-NDM-222 | 29 Aug 23 | 28 Aug 24 | - |
| 46 | Noise Dosimeter | Noise Dosimeter | Svantek | SV 104IS 106063 | Innovative Instrument Co.,Ltd. | 23-NDM-062 | 23 Mar 23 | 22 Mar 24 | - |
| 47 | Noise Dosimeter | Noise Dosimeter | Svantek | SV 104IS 128477 | Innovative Instrument Co.,Ltd. | 23-NDM-097 | 9 May 23 | 8 May 24 | - |

List of Instruments Certification for Air & Noise Quality Analysis

| No. | Instrument/Equipment | Parameter | Manufacturer | Model/Serial No. | Calibrator | Certification No. | Date of Calibration | Due date of Calibration | Remark |
|------------------|-------------------------|--|------------------------------|---------------------|--|-------------------|---------------------|-------------------------|--------|
| Workplace | | | | | | | | | |
| 48 | Noise Dosimeter | Noise Dosimeter | Svantek | SV 104IS 128475 | Innovative Instrument Co.,Ltd. | 23-NDM-096 | 9 May 23 | 8 May 24 | - |
| 49 | Noise Dosimeter | Noise Dosimeter | Svantek | SV 104IS 67628 | Innovative Instrument Co.,Ltd. | 23-NDM-189 | 11 Aug 23 | 10 Aug 24 | - |
| 50 | Noise Dosimeter | Noise Dosimeter | Svantek | SV 104 117721 | Innovative Instrument Co.,Ltd. | 23-NDM-109 | 15 May 23 | 14 May 24 | - |
| 51 | Noise Dosimeter | Noise Dosimeter | Svantek | SV 104IS 128474 | Innovative Instrument Co.,Ltd. | 23-NDM-095 | 9 May 23 | 8 May 24 | - |
| 52 | Noise Dosimeter | Noise Dosimeter | Svantek | SV 104IS 128472 | Innovative Instrument Co.,Ltd. | 23-NDM-093 | 9 May 23 | 8 May 24 | - |
| 53 | Noise Dosimeter | Noise Dosimeter | Svantek | SV 104IS 106134 | Innovative Instrument Co.,Ltd. | 23-NDM-061 | 22 Mar 23 | 21 Mar 24 | - |
| 54 | Noise Dosimeter | Noise Dosimeter | Svantek | SV 104IS 128360 | Innovative Instrument Co.,Ltd. | 23-NDM-088 | 8 May 23 | 7 May 24 | - |
| 55 | Digital Lux Meter | Lux | Extech Instrument, Taiwan | 407026 A 016897 | Innovative Instrument Co., Ltd. | 23-LXM-052 | 14 Feb 23 | 13 Feb 24 | - |
| 56 | Digital Lux Meter | Lux | Extech Instrument, Taiwan | 407026 A 016905 | Innovative Instrument Co., Ltd. | 23-LXM-313 | 26 Oct 23 | 25 Oct 24 | - |
| 57 | Primary Flow Calibrator | Calibrate personal pump | TSL Inc | 4146 41461708009 | Innovative Instrument Co., Ltd. | 23-AFM-080 | 23 Mar 23 | 22 Mar 24 | - |
| 58 | Aneroid Barometer | Total Dust Respirable Dust Propylene Ethylene Butene-1 Hexene-1 | Barigo, Germany | - | Technology Promotion Association (Thailand-Japan) | 23P1858 | 2 Jun 23 | 1 Jun 24 | - |

List of Instruments Certification for Air & Noise Quality Analysis

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|-----------|-----------------------------|--|--------------|--------------------|--|----------------------|------------------------|----------------------------|--------|
| Workplace | | | | | | | | | |
| 59 | Digital Thermo - Hygrometer | Total Dust Respirable Dust Propylene Ethylene Butene-1 Hexene-1 | Digicon | TH-02 395034175 | Technology Promotion Association (Thailand-Japan) | 23H1101 | 24 May 23 | 23 May 24 | - |

CERTIFICATE OF CALIBRATION

Certificate No.: CL-003-65

Page 1 of 2 Pages

MEASUREMENT ITEM

MANUFACTURER

MODEL/TYPE

SERIAL NUMBER

ID NUMBER

CONDITION AS-RECEIVED

CUSTOMER

Top Load Office

Tach Environmental, Inc.

17E-0025A

3383

UAE-EFM/022/2560

Used Item

United Analyst and Engineering Consultant Co., Ltd.

81 Soi Udomsuk 41, Sukhumvit Road, Bangkok, Phrakhanong,

Bangkok 10260

RECEIVED DATE

15 Jul 2022

MEASUREMENT DATE

25 Jul 2022

ISSUE DATE

26 Jul 2022

ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follows:

Temperature: 23.0 ± 3.0 °C

Relative Humidity: 55.0 ± 15.0 %RH

Atmospheric Pressure: 1010 ± 10 hPa

CALIBRATION CONDITION:

Preconditioning: 24 hours at ambient conditions.

Measurement Condition: The average values during measurement are 24.8 °C and 55.1 %RH.

TABULATION OF RESULTS:

The table on next page gives the measured values.

Calibration procedure:

The Office gas flow device was calibrated against Standard Rotary Displacement Meter (Rods Meter) Model G65/HC/V2-0p. The W-62-004 was used as a calibration guideline.

Traceability:

This certificate provides a traceability of the measurement to recognize the national standards and to evidence of the international system (SI) units through the VSL (National Metrology Institute of Netherlands) via Certificate number: 02213901

Uncertainty of Measurement:

The reported uncertainty of measurement is based on the standard uncertainty multiplied by a coverage factor $k=2$, which for a normal distribution corresponds to a coverage probability of approximately 95%. The standard uncertainty has been determined in accordance with the GUM "Evaluation of measurement data - Guide to the expression of uncertainty in measurement"

Calibrated by:

Mr. Sateen Thirathat
Mr. Misa Jiranan Lerthongkol



Approved signatory:

Mr. Parinya Booncharoen
Calibration Department Manager

Continuation of Certificate of Calibration Number CL-003-65

Page 2 of 2 Pages

MEASUREMENT RESULTS:

The Office gas flow device was calibrated by direct comparison method with the Standard Rotary Displacement Meter (Rods Meter). The humid air was used as a medium in the system. The standard conditions are 25 °C (298.15 K) and 760 mmHg for standard temperature and standard pressure respectively.

Table 1: The results of Q standard calibration data

| Plate | Flow rate m ³ /min | Pressure [Pa] mmHg | Temperature [T _g] °C | Temperature [T _m] °C | Ap_meter mmHg | Ap_Office inH ₂ O | Y | Standard Flow [Q _s] m ³ /min |
|-------|----------------------------------|--------------------------|--|--|------------------|---------------------------------|-------|--|
| 1 | 0.697 | 754.265 | 24.640 | 23.960 | 55.399 | 1.699 | 1.299 | 0.647 |
| 2 | 1.000 | 754.236 | 24.950 | 24.350 | 62.172 | 3.444 | 1.849 | 0.933 |
| 3 | 1.118 | 754.323 | 24.730 | 24.210 | 41.925 | 4.582 | 2.233 | 1.051 |
| 4 | 1.169 | 754.212 | 24.640 | 24.160 | 31.045 | 5.150 | 2.262 | 1.116 |
| 5 | 1.416 | 754.175 | 24.480 | 24.210 | 30.117 | 7.629 | 2.754 | 1.353 |

Slope (k):

2.04804

Intercept (b):

-0.01999

Correlation coefficient (r):

0.99982

Uncertainty (k=2):

0.011 m³/min

Table 2: The results of Q actual calibration data

| Plate | Flow rate m ³ /min | Pressure [Pa] mmHg | Temperature [T _g] °C | Temperature [T _m] °C | Ap_meter mmHg | Ap_Office inH ₂ O | Y | Standard Flow [Q _s] m ³ /min |
|-------|----------------------------------|--------------------------|--|--|------------------|---------------------------------|-------|--|
| 1 | 0.697 | 754.265 | 24.640 | 23.960 | 55.399 | 1.699 | 0.819 | 0.647 |
| 2 | 1.000 | 754.236 | 24.950 | 24.350 | 62.172 | 3.444 | 1.167 | 0.933 |
| 3 | 1.118 | 754.323 | 24.730 | 24.210 | 41.925 | 4.582 | 1.345 | 1.058 |
| 4 | 1.169 | 754.212 | 24.640 | 24.160 | 31.045 | 5.150 | 1.426 | 1.123 |
| 5 | 1.416 | 754.175 | 24.480 | 24.210 | 30.117 | 7.629 | 1.735 | 1.363 |

Slope (k):

1.28277

Intercept (b):

-0.01223

Correlation coefficient (r):

0.99982

Uncertainty (k=2):

0.012 m³/min

End of Certificate of Calibration



THIS CERTIFICATE REPORT MAY NOT BE REPRODUCED EXCEPT IN FULL UNLESS PERMISSION FOR IN WRITING FROM THE LABORATORY

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

Certificate of Calibration

Certificate No.: 23P1401
Page: 1 of 2

Equipment:

U-Tube Manometer

Manufacturer:

Dwyer

Model:

1221-36/W/M

Serial No.:

-

ID No.:

UAE-EFM/022/2560

Condition As-Received:

Used Item

Received Date:

26 April 2023

Calibration Date:

09 May 2023

Reference:

2304-0703WSC

Submitted by: United Analyst and Engineering Consultant Co., Ltd.

Ambient Temperature:

(23 ± 2) °C

81 Soi Udomsuk 41, Sukhumvit Road, Bangkok,

Relative Humidity:

(50 ± 15) %

Phrakhanong, Bangkok 10260

Atmospheric Pressure:

1010 mbar

Procedure used:

The calibration was conducted by direct comparison method against Pressure Measuring Instruments Standard according to in-house calibration procedure CP-P04, using "DKD-R 6-1 : Calibration of Pressure Gauges, Edition 03/2014" as a guidelines.

Condition of this result of calibration

1. Reference standards instruments:

Instrument

Serial No.

Certificate No.

Due Date

1) Pressure Calibrator

PC106P

1189

MP-0137-22

24 Aug 2023

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

3. Scale and conversion factor is $1 \text{ kPa} = 0.0145039 \text{ inHg}$

4. This instrument was used clean air and oil as pressure media.

5. This instrument was calibrated by applied pressure to high-port (+) side and low-port (-) side open to atmospheric pressure.

6. This instrument was installed in vertical orientation and top of the pressure port was used as the reference level.

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

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

-National Institute of Metrology Thailand (NIMT)

Calibrated by: Suwit Aissarnae

Issue Date: 11 May 2023

Approved Signatory:

Attapol P.

[] Phalinee Pratsapal

[] Sura Suwananai

[x] Attapol Panurach

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B 0314241



Cert.No.: 23P1401
Page: 2 of 2

Result of calibration: Without adjustment

Function: Pressure Measurement

Increasing Pressure

Range: 0 inH₂O to 36 inH₂O

Scale Interval: 0.1 inH₂O (The Fifth Estimate)

| Applied Pressure (inH ₂ O) | High-port side (inH ₂ O) | Low-port side (inH ₂ O) | ΔP (inH ₂ O) | Error (inH ₂ O) |
|--|--|---------------------------------------|----------------------------|-------------------------------|
| 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 2.00 | 1.00 | -0.98 | 1.98 | -0.02 |
| 4.00 | 2.00 | -1.98 | 3.98 | -0.02 |
| 6.00 | 3.00 | -2.98 | 5.98 | -0.02 |
| 8.00 | 4.00 | -3.98 | 7.98 | -0.02 |
| 10.00 | 5.00 | -4.98 | 9.98 | -0.02 |
| 12.00 | 6.00 | -5.98 | 12.00 | 0.00 |
| 14.00 | 7.00 | -7.00 | 14.00 | 0.00 |
| 16.00 | 8.00 | -8.00 | 16.00 | 0.00 |
| 18.00 | 9.00 | -9.00 | 18.00 | 0.00 |
| 20.00 | 10.00 | -10.00 | 20.00 | 0.00 |
| 22.00 | 11.00 | -11.00 | 22.00 | 0.00 |
| 24.00 | 12.02 | -12.02 | 24.02 | 0.02 |
| 26.00 | 13.02 | -13.02 | 26.02 | 0.02 |
| 28.00 | 14.02 | -14.02 | 28.02 | 0.02 |
| 30.00 | 15.04 | -15.00 | 30.04 | 0.04 |
| 32.00 | 16.04 | -16.00 | 32.04 | 0.04 |
| 34.00 | 17.02 | -17.00 | 34.02 | 0.02 |
| 35.80 | 18.00 | -17.96 | 35.96 | 0.16 |

The uncertainty of measurement was ± 0.11 inH₂O

* UUC = Unit Under Calibration

* ΔP = High-port side - Low-port side

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 %.

-o0o-

Attapol P.

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a 1160340



CALIBRATION CERTIFICATE

Certificate No. : L202309298-0002

Date Issued : 28-Sep-23

Customer : United Analyst and Engineering Consultant Co.,Ltd.
81 Soi Udomsuk 41,Sukhumvit Road,Bangchak,Phrakhanong,Bangkok
10260

Equipment : Mass Flow Meter

Manufacturer : Alicat Scientific

Model : MB-5SCCM-D/5M

Serial No. : 71015

ID No./Tag No. : UAE.EMA2.119/2555

Date Received : 25-Sep-23

Date Calibrated : 27-Sep-23

Calibrated by : Mr. Jame Khaothong

Calibration Method or Calibration Procedure Used

In-house method : CP-34 by comparison against mass flow calibrator.

This certificate is traceable to national standards, which realize the units of measurement according to the International System of Units (SI).

Result of Calibration

The reported uncertainty of measurement was based on standard uncertainty multiplied by a coverage factor $k = 2$, providing a level confidence approximately 95 percent.

This certificate may not be reproduced other than in full except with the prior written approval of the Miracle International Technology Company Limited.

Approved by: *Sorayuth T.*
(Mr. Sarayuth Toehua)



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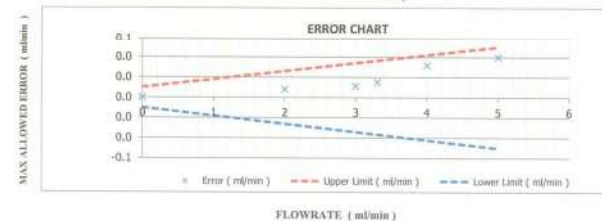
Certificate No. : L202309298-0002

Environment : Ambient temperature : (23 ± 2) °C
Relative humidity : (50 ± 15) % RH
Capacity Range : 5 ml/min
Calibration Media : Air
Type : Mass Flowmeter

| Unit Under Calibration Reference Condition : Pressure 101.325 kPa(abs) , 25 °C , Air | | | | | | | |
|--|---------------------|---------------------------|---------------------------|---------------------|-----------------------------|-------------------|-------------------------------------|
| Temperature (°C) | Pressure (kPa) | UUC Reading (ml/min) | STD Reading (ml/min) | Error (ml/min) | Uncertainty (± ml/min) | MPE (ml/min) | Pass / Fail Simple Acceptance |
| 23.81 | 100.52 | 0.000 | 0.000 * | 0.000 | 0.063 | 0.010 | Pass |
| 23.81 | 104.15 | 2.002 | 1.994 | 0.008 | 0.094 | 0.026 | Pass |
| 23.82 | 105.79 | 3.001 | 2.990 | 0.011 | 0.13 | 0.034 | Pass |
| 23.86 | 106.28 | 3.305 | 3.290 | 0.015 | 0.14 | 0.036 | Pass |
| 23.87 | 107.53 | 4.006 | 3.974 | 0.032 | 0.16 | 0.042 | Pass |
| 23.97 | 109.53 | 5.004 | 4.964 | 0.040 | 0.19 | 0.050 | Pass |

Error = Unit Under Calibration - Standard Pass = |error| <= |MPE|
Fail = |error| > |MPE|

Marked * are not included in the NSC-ONSC accreditation schedule for our laboratory.



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Certificate No. : L202309298-0002

Note : The actual flow rate is determined by the equation :

$$Q_{Meas} = Q_{Ref} \times \frac{P_{Ref}}{P_{Meas}} \times \frac{T_{Meas}}{T_{Ref}}$$

; Q = Flow rate
 ; P = Absolute pressure
 ; T = Absolute temperature
 ; Subscript "Meas" = Measurement condition
 ; Subscript "Ref" = Reference condition

Condition As-Received : Used Item

The measurement results and statements of conformity with specification only relate to the item calibrated.

Traceability of Certificate :

The International System of Units (SI) through

NIMT Calibration Certificate No. MW-0013-22 for Mass Flow Calibrator (20 SCCM) Serial No. G500971G20, Due 22-Feb-24

End of Certificate

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TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3 EQUIPMENT CALIBRATION AND TESTING SERVICES
534/4 BATTANAKARN ROAD SOI 18, SUKHUMVI, SUKHUMVI, BANGKOK 10258
TEL. 0-2717-3880-24 FAX. 0-2719-9484

Certificate of Calibration

Certificate No. : 23P1658
Page : 1 of 2

Equipment : Aneroid Barometer
Manufacturer : Barigo
Model : -
Serial No. : -
ID No. : UAE.ANV.124/2550
Condition As-Received : Used Item
Received Date : 26 May 2023
Calibration Date : 02 June 2023
Reference : 2305-0919WSG
Ambient Temperature : (23 ± 2) °C
Relative Humidity : (50 ± 15) %
Atmospheric Pressure : 1007 mbar
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
81 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phrakhanong, Bangkok 10260

Procedure used : The calibration was conducted by direct comparison method against Pressure Measuring Instruments Standard according to in-house calibration procedure CP-P10, using "DKD-R 6-1 ; Calibration of Pressure Gauges, Edition 03/2014 " as a guidelines.

Condition of this result of calibration

- Reference standards instruments :

| Instrument | Model | Serial No. | Certificate No. | Due Date |
|-----------------------|--------|------------|-----------------|-------------|
| 1) Standard Barometer | DP1142 | 1422505046 | MP-0094-23 | 03 May 2024 |
- This instrument was installed in vertical orientation and center of the dial was used as the reference level.
- This result of calibration was made on requested at the point specified by customer.
- This result of calibration instrument was in absolute pressure.
- This instrument was used clean air as pressure media.
- The certificate is valid only to the item calibrated on date and place of calibration.
- This Certification is traceable to the International System of Unit maintained through:-
-National Institute of Metrology Thailand (NIMT)

Calibrated by : Sukson Khankaew
Issue Date : 08 June 2023

Approved Signatory : *Attapol P.*
[] Phalinee Pratsapal
[] Sura Suwanasri
[x] Attapol Panurach

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0316958



Cert.No.: 23P1858
Page: 2 of 2

Result of calibration:- Without adjustment
Function:- Absolute Pressure Measurement

Range: 960 hPa to 1030 hPa
Scale Interval: 1 hPa (The Fifth Estimate)

| | | | | | | | | |
|------------------------|--------|--------|--------|--------|---------|---------|---------|---------|
| Applied Pressure (hPa) | 959.93 | 970.47 | 981.93 | 991.32 | 1002.29 | 1011.04 | 1021.14 | 1032.30 |
| UUC* Indication (hPa) | 960.0 | 970.0 | 980.0 | 990.0 | 1000.0 | 1010.0 | 1020.0 | 1030.0 |
| Error (hPa) | 0.07 | -0.47 | -1.93 | -1.32 | -2.29 | -1.84 | -1.14 | -2.30 |

| | | | | | | | | |
|------------------------|---------|---------|---------|---------|--------|--------|--------|--------|
| Decreasing Pressure | | | | | | | | |
| Applied Pressure (hPa) | 1032.30 | 1021.44 | 1011.67 | 1002.36 | 992.35 | 981.94 | 970.49 | 959.94 |
| UUC* Indication (hPa) | 1030.0 | 1020.0 | 1010.0 | 1000.0 | 990.0 | 980.0 | 970.0 | 960.0 |
| Error (hPa) | -2.30 | -1.44 | -1.67 | -2.36 | -2.35 | -1.94 | -0.49 | 0.06 |

The uncertainty of measurement was ± 0.30 hPa

* UUC = Unit Under Calibration

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

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Atapol P.
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1165506



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
534/4 PATTANAKARN ROAD SOI 18, SUANLIANG, SUANLIANG, BANGKOK 10250
TEL: 0-2717-3880-24 FAX: 0-2718-9484



Certificate of Calibration

Certificate No.: 23H1200
Page: 1 of 2

Equipment: Dial Thermo-Hygrometer

Manufacturer: Barigo

Model: -

Serial No.: -

ID No.: UAE.ANV.130/2550

Condition As-Received: Used Item

Received Date: 26 May 2023

Calibration Date: 30 May 2023

Reference: 2305-0919WSC

Ambient Temperature: $(25 \pm 3) ^\circ\text{C}$

Relative Humidity: $(50 \pm 30) \%$

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: United Analyst and Engineering Consultant Co., Ltd.

81 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phraekhong, Bangkok 10260

Procedure used: Calibration were conducted using in-house calibration procedure CP-H02 according to comparison with standard chilled mirror sensor for humidity measurement function and comparison with standard temperature probe for temperature measurement function into humidity / temperature chamber.

Condition of this result of calibration

1. Reference standards instruments:

| Instrument | Model | Serial No. | Certificate No. | Due Date |
|-------------------------------------|-------|------------|-----------------|-------------|
| 1) Hygro-M2 Dew Point Monitor | 5112 | 2360195 | 20703 | 02 Aug 2023 |
| 2) Handheld Thermometer With Sensor | 1523 | 3240076 | 231005 | 15 Mar 2024 |

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

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

- National Institute of Standards and Technology (NIST), The United States of America

- Technology Promotion Association (Thailand-Japan), NSC-ONSC Accredited No. Calibration 0008

Calibrated by: Somchai Duhwor

Issue Date: 07 June 2023

Approved Signatory:

☒ Chakrit Waeewarjua
☐ Pornthippa Tameyakul
☐ Viporn Tantiyawutti

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B 0316274



Cert. No.: 23H1200
Page: 2 of 2

Result of Calibration:- Before Adjustment
Function: Humidity Measurement

| Reference Temperature ($^\circ\text{C}$) | Standard Humidity (%R.H.) | UUC* Reading (%R.H.) | Error (%R.H.) | Uncertainty of Measurement ($\pm\%$ R.H.) |
|---|------------------------------|-------------------------|------------------|---|
| 25.0 | 40.1 | 48 | 7.9 | 1.6 |
| 25.0 | 60.0 | 63 | 3.0 | 1.7 |
| 25.0 | 80.0 | 76 | -4.0 | 1.9 |

Result of Calibration:- After Adjustment
Function: Humidity Measurement

| Reference Temperature ($^\circ\text{C}$) | Standard Humidity (%R.H.) | UUC* Reading (%R.H.) | Error (%R.H.) | Uncertainty of Measurement ($\pm\%$ R.H.) |
|---|------------------------------|-------------------------|------------------|---|
| 25.0 | 40.1 | 44 | 3.9 | 1.6 |
| 25.0 | 60.0 | 60 | 0.0 | 1.7 |
| 25.0 | 80.0 | 75 | -5.0 | 1.9 |

Result of Calibration:- Without Adjustment
Function: Temperature Measurement

| Standard Temperature ($^\circ\text{C}$) | UUC* Reading ($^\circ\text{C}$) | Error ($^\circ\text{C}$) | Uncertainty of Measurement ($\pm\%$ °C) |
|--|--------------------------------------|-------------------------------|---|
| 19.987 | 20.0 | 0.013 | 0.72 |
| 30.016 | 30.0 | -0.016 | 0.72 |
| 39.944 | 39.5 | -0.444 | 0.72 |

UUC* : Unit Under Calibration

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

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1165295



United Analyst and Engineering Consultant Co., Ltd.

3 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Phraekhong, Bangkok 10260

Tel: 0 2763 2826 Fax 0 2763 2800 www.uaeconsultant.com E-mail: uae@uaeconsultant.com

MULTI-POINT GAS TEST REPORT

Test Date: Jan 11, 2023

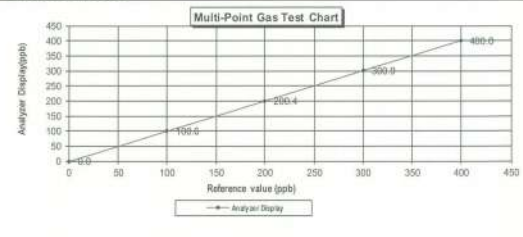
Equipment: Gas Analyzer (NO₂) Model: 42i
Manufacturer: Thermo Scientific Serial Number: CM08130002

Standard Gas Concentration

| Standard Gas Concentration | Value | Unit | Dilutor Detail |
|------------------------------------|--------------|------|---------------------------------|
| Sulphur Dioxide (SO ₂) | 44.68 | PPM | Manufacturer: Thermo Scientific |
| Nitric Oxide (NO) | 45.94 | PPM | Model: 146i |
| Methane (CH ₄) | - | PPM | Serial Number: 1180540071 |
| Carbon Monoxide (CO) | 984.8 | PPM | |
| Cylinder No.: | EB0143262 | | |
| Expiration Date: | Jun 21, 2024 | | |

Multi-point gas test data

| Reference Value (ppb) | Analyzer Display (ppb) | Difference Error | Percent Error | [% Error] |
|-------------------------|------------------------|------------------------|---------------|-----------|
| Level 1 Zero | 0.0 | 0.00 | 0.00 | 0.00 |
| Level 2 100.00% | 100.0 | 0.60 | 0.60 | 0.60 |
| Level 3 40.00% | 200.0 | 0.40 | 0.20 | 0.20 |
| Level 4 60.00% | 300.0 | 0.90 | 0.30 | 0.30 |
| Level 5 100.00% | 400.0 | 0.60 | 0.15 | 0.15 |
| Remark: Measuring Range | 500.0 ppb | Average Difference (%) | 0.22 | |
| Acceptable Limit | $\pm 5\%$ | | | |



Calculate by
Somchai Duhwor
11/1/2023

Approve by
Chakrit Waeewarjua
11/1/2023

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MULTI-POINT GAS TEST REPORT

Test Date : Feb 15, 2023

Equipment : Gas Analyzer (NO₂) Model : 42i
Manufacturer : Thermo Scientific Serial Number : CM19050148

Standard Gas Concentration

| | | | | |
|------------------------------------|--------------|-----|-----------------|-------------------|
| Sulphur Dioxide (SO ₂) | 44.68 | PPM | Manufacturer : | Thermo Scientific |
| Nitric Oxide (NO) | 45.94 | PPM | Model : | 146i |
| Methane (CH ₄) | - | PPM | Serial Number : | 1180540071 |
| Carbon Monoxide (CO) | 984.8 | | | |
| Cylinder No. : | EB0143262 | | | |
| Expiration Date : | Jun 21, 2024 | | | |

Dilutor Detail

Multi-point gas test data

| Reference Value (ppb) | Analyzer Display (ppb) | Difference Error | Percent Error | [% Error] |
|--------------------------|------------------------|------------------------|---------------|-----------|
| Level 1 Zero | 0.0 | 0.00 | 0.00 | 0.00 |
| Level 2 20.00% | 100.2 | 0.20 | 0.20 | 0.20 |
| Level 3 40.00% | 201.0 | 1.00 | 0.50 | 0.50 |
| Level 4 60.00% | 300.9 | 0.90 | 0.30 | 0.30 |
| Level 5 80.00% | 400.0 | 0.00 | 0.00 | 0.00 |
| Remark : Measuring Range | 500.0 ppb | Average Difference (%) | 0.20 | |

Acceptable Limit $\pm 5\%$

Multi-Point Gas Test Chart

Calculate by *Sirichan Sangmanee* 15 Feb 2023

Approve by *Sirichan Sangmanee* 15 Feb 2023

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MULTI-POINT GAS TEST REPORT

Test Date : Jan 9, 2023

Equipment : Gas Analyzer (NO₂) Model : 42i
Manufacturer : Thermo Scientific Serial Number : CM19050149

Standard Gas Concentration

| | | | | |
|------------------------------------|--------------|-----|-----------------|-------------------|
| Sulphur Dioxide (SO ₂) | 44.68 | PPM | Manufacturer : | Thermo Scientific |
| Nitric Oxide (NO) | 45.94 | PPM | Model : | 146i |
| Methane (CH ₄) | - | PPM | Serial Number : | 1180540071 |
| Carbon Monoxide (CO) | 984.8 | | | |
| Cylinder No. : | EB0143262 | | | |
| Expiration Date : | Jun 21, 2024 | | | |

Dilutor Detail

Multi-point gas test data

| Reference Value (ppb) | Analyzer Display (ppb) | Difference Error | Percent Error | [% Error] |
|--------------------------|------------------------|------------------------|---------------|-----------|
| Level 1 Zero | 0.0 | 0.00 | 0.00 | 0.00 |
| Level 2 20.00% | 100.8 | 0.80 | 0.79 | 0.79 |
| Level 3 40.00% | 201.2 | 1.20 | 0.60 | 0.60 |
| Level 4 60.00% | 300.7 | 0.70 | 0.23 | 0.23 |
| Level 5 80.00% | 400.0 | 0.00 | 0.00 | 0.00 |
| Remark : Measuring Range | 500.0 ppb | Average Difference (%) | 0.32 | |

Acceptable Limit $\pm 5\%$

Multi-Point Gas Test Chart

Calculate by *Sirichan Sangmanee* 9 Jan 2023

Approve by *Sirichan Sangmanee* 9 Jan 2023

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MULTI-POINT GAS TEST REPORT

Test Date : Jan 16, 2023

Equipment : Gas Analyzer (NO₂) Model : 42i
Manufacturer : Thermo Scientific Serial Number : CM19050150

Standard Gas Concentration

| | | | | |
|------------------------------------|--------------|-----|-----------------|-------------------|
| Sulphur Dioxide (SO ₂) | 44.68 | PPM | Manufacturer : | Thermo Scientific |
| Nitric Oxide (NO) | 45.94 | PPM | Model : | 146i |
| Methane (CH ₄) | - | PPM | Serial Number : | 1180540071 |
| Carbon Monoxide (CO) | 984.8 | | | |
| Cylinder No. : | EB0143262 | | | |
| Expiration Date : | Jun 21, 2024 | | | |

Dilutor Detail

Multi-point gas test data

| Reference Value (ppb) | Analyzer Display (ppb) | Difference Error | Percent Error | [% Error] |
|--------------------------|------------------------|------------------------|---------------|-----------|
| Level 1 Zero | 0.0 | 0.00 | 0.00 | 0.00 |
| Level 2 20.00% | 100.5 | 0.50 | 0.50 | 0.50 |
| Level 3 40.00% | 200.6 | 0.60 | 0.30 | 0.30 |
| Level 4 60.00% | 300.7 | 0.70 | 0.23 | 0.23 |
| Level 5 80.00% | 400.0 | 0.00 | 0.00 | 0.00 |
| Remark : Measuring Range | 500.0 ppb | Average Difference (%) | 0.21 | |

Acceptable Limit $\pm 5\%$

Multi-Point Gas Test Chart

Calculate by *Aphint* 16 Jan 2023

Approve by *Aphint* 16 Jan 2023

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CERTIFICATE OF ANALYSIS

Grade of Product: EPA Protocol

Part Number: E04N199E15A01D3 Reference Number: 122-402135167-1
Cylinder Number: EB0143262 Cylinder Volume: 144.4 CF
Laboratory: 124 - Durham (SAP) - NC Cylinder Pressure: 2015 PSIG
PGVP Number: B22021 Valve Outlet: 680
Gas Code: CO,NO,NOX,SO2,BALN Certification Date: Jun 21, 2021

Expiration Date: Jun 21, 2024

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 600/R-12/031, using the assay procedures listed. Analytical Methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a mole/mole basis unless otherwise noted.

Do Not Use This Cylinder below 100 psia, i.e. 6.7 megapascals

| ANALYTICAL RESULTS | | | | | |
|--------------------|-------------------------|----------------------|-----------------|----------------------------|------------------------|
| Component | Requested Concentration | Actual Concentration | Protocol Method | Total Relative Uncertainty | Assay Dates |
| NOX | 45.00 PPM | 45.96 PPM | G1 | $\pm 1.4\%$ NIST Traceable | 06/14/2021, 08/21/2021 |
| NITRIC OXIDE | 45.00 PPM | 45.94 PPM | G1 | $\pm 1.4\%$ NIST Traceable | 06/14/2021, 08/21/2021 |
| SULFUR DIOXIDE | 45.00 PPM | 44.88 PPM | G1 | $\pm 1.0\%$ NIST Traceable | 06/14/2021, 08/21/2021 |
| CARBON MONOXIDE | 1900 PPM | 984.8 PPM | G1 | $\pm 0.7\%$ NIST Traceable | 06/14/2021 |
| NITROGEN | Balance | | | | |

| CALIBRATION STANDARDS | | | | |
|-----------------------|--------------|-------------|-------------------------------------|-------------|
| Type | Lot ID | Cylinder No | Concentration | Uncertainty |
| NTRM | 20081120 | CC708068 | 45.82 PPM NITRIC OXIDE/NITROGEN | $\pm 1.0\%$ |
| PRM | 121505 | CC809055 | 9.91 PPM NITROGEN DIOXIDE/NITROGEN | $\pm 1.0\%$ |
| GMIS | 401423836102 | CC505081 | 4.345 PPM NITROGEN DIOXIDE/NITROGEN | $\pm 1.1\%$ |
| NTRM | 16011043 | CC473277 | 45.02 PPM SULFUR DIOXIDE/NITROGEN | $\pm 0.8\%$ |
| NTRM | 14080119 | CC434277 | 990.9 PPM CARBON MONOXIDE/NITROGEN | $\pm 0.6\%$ |

The SRM, PRM or RGM noted above is only in reference to the GMIS used in the assay and not part of the analysis.

| ANALYTICAL EQUIPMENT | | | |
|-----------------------------|----------------------|-----------------------------|--|
| Instrument/Make/Model | Analytical Principle | Last Multipoint Calibration | |
| Nicolet 6700 AHR0801333 CO | FTIR | Jun 03, 2021 | |
| Nicolet 6700 AHR0801333 NO | FTIR | Jun 03, 2021 | |
| Nicolet 6700 AHR0801333 NO2 | FTIR | Jun 03, 2021 | |
| Nicolet 6700 AHR0801333 SO2 | FTIR | Jun 03, 2021 | |

Triad Data Available Upon Request

NOTES: PO #5221002607
GROSS WT: 28.40kg
NET WT: 4.73kg



The analytical test results reported on this certificate relate only to the cylinder number specified above. This concludes the test report.

Approved for Release



CERT 3002.01

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THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2804, 0-2399-0469

Calibration Certificate

Issued by : Calibration & Test Section : Meteorological Instruments Bureau

Date of Issue : 31 March, 2023

Certification No. 143/23

Page : 1 of 5

Object : WIRELESS ANEMOMETER

Manufacturer : SCARLET

Type : WIRELESS RECEIVER : WL-21

WIND SENSOR : WL-21

Mfg Code : WIRELESS RECEIVER : 2111DR0041

WIND SENSOR : 2111DT0041

Customer : United Analyst and Engineering Consultant Co., Ltd.

81 Soi Udomsuk 41, Sukhumvit Road,

Bangchak, Prakanong, Bangkok 10260.

Calibration Condition : Temperature : 25.1 °C Barometric Pressure : 1009.2 hPa

NATIONAL STANDARD WIND TUNNEL : Thermal Anemometer 642 S/N 91583

: HOOK GAGE NO 1425 : Wind Aloft Plotting Board

N.I.S.T. Test Reference Number 731241460

: Ultrasonic Anemometer Model DA-650-3TV (sensor TR-90AH)

Serial Number 110730029 (sensor 120629586)

JAPAN QUALITY ASSURANCE ORGANIZATION

STANDARD THERMOMETER : Theodor Friedrich : Dry No.8390/94 Wet No. 8389/94

: testo, testo 645 Serial No. 02848057 : Thermoschneider No.918802

STANDARD BAROMETER : Digital Barometer Vaisala Type PTB330 No. V1220015

: Digital Barometer Vaisala Type PTB330 No. V1220015

Calibrated by : Signed :

Mr. Watcharapol Subwat

Mr. Ploech Promsat

Mechanical Engineer

Authorized Signature

For the Chief

Sub-Mandarin

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THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2804, 0-2399-0469

The Result of Calibration

Certification No. 143/23

31 March, 2023

Page : 2 of 5

| Standard | HOOK GAGE NO. 1425 | | | TESTED ANEMOMETER | |
|-----------------------|--------------------|-----------|----------|-------------------|------------|
| | Pressure | Vacuum | Velocity | Velocity | Correction |
| Ultrasonic Anemometer | m/sec | m/sec RSD | m/sec | m/sec | m/sec |
| 1.00 | - | - | - | 1.0 | 0.00 |
| 3.02 | - | - | - | 3.0 | 0.02 |
| 5.00 | - | - | - | 5.0 | 0.00 |
| 7.04 | - | - | - | 6.9 | 0.14 |
| 9.02 | - | - | - | 6.0 | 0.02 |
| 11.02 | - | - | - | 10.9 | 0.12 |
| 13.01 | - | - | - | 13.0 | 0.01 |
| 15.01 | - | - | - | 14.9 | 0.11 |
| 17.02 | - | - | - | 17.0 | 0.02 |
| 20.02 | - | - | - | 20.0 | 0.02 |

| Wind Aloft Plotting Board. | |
|--|-----------------------|
| US DEPARTMENT OF COMMERCE WEATHER BUREAU | |
| WIND DIRECTION | TESTED WIND DIRECTION |
| 0 | 0 |
| 90 | 90 |
| 180 | 180 |
| 270 | 270 |

Calibrated by :

Mr. Watcharapol Subwat

Mechanical Engineer

Calibration & Test Section

Meteorological Instruments Bureau

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THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2804, 0-2399-0469

The Result of Calibration

Certification No. 143/23

31 March, 2023

Page : 3 of 5

| Standard Barometer | Tested Barometer | Correction |
|--------------------|------------------|------------|
| Pressure | Pressure | |
| 1014.29 | 1014 | 0.29 |
| 1014.02 | 1014 | 0.02 |
| 1011.47 | 1012 | -0.53 |
| 1011.25 | 1011 | 0.25 |
| 1011.11 | 1011 | 0.11 |
| 1011.38 | 1012 | -0.62 |
| 1011.71 | 1012 | -0.29 |
| 1013.48 | 1014 | -0.52 |
| 1013.81 | 1014 | -0.19 |
| 1014.02 | 1014 | 0.02 |
| 1013.73 | 1013 | 0.73 |
| 1013.32 | 1013 | 0.32 |
| 1014.92 | 1015 | -0.08 |
| 1014.75 | 1015 | -0.25 |
| 1014.36 | 1014 | 0.36 |
| 1014.21 | 1014 | 0.21 |
| 1013.57 | 1013 | 0.57 |
| 1013.01 | 1013 | 0.01 |
| 1011.26 | 1011 | 0.26 |
| 1011.50 | 1012 | -0.41 |

Average

Calibrated by :

Mr. Watcharapol Subwat

Mechanical Engineer

Calibration & Test Section

Meteorological Instruments Bureau

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THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2804, 0-2399-0469

The Result of Calibration

Certification No. 143/23

31 March, 2023

Page : 4 of 5

| Standard Barometer | Tested Barometer | Correction |
|--------------------|------------------|------------|
| Pressure | Pressure | |
| 760.78 | 761 | -0.22 |
| 760.58 | 761 | -0.42 |
| 759.66 | 759 | -0.34 |
| 758.50 | 758 | 0.50 |
| 758.39 | 758 | 0.39 |
| 758.60 | 759 | -0.40 |
| 758.84 | 759 | -0.16 |
| 760.17 | 760 | 0.17 |
| 760.42 | 760 | 0.42 |
| 760.58 | 761 | -0.42 |
| 760.36 | 760 | 0.36 |
| 760.05 | 760 | 0.05 |
| 761.25 | 761 | 0.25 |
| 761.12 | 761 | 0.12 |
| 760.85 | 761 | -0.15 |
| 760.72 | 761 | -0.28 |
| 760.24 | 760 | 0.24 |
| 759.82 | 760 | -0.18 |
| 758.51 | 759 | -0.49 |
| 758.75 | 759 | -0.25 |

Average

Calibrated by :

Mr. Watcharapol Subwat

Mechanical Engineer

Calibration & Test Section

Meteorological Instruments Bureau

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THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2804, 0-2399-0469

The Result of Calibration

Certification No. 143/23

31 March, 2023

Page : 5 of 5

| Standard Temp. °C | Temperature Sensor Reading | |
|-------------------------|----------------------------|------------------|
| | Reading °C | Correction °C |
| 45.24 | 45.4 | -0.16 |
| 32.16 | 32.3 | -0.14 |
| 16.48 | 16.5 | -0.02 |

Calibrated by :

Mr. Watcharapol Subwat
Mechanical Engineer

Calibration & Test Section
Meteorological Instruments Bureau



เอกสารไม่ควบคุม



THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2804, 0-2399-0469

Calibration Certificate

Issued by : Calibration & Test Section : Meteorological Instruments Bureau

Date of Issue : 10 April, 2023

Certification No. 178/23

Page : 1 of 5

Object : WIRELESS ANEMOMETER

Manufacturer : SCARLET

Type : WIRELESS RECEIVER : WL-21

WIND SENSOR : WL-21

Mfg Code : WIRELESS RECEIVER : 2111DR0052

WIND SENSOR : 2111DT0052

Customer : United Analyst and Engineering Consultant Co., Ltd.

81 Soi Udomsuk 41, Sukhumvit Road,

Bangchak, Prakanong, Bangkok 10260.

Calibration Condition : Temperature 25.1 °C Barometric Pressure 1006.9 hPa

NATIONAL STANDARD WIND TUNNEL : Thermal Anemometer 642 S/N 91563

: HOOK GAGE NO 1425 : Wind Aloft Plotting Board

N.I.S.T. Test Reference Number 731/241460

: Ultrasonic Anemometer Model DA-650-3TV (sensor TR-90AH)

Serial Number 110730029 (sensor 1206295886)

JAPAN QUALITY ASSURANCE ORGANIZATION

STANDARD THERMOMETER : Theodor Friedrich : Dry No. 8390/94 Wet No. 8389/94

: testo, testo 645 Serial No. 02848057 : Thermoachneider No. 918802

STANDARD BAROMETER : Digital Barometer Vaisala Type PTB330 No. 1520015

: Digital Barometer Vaisala Type PTB330 No. 1520015

Calibrated by :

Mr. Watcharapol Subwat

Mechanical Engineer

Signed :

Mr. Pasad Promat

Mechanical Engineer

(Authorized Signature)

for the Chief

Sub-Standard Instrument

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THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2804, 0-2399-0469

The Result of Calibration

Certification No. 178/23

10 April, 2023

Page : 2 of 5

| Standard Ultrasonic Anemometer m/sec | HOOK GAGE NO. 1425 | | | TESTED ANEMOMETER | |
|--|--------------------|---------------|-------------------|-------------------|---------------------|
| | Pressure hPa | Vacuum hPa | Velocity m/sec | Velocity m/sec | Correction m/sec |
| 1.00 | - | - | - | 1.0 | 0.00 |
| 3.02 | - | - | - | 3.0 | 0.02 |
| 5.00 | - | - | - | 5.0 | 0.00 |
| 7.04 | - | - | - | 7.0 | 0.04 |
| 9.02 | - | - | - | 9.0 | 0.02 |
| 11.02 | - | - | - | 10.9 | 0.12 |
| 13.01 | - | - | - | 13.1 | -0.09 |
| 15.01 | - | - | - | 15.0 | 0.01 |
| 17.02 | - | - | - | 17.0 | 0.02 |
| 20.02 | - | - | - | 20.1 | -0.08 |

Wind Aloft Plotting Board.

U.S. DEPARTMENT OF COMMERCE WEATHER BUREAU

| WIND DIRECTION | TESTED WIND DIRECTION |
|----------------|-----------------------|
| 0 | 0 |
| 90 | 90 |
| 180 | 180 |
| 270 | 270 |

Calibrated by :

Mr. Watcharapol Subwat
Mechanical Engineer

Calibration & Test Section
Meteorological Instruments Bureau



เอกสารไม่ควบคุม



THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2804, 0-2399-0469

The Result of Calibration

10 April, 2023

Certification No. 178/23

Page : 3 of 5

| Standard Barometer Pressure | Tested Barometer Pressure | Correction |
|--------------------------------|------------------------------|------------|
| 1013.17 | 1013 | 0.17 |
| 1013.43 | 1014 | -0.57 |
| 1014.15 | 1014 | 0.15 |
| 1014.22 | 1014 | 0.22 |
| 1009.63 | 1009 | 0.63 |
| 1009.71 | 1010 | -0.29 |
| 1009.95 | 1010 | -0.05 |
| 1010.31 | 1010 | 0.31 |
| 1010.72 | 1011 | -0.29 |
| 1010.80 | 1011 | -0.20 |
| 1011.47 | 1011 | 0.47 |
| 1011.21 | 1011 | 0.21 |
| 1011.33 | 1011 | 0.33 |
| 1011.59 | 1012 | -0.41 |
| 1011.89 | 1012 | -0.11 |
| 1012.40 | 1012 | 0.40 |
| 1008.64 | 1009 | -0.36 |
| 1008.80 | 1009 | -0.20 |
| 1009.25 | 1009 | 0.25 |
| 1009.45 | 1009 | 0.45 |

Average

0.06

Calibrated by :

Mr. Watcharapol Subwat

Mechanical Engineer

Calibration & Test Section

Meteorological Instruments Bureau



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THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2804, 0-2399-0469

The Result of Calibration

Certification No. 178/23

10 April, 2023

Page : 4 of 5

| Standard Barometer Pressure | Tested Barometer Pressure | Correction |
|--------------------------------|------------------------------|------------|
| 759.94 | 760 | -0.06 |
| 760.13 | 760 | 0.13 |
| 760.67 | 761 | -0.33 |
| 760.73 | 761 | -0.27 |
| 757.28 | 757 | 0.28 |
| 757.34 | 757 | 0.34 |
| 757.52 | 756 | -0.48 |
| 757.79 | 756 | -0.21 |
| 758.10 | 756 | 0.10 |
| 758.16 | 756 | 0.16 |
| 758.66 | 759 | -0.34 |
| 758.47 | 758 | 0.47 |
| 758.56 | 758 | 0.56 |
| 758.75 | 759 | -0.25 |
| 758.98 | 759 | -0.02 |
| 759.30 | 759 | 0.30 |
| 756.54 | 757 | -0.46 |
| 756.66 | 757 | -0.34 |
| 757.00 | 757 | 0.00 |
| 757.15 | 757 | 0.15 |

Average : 0.01

Calibrated by : *Watcharapol*
Mr. Watcharapol Subwat
Mechanical Engineer

Calibration & Test Section
Meteorological Instruments Bureau

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THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2804, 0-2399-0469

The Result of Calibration

Certification No. 178/23

10 April, 2023

Page : 5 of 5

| Standard Temp. °C | Temperature Sensor Reading | |
|-------------------------|----------------------------|------------------|
| | Reading °C | Correction °C |
| 45.15 | 45.3 | -0.15 |
| 31.05 | 31.1 | -0.05 |
| 15.32 | 15.5 | -0.18 |

Calibrated by : *Watcharapol*
Mr. Watcharapol Subwat
Mechanical Engineer



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THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2804, 0-2399-0469

Calibration Certificate

Issued by : Calibration & Test Section : Meteorological Instruments Bureau

Date of Issue : 11 April, 2023

Certification No. 161/23

Page : 1 of 5

Object : WIRELESS ANEMOMETER

Manufacturer : SCARLET

Type : WIRELESS RECEIVER : WL-21

WIND SENSOR : WL-21

Mfg Code : WIRELESS RECEIVER : 2112DR0102

WIND SENSOR : 2112DT0102

Customer : United Analyst and Engineering Consultant Co., Ltd.

81 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Prakanong, Bangkok 10260.

Calibration Condition : Temperature 25.1 °C Barometric Pressure 1008.5 hPa

NATIONAL STANDARD WIND TUNNEL : Thermal Anemometer 642 S/N 81563

: HOOK GAGE NO 1425 : Wind Aloft Plotting Board

N.J.S.T. Test Reference- Number 731/241460 : Standard Velocity at 20 - 30 m/sec

: Ultrasonic Anemometer Model DA-650-3TV (sensor TR-90AH)

Serial Number 110730029 (sensor 120629506)

JAPAN QUALITY ASSURANCE ORGANIZATION : Standard Velocity at 0 - 20 m/sec

STANDARD THERMOMETER : Theodor Friedrich : Dry No.8390/94 Wet No. 8389/94

: Isetto, Isetto 645 Serial No. 02848057 : Thermoschneider No.918802

STANDARD BAROMETER : Digital Barometer Vaisala Type PTB22019-31220015

Digital Barometer Vaisala Type PTB330 No. K6920001

Calibrated by : *Watcharapol*

Signed : *Watcharapol*

Mr. Watcharapol Subwat

Mechanical Engineer

(Authorized Signatory)

for the Chief

Sub-Standard Instrument

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THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2804, 0-2399-0469

The Result of Calibration

Certification No. 161/23

11 April, 2023

Page : 2 of 5

| Standard Ultrasonic Anemometer m/sec | HOOK GAGE NO. 1425 | | | TESTED ANEMOMETER | |
|--|------------------------|----------------------|-------------------|-------------------|---------------------|
| | Pressure inches H2O | Vacuum inches H2O | Velocity m/sec | Velocity m/sec | Correction m/sec |
| 1.00 | - | - | - | 1.0 | 0.00 |
| 3.02 | - | - | - | 3.0 | 0.02 |
| 5.00 | - | - | - | 5.0 | 0.00 |
| 7.04 | - | - | - | 7.0 | 0.04 |
| 9.02 | - | - | - | 9.0 | 0.02 |
| 11.02 | - | - | - | 10.9 | 0.12 |
| 13.01 | - | - | - | 13.0 | 0.01 |
| 15.01 | - | - | - | 15.0 | 0.01 |
| 17.02 | - | - | - | 17.0 | 0.02 |
| 20.02 | - | - | - | 20.0 | 0.02 |

Wind Aloft Plotting Board.

U.S. DEPARTMENT OF COMMERCE WEATHER BUREAU

| WIND DIRECTION | TESTED WIND DIRECTION |
|----------------|-----------------------|
| 0 | 0 |
| 90 | 90 |
| 180 | 180 |
| 270 | 270 |

Calibrated by : *Watcharapol*
Mr. Watcharapol Subwat
Mechanical Engineer

Calibration & Test Section
Meteorological Instruments Bureau

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The Result of Calibration

Certification No. 161/23

11 April, 2023

Page : 3 of 5

| Standard Barometer Pressure (mbar) | Tested Barometer Pressure (mbar) | Correction (mbar) |
|---------------------------------------|-------------------------------------|----------------------|
| 1010.39 | 1010 | 0.39 |
| 1011.13 | 1011 | 0.13 |
| 1011.31 | 1011 | 0.31 |
| 1011.57 | 1012 | -0.43 |
| 1008.42 | 1008 | 0.42 |
| 1008.86 | 1008 | -0.14 |
| 1008.99 | 1009 | -0.01 |
| 1009.36 | 1009 | 0.36 |
| 1009.94 | 1010 | -0.06 |
| 1010.36 | 1010 | 0.36 |
| 1009.53 | 1009 | 0.53 |
| 1009.85 | 1010 | -0.15 |
| 1010.06 | 1010 | 0.06 |
| 1010.23 | 1010 | 0.23 |
| 1009.06 | 1009 | 0.06 |
| 1009.21 | 1009 | 0.21 |
| 1009.71 | 1010 | -0.29 |
| 1010.32 | 1010 | 0.32 |
| 1011.21 | 1011 | 0.21 |
| 1011.50 | 1012 | -0.50 |

Average

0.00

Calibrated by :

Mr. Watcharapol Subwat
Mechanical EngineerCalibration & Test Section
Meteorological Instruments Bureau

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The Result of Calibration

Certification No. 161/23

11 April, 2023

Page : 4 of 5

| Standard Barometer Pressure (mmHg) | Tested Barometer Pressure (mmHg) | Correction (mmHg) |
|---------------------------------------|-------------------------------------|----------------------|
| 757.85 | 758 | -0.15 |
| 758.41 | 758 | 0.41 |
| 758.54 | 759 | -0.46 |
| 758.74 | 759 | -0.26 |
| 756.38 | 756 | 0.38 |
| 756.71 | 757 | -0.29 |
| 756.80 | 757 | -0.20 |
| 757.08 | 757 | 0.08 |
| 757.52 | 758 | -0.48 |
| 757.83 | 758 | -0.17 |
| 757.21 | 757 | 0.21 |
| 757.45 | 757 | 0.45 |
| 757.61 | 758 | -0.39 |
| 757.73 | 758 | -0.27 |
| 756.86 | 757 | -0.14 |
| 756.97 | 757 | -0.03 |
| 757.34 | 757 | 0.34 |
| 757.80 | 758 | -0.20 |
| 758.47 | 758 | 0.47 |
| 758.69 | 759 | -0.31 |

Average

0.00

Calibrated by :

Mr. Watcharapol Subwat
Mechanical EngineerCalibration & Test Section
Meteorological Instruments Bureau

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The Result of Calibration

Certification No. 161/23

11 April, 2023

Page : 5 of 5

| Standard Temp. °C | Temperature Sensor Reading | |
|-------------------------|----------------------------|------------------|
| | Reading °C | Correction °C |
| 45.12 | 45.1 | 0.02 |
| 31.24 | 31.4 | -0.16 |
| 15.82 | 16.0 | -0.18 |

Calibrated by :

Mr. Watcharapol Subwat
Mechanical EngineerCalibration & Test Section
Meteorological Instruments Bureau

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Calibration Certificate

Issued by : Calibration & Test Section : Meteorological Instruments Bureau

Date of Issue : 11 March, 2023

Certification No. : 144/23

Page : 1 of 5

Object : WIRELESS ANEMOMETER

Manufacturer : SCARLET

Type : WIRELESS RECEIVER : WL-21

WIND SENSOR : WL-21

Mfg Code : WIRELESS RECEIVER : 2205DR0105

WIND SENSOR : 2206DT0105

Customer : United Analyst and Engineering Consultant Co., Ltd.

81 Soi Udomsuk 41, Sukhumvit Road,

Bangchak, Prakanong, Bangkok 10260.

Calibration Condition : Temperature : 25.1 °C Barometric Pressure : 1008.9 hPa

NATIONAL STANDARD WIND TUNNEL : Thermal Anemometer 642 S/N 91563

HOOK GAGE NO 1425 : Wind Aloft Plotting Board

N.I.S.T. Test Reference Number 731/241460

Ultrasonic Anemometer : Model DA-650-3TV (sensor TR-90AH)

Serial Number 110730029 (sensor 120629586)

JAPAN QUALITY ASSURANCE ORGANIZATION

STANDARD THERMOMETER : Theodor Friedrich : Dry No. 8390/94 Wet No. 8369/94

: Testo - testo 645 Serial No. 02848057 : ThermoSchneider No. 918802

STANDARD BAROMETER : Digital Barometer Vaisala Type PPH300 No. 31220015

Digital Barometer Vaisala Type PPH300 No. 31220015

Calibrated by :

Mr. Watcharapol Subwat
Mechanical Engineer

Signed :

Mr. Pisod Promsat
Sub-Standard Master

for the Chief

Sub-Standard Master

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THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2804, 0-2399-0469

The Result of Calibration

Certification No. 144/23

31 March, 2023

Page : 2 of 5

| Standard | HOOK GAGE NO. 1425 | | | TESTED ANEMOMETER | |
|-----------------------|--------------------|------------|------------|-------------------|------------|
| | Pressure | Vacuum | Velocity | Velocity | Correction |
| Ultrasonic Anemometer | m/sec | inches H2O | inches H2O | inches H2O | m/sec |
| 1.00 | - | - | - | 1.0 | 0.00 |
| 3.02 | - | - | - | 3.0 | 0.02 |
| 5.00 | - | - | - | 5.0 | 0.00 |
| 7.04 | - | - | - | 6.9 | 0.14 |
| 9.02 | - | - | - | 9.0 | 0.03 |
| 11.02 | - | - | - | 10.9 | 0.12 |
| 13.01 | - | - | - | 13.0 | 0.01 |
| 15.01 | - | - | - | 14.9 | 0.11 |
| 17.02 | - | - | - | 17.0 | 0.02 |
| 20.02 | - | - | - | 20.0 | 0.02 |

| Wind Aloft Plotting Board. | |
|--|-----------------------|
| U.S. DEPARTMENT OF COMMERCE WEATHER BUREAU | |
| WIND DIRECTION | TESTED WIND DIRECTION |
| 0 | 0 |
| 90 | 90 |
| 180 | 180 |
| 270 | 180 |

Calibrated by :

Mr. Watcharapol Subwat

Mechanical Engineer

Calibration & Test Section

Meteorological Instruments Bureau

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THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2804, 0-2399-0469

The Result of Calibration

Certification No. 144/23

Page : 3 of 5

31 March, 2023

| Standard Barometer | Tested Barometer | Correction |
|--------------------|------------------|------------|
| Pressure | Pressure | |
| 1014.29 | 1014 | 0.29 |
| 1014.02 | 1014 | 0.02 |
| 1013.47 | 1012 | -0.53 |
| 1011.25 | 1011 | 0.25 |
| 1011.11 | 1011 | 0.11 |
| 1011.38 | 1011 | 0.38 |
| 1011.71 | 1012 | -0.29 |
| 1013.48 | 1013 | 0.48 |
| 1013.24 | 1014 | -0.19 |
| 1014.02 | 1014 | 0.02 |
| 1013.73 | 1014 | -0.27 |
| 1013.32 | 1013 | 0.32 |
| 1014.92 | 1015 | -0.08 |
| 1014.75 | 1015 | -0.25 |
| 1014.38 | 1014 | 0.38 |
| 1014.21 | 1014 | 0.21 |
| 1013.57 | 1014 | -0.43 |
| 1013.01 | 1013 | 0.01 |
| 1011.26 | 1011 | 0.26 |
| 1011.59 | 1012 | -0.41 |

Average

Calibrated by :

Mr. Watcharapol Subwat

Mechanical Engineer

Calibration & Test Section

Meteorological Instruments Bureau

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THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2804, 0-2399-0469

The Result of Calibration

Certification No. 144/23

31 March, 2023

Page : 4 of 5

| Standard Barometer | Tested Barometer | Correction |
|--------------------|------------------|------------|
| Pressure | Pressure | |
| 760.78 | 761 | -0.22 |
| 760.58 | 761 | -0.42 |
| 758.66 | 759 | -0.34 |
| 758.50 | 759 | -0.50 |
| 758.39 | 758 | 0.39 |
| 758.60 | 759 | -0.40 |
| 758.84 | 759 | -0.16 |
| 760.17 | 760 | 0.17 |
| 760.42 | 760 | 0.42 |
| 760.58 | 760 | 0.58 |
| 760.36 | 760 | 0.36 |
| 760.06 | 760 | 0.06 |
| 761.25 | 761 | 0.25 |
| 761.12 | 761 | 0.12 |
| 760.85 | 761 | -0.15 |
| 760.72 | 761 | -0.28 |
| 760.24 | 760 | 0.24 |
| 759.82 | 760 | -0.18 |
| 758.51 | 759 | -0.49 |
| 758.75 | 759 | -0.25 |

Average

0.00

Calibrated by :

Mr. Watcharapol Subwat

Mechanical Engineer

Calibration & Test Section

Meteorological Instruments Bureau

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THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2804, 0-2399-0469

The Result of Calibration

Certification No. 144/23

Page : 5 of 5

31 March, 2023

| Standard | Temperature Sensor Reading | |
|----------|----------------------------|------------|
| | Reading | Correction |
| Temp. | °C | °C |
| 45.24 | 45.0 | 0.24 |
| 32.16 | 32.0 | 0.16 |
| 16.48 | 16.4 | 0.08 |

Calibrated by :

Mr. Watcharapol Subwat

Mechanical Engineer

Calibration & Test Section

Meteorological Instruments Bureau

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Acoustic Signal Tests, C-weighting

Measured according to IEC 61672-3:2013 12 and ANSI S1.4-2014 Part 3: 12 using a comparison coupler with Unit Under Test (UUT) and reference SLM using slow time-weighted sound level for compliance to IEC 61672-1:2013 5.5; ANSI S1.4-2014 Part 1: 5.5

| Frequency [Hz] | Test Result [dB] | Expected [dB] | Lower Limit [dB] | Upper Limit [dB] | Expanded Uncertainty [dB] | Result |
|----------------|------------------|---------------|------------------|------------------|---------------------------|--------|
| 125 | -0.24 | -0.20 | -1.70 | 1.30 | 0.23 | Pass |
| 1000 | 0.14 | 0.00 | -1.00 | 1.00 | 0.23 | Pass |
| 8000 | -2.43 | -3.00 | -8.00 | 2.00 | 0.32 | Pass |

-- End of measurement results--

Self-generated Noise

Measured according to IEC 61672-3:2013 11.1 and ANSI S1.4-2014 Part 3: 11.1

| Measurement | Test Result [dB] |
|-------------|------------------|
| A-weighted | 41.00 |

-- End of measurement results--

-- End of Report--

Signature: Jacob Cannon

LARSON DAVIS - A PCB PIEZOTRONICS DIV.
1681 West 820 North
Provo, UT 84601, United States
716-684-0001



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LARSON DAVIS
A PCB DIVISION

D0001.8406 Rev F

Calibration Certificate

Certificate Number 2022002977

Customer:

United Analyst and Engineering Consultant Co Ltd
No. 81 Soi Udonok 41 Sukhumvit Road, Bangkok, Phra
Khanong, Bangkok, 10260, Thailand

Model Number LxT2
Serial Number 0006689

Test Results **Pass**

Initial Condition As Manufactured

Description SoundTrack LxT Class 2
Class 2 Sound Level Meter
Firmware Revision: 2.404

Procedure Number D0001.6378
Technician Jacob Cannon
Calibration Date 9 Mar 2022

Calibration Due Temperature 23.97 °C ± 0.25 °C
Humidity 51.1 %RH ± 2.0 %RH
Static Pressure 85.4 kPa ± 0.13 kPa

Evaluation Method Tested electrically using Larson Davis PMLxT2C S/N 071570 and a 12.0 pF capacitor to simulate microphone capacitance. Data reported in dB re 20 µPa assuming a microphone sensitivity of 50.0 mV/Pa.

Compliance Standards Compliant to Manufacturer Specifications and the following standards when combined with Calibration Certificate from procedure D0001.8384:

| | |
|------------------------|----------------------------|
| IEC 60651:2001 Type 2 | ANSI S1.4-2014 Class 2 |
| IEC 60804:2000 Type 2 | ANSI S1.4 (R2006) Type 2 |
| IEC 61252:2002 | ANSI S1.25 (R2007) |
| IEC 61672:2013 Class 2 | ANSI S1.43 (R2007) Type 2 |
| IEC 61260:2001 Class 2 | ANSI S1.11 (R2009) Class 2 |

Issuing lab certifies that the instrument described above meets or exceeds all specifications as stated in the referenced procedure (unless otherwise noted). It has been calibrated using measurement standards traceable to the International System of Units (SI) through the National Institute of Standards and Technology (NIST), or other national measurement institutes, and meets the requirements of ISO/IEC 17025:2017. Test points marked with a * in the uncertainties column do not fall within this laboratory's scope of accreditation.

The quality system is registered to ISO 9001:2015.

This calibration is a direct comparison of the unit under test to the listed reference standards and did not involve any sampling plans to complete. No allowance has been made for the instability of the test device due to use, time, etc. Such allowances would be made by the customer as needed.

The uncertainties were computed in accordance with the ISO Guide to the Expression of Uncertainty in Measurement (GUM). A coverage factor of approximately 2 sigma (k=2) has been applied to the standard uncertainty to express the expanded uncertainty at approximately 95% confidence level.

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Correction data from Larson Davis LxT Manual for SoundTrack LxT & SoundExpert LxT, 1770.01 Rev O Supporting Firmware Version 4.0.5, 2019-09-10

Calibration Check Frequency: 1000 Hz; Reference Sound Pressure Level: 114 dB re 20 µPa

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716-684-0001



Page 1 of 8

LARSON DAVIS
A PCB DIVISION

D0001.8407 Rev F

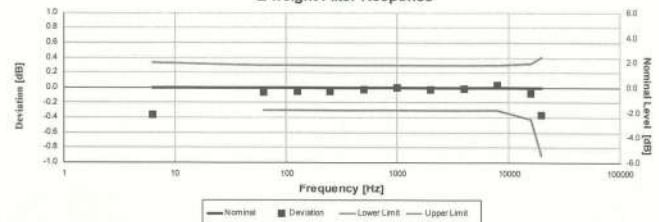
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Certificate Number 2022002977

Certificate Number 2022002977

Z-weight Filter Response



Electrical signal test of frequency weighting performed according to IEC 61672-3:2013 13 and ANSI S1.4-2014 Part 3: 13 for compliance to IEC 61672-1:2013 5.5; IEC 60651:2001 6.1 and 6.2.2; IEC 60804:2000 5; ANSI S1.4-1993 (R2009) 5.1 and 5.2.1; ANSI S1.4-2014 Part 1: 5.5

| Frequency [Hz] | Test Result [dB] | Deviation [dB] | Lower limit [dB] | Upper limit [dB] | Expanded Uncertainty [dB] | Result |
|----------------|------------------|----------------|------------------|------------------|---------------------------|--------|
| 6.31 | -0.37 | -0.37 | -1.11 | 0.33 | 0.15 | Pass |
| 63.10 | -0.06 | -0.06 | -0.30 | 0.30 | 0.15 | Pass |
| 125.89 | -0.06 | -0.06 | -0.30 | 0.30 | 0.15 | Pass |
| 251.19 | -0.06 | -0.06 | -0.30 | 0.30 | 0.15 | Pass |
| 501.19 | -0.03 | -0.02 | -0.30 | 0.30 | 0.15 | Pass |
| 1,000.00 | 0.00 | 0.00 | -0.30 | 0.30 | 0.15 | Pass |
| 1,995.26 | -0.03 | -0.03 | -0.30 | 0.30 | 0.15 | Pass |
| 3,981.07 | -0.01 | -0.01 | -0.30 | 0.30 | 0.15 | Pass |
| 7,943.28 | 0.04 | 0.04 | -0.30 | 0.30 | 0.15 | Pass |
| 15,848.93 | -0.08 | -0.08 | -0.42 | 0.32 | 0.15 | Pass |
| 19,952.62 | -0.36 | -0.36 | -0.91 | 0.41 | 0.15 | Pass |

-- End of measurement results--

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716-684-0001



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LARSON DAVIS
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D0001.8407 Rev F

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716-684-0001



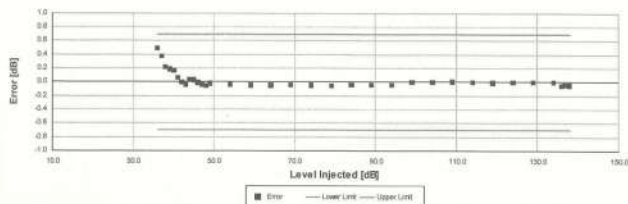
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LARSON DAVIS
A PCB DIVISION

D0001.8407 Rev F

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A-weighted Broadband Log Linearity: 8,000.00 Hz



Broadband level linearity performed according to IEC 61672-3:2013 16 and ANSI S1.4-2014 Part 3: 16 for compliance to IEC 61672-1:2013 5.6, IEC 60804-2000 6.2, IEC 61252-2002 8, ANSI S1.4 (R2006) 6.9, ANSI S1.4-2014 Part 1: 5.6, ANSI S1.43 (R2007) 6.2

| Level [dB] | Error [dB] | Lower limit [dB] | Upper limit [dB] | Expanded Uncertainty [dB] | Result |
|------------|------------|------------------|------------------|---------------------------|--------|
| 36.00 | 0.50 | -0.70 | 0.70 | 0.16 | Pass |
| 37.00 | 0.38 | -0.70 | 0.70 | 0.16 | Pass |
| 38.00 | 0.22 | -0.70 | 0.70 | 0.16 | Pass |
| 39.00 | 0.19 | -0.70 | 0.70 | 0.16 | Pass |
| 40.00 | 0.17 | -0.70 | 0.70 | 0.16 | Pass |
| 41.00 | 0.06 | -0.70 | 0.70 | 0.16 | Pass |
| 42.00 | 0.00 | -0.70 | 0.70 | 0.16 | Pass |
| 43.00 | -0.04 | -0.70 | 0.70 | 0.16 | Pass |
| 44.00 | 0.04 | -0.70 | 0.70 | 0.17 | Pass |
| 45.00 | 0.03 | -0.70 | 0.70 | 0.16 | Pass |
| 46.00 | -0.01 | -0.70 | 0.70 | 0.16 | Pass |
| 47.00 | -0.03 | -0.70 | 0.70 | 0.16 | Pass |
| 48.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 49.00 | -0.02 | -0.70 | 0.70 | 0.16 | Pass |
| 54.00 | -0.03 | -0.70 | 0.70 | 0.16 | Pass |
| 58.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 64.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 69.00 | -0.04 | -0.70 | 0.70 | 0.16 | Pass |
| 74.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 79.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 84.00 | -0.04 | -0.70 | 0.70 | 0.16 | Pass |
| 89.00 | -0.04 | -0.70 | 0.70 | 0.16 | Pass |
| 94.00 | -0.04 | -0.70 | 0.70 | 0.16 | Pass |
| 99.00 | 0.00 | -0.70 | 0.70 | 0.15 | Pass |
| 104.00 | 0.00 | -0.70 | 0.70 | 0.15 | Pass |
| 109.00 | 0.00 | -0.70 | 0.70 | 0.15 | Pass |
| 114.00 | 0.00 | -0.70 | 0.70 | 0.15 | Pass |
| 119.00 | -0.01 | -0.70 | 0.70 | 0.15 | Pass |
| 124.00 | 0.00 | -0.70 | 0.70 | 0.15 | Pass |
| 129.00 | 0.00 | -0.70 | 0.70 | 0.15 | Pass |
| 134.00 | 0.00 | -0.70 | 0.70 | 0.15 | Pass |
| 136.00 | -0.05 | -0.70 | 0.70 | 0.15 | Pass |
| 137.00 | -0.04 | -0.70 | 0.70 | 0.15 | Pass |
| 138.00 | -0.04 | -0.70 | 0.70 | 0.15 | Pass |

-- End of measurement results--

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Peak Rise Time

Peak rise time performed according to IEC 60651-2001 9.4.4 and ANSI S1.4-1993 (R2006) 8.4.2

| Amplitude [dB] | Duration [μs] | | Test Result [dB] | Lower limit [dB] | Upper limit [dB] | Expanded Uncertainty [dB] | Result |
|----------------|---------------|----------------|------------------|------------------|------------------|------------------------------|--------|
| 136.95 | 40 | Negative Pulse | 135.14 | 133.71 | 135.71 | 0.15 | Pass |
| | | Positive Pulse | 135.14 | 133.70 | 135.70 | 0.15 | Pass |
| | 30 | Negative Pulse | 134.20 | 133.71 | 135.71 | 0.15 | Pass |
| | | Positive Pulse | 134.17 | 133.70 | 135.70 | 0.15 | Pass |

-- End of measurement results--

Positive Pulse Crest Factor

200 μs pulse tests at 2.0, 12.0, 22.0, 32.0 dB below Overload Limit

Crest Factor measured according to IEC 60651-2001 9.4.2 and ANSI S1.4-1993 (R2006) 8.4.2

| Amplitude [dB] | Crest Factor | Test Result [dB] | Limits [dB] | Expanded Uncertainty [dB] | Result |
|----------------|--------------|------------------|-------------|---------------------------|--------|
| 135.95 | 3 | OVLD | ±1.00 | 0.15 ± | Pass |
| | 5 | OVLD | ±1.00 | 0.15 ± | Pass |
| 125.95 | 3 | -0.18 | ±1.00 | 0.15 ± | Pass |
| | 5 | -0.18 | ±1.00 | 0.16 ± | Pass |
| 115.95 | 3 | -0.22 | ±1.00 | 0.15 ± | Pass |
| | 5 | -0.16 | ±1.00 | 0.15 ± | Pass |
| 105.95 | 3 | -0.19 | ±1.00 | 0.15 ± | Pass |
| | 5 | -0.16 | ±1.00 | 0.15 ± | Pass |

-- End of measurement results--

Negative Pulse Crest Factor

200 μs pulse tests at 2.0, 12.0, 22.0, 32.0 dB below Overload Limit

Crest Factor measured according to IEC 60651-2001 9.4.2 and ANSI S1.4-1993 (R2006) 8.4.2

| Amplitude [dB] | Crest Factor | Test Result [dB] | Limits [dB] | Expanded Uncertainty [dB] | Result |
|----------------|--------------|------------------|-------------|---------------------------|--------|
| 135.95 | 3 | OVLD | ±1.00 | 0.15 ± | Pass |
| | 5 | OVLD | ±1.00 | 0.15 ± | Pass |
| 125.95 | 3 | -0.17 | ±1.00 | 0.15 ± | Pass |
| | 5 | -0.15 | ±1.00 | 0.15 ± | Pass |
| 115.95 | 3 | -0.19 | ±1.00 | 0.15 ± | Pass |
| | 5 | -0.16 | ±1.00 | 0.15 ± | Pass |
| 105.95 | 3 | -0.19 | ±1.00 | 0.15 ± | Pass |
| | 5 | -0.16 | ±1.00 | 0.15 ± | Pass |

-- End of measurement results--

Gain

Gain measured according to IEC 61672-3:2013 17.3 and 17.4 and ANSI S1.4-2014 Part 3: 17.3 and 17.4

| Measurement | Test Result [dB] | Lower limit [dB] | Upper limit [dB] | Expanded Uncertainty [dB] | Result |
|----------------------|------------------|------------------|------------------|---------------------------|--------|
| 0 dB Gain | 93.86 | 93.78 | 93.98 | 0.15 | Pass |
| 0 dB Gain, Linearity | 40.31 | 39.28 | 40.88 | 0.16 | Pass |
| OBA Low Range | 93.90 | 93.78 | 93.98 | 0.15 | Pass |
| OBA Normal Range | 93.88 | 93.20 | 94.80 | 0.15 | Pass |

-- End of measurement results--

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Broadband Noise Floor

Self-generated noise measured according to IEC 61672-3:2013 11.2 and ANSI S1.4-2014 Part 3: 11.2

| Measurement | Test Result [dB] | Upper Limit [dB] | Result |
|----------------------|------------------|------------------|--------|
| A-weight Noise Floor | 27.11 | 36.00 | Pass |
| C-weight Noise Floor | 27.00 | 35.00 | Pass |
| Z-weight Noise Floor | 32.93 | 36.00 | Pass |

-- End of measurement results--

Total Harmonic Distortion

Measured using 1/3-Octave filters

| Measurement | Test Result [dB] | Lower Limit [dB] | Upper Limit [dB] | Expanded Uncertainty [dB] | Result |
|--------------|------------------|------------------|------------------|---------------------------|--------|
| 10 Hz Signal | 135.72 | 134.15 | 136.75 | 0.15 | Pass |
| THD | -67.19 | -58.00 | -58.00 | 0.00 ± | Pass |
| THD+N | -63.08 | -58.00 | -58.00 | 0.00 ± | Pass |

-- End of measurement results--

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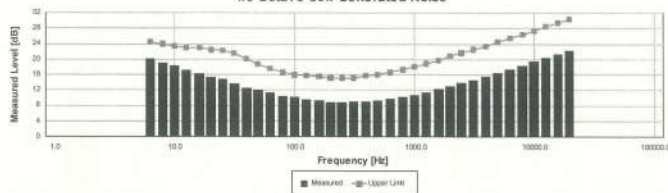
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1/3-Octave Self-Generated Noise



The SLM is set to low range.

| Frequency [Hz] | Test Result [dB] | Upper Limit [dB] | Result |
|----------------|------------------|------------------|--------|
| 6.30 | 20.13 | 24.00 | Pass |
| 8.00 | 19.06 | 24.00 | Pass |
| 10.00 | 18.35 | 23.50 | Pass |
| 12.50 | 17.22 | 23.00 | Pass |
| 16.00 | 16.30 | 22.90 | Pass |
| 20.00 | 15.31 | 22.40 | Pass |
| 25.00 | 14.86 | 22.30 | Pass |
| 31.50 | 13.72 | 21.50 | Pass |
| 40.00 | 12.58 | 20.20 | Pass |
| 50.00 | 12.09 | 18.80 | Pass |
| 63.00 | 11.28 | 17.60 | Pass |
| 80.00 | 10.56 | 16.60 | Pass |
| 100.00 | 10.19 | 15.90 | Pass |
| 125.00 | 9.44 | 15.70 | Pass |
| 160.00 | 9.26 | 15.50 | Pass |
| 200.00 | 8.90 | 15.20 | Pass |
| 250.00 | 8.76 | 15.20 | Pass |
| 315.00 | 8.96 | 15.20 | Pass |
| 400.00 | 9.07 | 15.70 | Pass |
| 500.00 | 9.39 | 16.00 | Pass |
| 630.00 | 9.74 | 16.60 | Pass |
| 800.00 | 10.23 | 17.30 | Pass |
| 1,000.00 | 10.78 | 18.10 | Pass |
| 1,250.00 | 11.46 | 18.90 | Pass |
| 1,600.00 | 12.20 | 19.80 | Pass |
| 2,000.00 | 12.98 | 20.80 | Pass |
| 2,500.00 | 13.63 | 21.70 | Pass |
| 3,150.00 | 14.67 | 22.60 | Pass |
| 4,000.00 | 15.58 | 23.50 | Pass |
| 5,000.00 | 16.50 | 24.50 | Pass |
| 6,300.00 | 17.43 | 25.50 | Pass |
| 8,000.00 | 18.44 | 26.50 | Pass |
| 10,000.00 | 19.39 | 27.40 | Pass |
| 12,500.00 | 20.41 | 28.50 | Pass |
| 16,000.00 | 21.41 | 29.50 | Pass |
| 20,000.00 | 22.37 | 30.40 | Pass |

-- End of measurement results--

-- End of Report--

Signature: *Jacob Cannon*

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Calibration Certificate

Certificate Number 2022003087

Customer:

United Analyst and Engineering Consultant Co Ltd
No. 81 Soi Udomsak 41, Sukhumvit Road,
Bangchak, Phra Khanong,
Bangkok, 10260, Thailand

Model Number

LxT2

Serial Number

0006591

Test Results

Pass

Initial Condition

As Manufactured

Description

SoundTrack LxT Class 2

Class 2 Sound Level Meter

Firmware Revision: 2.404

Procedure Number

D0001.8384

Technician

Jacob Cannon

Calibration Date

11 Mar 2022

Calibration Due

Temperature

23.67 °C ± 0.25 °C

Humidity

52.4 %RH ± 2.0 %RH

Static Pressure

87.17 kPa ± 0.13 kPa

Evaluation Method

Tested with:

PCB 375A04, S/N 335075

Larson Davis CAL291, S/N 0108

Larson Davis CAL200, S/N 9079

Larson Davis FRMLxT2C, S/N 071560

Data reported in dB re 20 µPa.

Compliance Standards

Compliant to Manufacturer Specifications and the following standards when combined with Calibration Certificate from procedure D0001.8376:

IEC 60651:2001 Type 2

ANSI S1.4-2014 Class 2

IEC 60604:2000 Type 2

ANSI S1.4 (R2006) Type 2

IEC 61262:2002

ANSI S1.11 (R2009) Class 2

IEC 61260:2001 Class 2

ANSI S1.25 (R2007)

IEC 61672:2013 Class 2

ANSI S1.43 (R2007) Type 2

Issuing lab certifies that the instrument described above meets or exceeds all specifications as stated in the referenced procedure (unless otherwise noted). It has been calibrated using measurement standards traceable to the International System of Units (SI) through the National Institute of Standards and Technology (NIST), or other national measurement institutes, and meets the requirements of ISO/IEC 17025:2017.

Test points marked with a † in the uncertainties column do not fall within this laboratory's scope of accreditation.

The quality system is registered to ISO 9001:2015.

This calibration is a direct comparison of the unit under test to the listed reference standards and did not involve any sampling plans to complete. No allowance has been made for the instability of the test device due to use, time, etc. Such allowances would be made by the customer as needed.

The uncertainties were computed in accordance with the ISO Guide to the Expression of Uncertainty in Measurement (GUM). A coverage factor of approximately 2 sigma (k=2) has been applied to the standard uncertainty to express the expanded uncertainty at approximately 95% confidence level.

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Correction data from Larson Davis LxT Manual for SoundTrack LxT & SoundExpert LxT, 1770.01 Rev J Supporting Firmware Version: 2.301, 2015-04-30

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Acoustic Signal Tests, C-weighting

Measured according to IEC 61672-3:2013 12 and ANSI S1.4-2014 Part 3: 12 using a comparison coupler with Unit Under Test (UUT) and reference SLM using slow time-weighted sound level for compliance to IEC 61672-1:2013 5.5; ANSI S1.4-2014 Part 1: 5.5

| Frequency [Hz] | Test Result [dB] | Expected [dB] | Lower Limit [dB] | Upper Limit [dB] | Expanded Uncertainty [dB] | Result |
|----------------|------------------|---------------|------------------|------------------|---------------------------|--------|
| 125 | -0.24 | -0.20 | -1.70 | 1.30 | 0.23 | Pass |
| 1000 | 0.17 | 0.00 | -1.00 | 1.00 | 0.23 | Pass |
| 8000 | -2.35 | -3.00 | -8.00 | 2.00 | 0.32 | Pass |

— End of measurement results—

Self-generated Noise

Measured according to IEC 61672-3:2013 11.1 and ANSI S1.4-2014 Part 3: 11.1

| Measurement | Test Result [dB] |
|-------------|------------------|
| A-weighted | 40.82 |

— End of measurement results—

— End of Report—

Signature: Jacob Cannon

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Calibration Certificate

Certificate Number 2022002970

Customer:

United Analyst and Engineering Consultant Co Ltd
No. 81 Soi Udomsak 41, Sukhumvit Road, Bangkok, Phra
Khaeng, Bangkok, 10260, Thailand

Model Number LXT2
Serial Number 0006591
Test Results Pass

Initial Condition As Manufactured

Description SoundTrack LXT Class 2
Class 2 Sound Level Meter
Firmware Revision: 2.404

Procedure Number D0001.8378
Technician Jacob Cannon
Calibration Date 9 Mar 2022
Calibration Due
Temperature 24 °C ± 0.25 °C
Humidity 51.7 %RH ± 2.0 %RH
Static Pressure 85.34 kPa ± 0.13 kPa

Evaluation Method Tested electrically using Larson Davis PRLxT2C S/N 071560 and a 12.0 pF capacitor to simulate microphone capacitance. Data reported in dB re 20 µPa assuming a microphone sensitivity of 50.0 mV/Pa.

Compliance Standards Compliant to Manufacturer Specifications and the following standards when combined with Calibration Certificate from procedure D0001.8384.

| | |
|------------------------|----------------------------|
| IEC 60651:2001 Type 2 | ANSI S1.4-2014 Class 2 |
| IEC 60804:2000 Type 2 | ANSI S1.4 (R2006) Type 2 |
| IEC 61252:2002 | ANSI S1.25 (R2007) |
| IEC 61672:2013 Class 2 | ANSI S1.43 (R2007) Type 2 |
| IEC 61260:2001 Class 2 | ANSI S1.11 (R2009) Class 2 |

Issuing lab certifies that the instrument described above meets or exceeds all specifications as stated in the referenced procedure (unless otherwise noted). It has been calibrated using measurement standards traceable to the International System of Units (SI) through the National Institute of Standards and Technology (NIST), or other national measurement institutes, and meets the requirements of ISO/IEC 17025:2017. Test points marked with a \pm in the uncertainties column do not fall within this laboratory's scope of accreditation.

The quality system is registered to ISO 9001:2015.

This calibration is a direct comparison of the unit under test to the listed reference standards and did not involve any sampling plans to complete. No allowance has been made for the instability of the test device due to use, time, etc. Such allowances would be made by the customer as needed.

The uncertainties were computed in accordance with the ISO Guide to the Expression of Uncertainty in Measurement (GUM). A coverage factor of approximately 2 sigma (k=2) has been applied to the standard uncertainty to express the expanded uncertainty at approximately 95% confidence level.

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Correction data from Larson Davis LXT Manual for SoundTrack LXT & SoundExpert LXT, 1770.01 Rev O Supporting Firmware Version 4.0.5, 2019-09-10

Calibration Check Frequency: 1000 Hz; Reference Sound Pressure Level: 114 dB re 20 µPa

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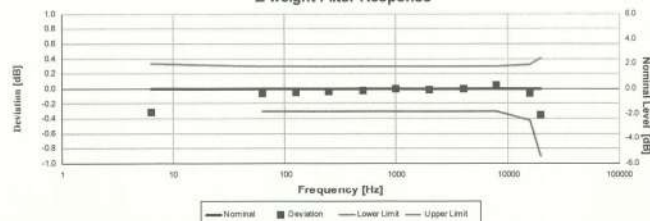
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Certificate Number 2022002970

Certificate Number 2022002970

Z-weight Filter Response



Electrical signal test of frequency weighting performed according to IEC 61672-3:2013 13 and ANSI S1.4-2014 Part 3: 13 for compliance to IEC 61672-1:2013 5.5; IEC 60651:2001 6.1 and 8.2.2; IEC 60804:2000 5; ANSI S1.4-1983 (R2006) 5.1 and 8.2.1; ANSI S1.4-2014 Part 1: 5.5

| Frequency [Hz] | Test Result [dB] | Deviation [dB] | Lower limit [dB] | Upper limit [dB] | Expanded Uncertainty [dB] | Result |
|----------------|------------------|----------------|------------------|------------------|---------------------------|--------|
| 6.31 | -0.31 | -0.31 | -1.11 | 0.33 | 0.15 | Pass |
| 63.10 | -0.07 | -0.07 | -0.30 | 0.30 | 0.15 | Pass |
| 125.89 | -0.05 | -0.05 | -0.30 | 0.30 | 0.15 | Pass |
| 251.19 | -0.04 | -0.04 | -0.30 | 0.30 | 0.15 | Pass |
| 501.19 | -0.02 | -0.02 | -0.30 | 0.30 | 0.15 | Pass |
| 1,000.00 | 0.00 | 0.00 | -0.30 | 0.30 | 0.15 | Pass |
| 1,995.26 | -0.02 | -0.02 | -0.30 | 0.30 | 0.15 | Pass |
| 3,981.07 | 0.00 | 0.00 | -0.30 | 0.30 | 0.15 | Pass |
| 7,943.28 | 0.04 | 0.04 | -0.30 | 0.30 | 0.15 | Pass |
| 15,946.93 | -0.06 | -0.06 | -0.42 | 0.32 | 0.15 | Pass |
| 19,952.62 | -0.35 | -0.35 | -0.91 | 0.41 | 0.15 | Pass |

— End of measurement results—

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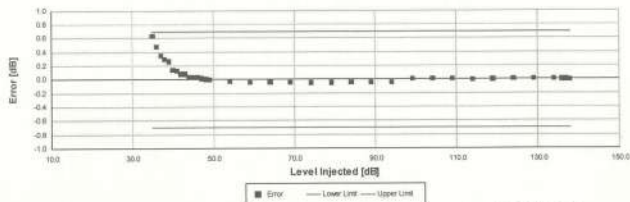
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A-weighted Broadband Log Linearity: 8,000.00 Hz



Broadband level linearity performed according to IEC 61672-3:2013 16 and ANSI S1.4-2014 Part 3: 16 for compliance to IEC 61672-1:2013 5.6, IEC 60804:2000 6.2, IEC 61252:2002 8, ANSI S1.4 (R2006) 9.9, ANSI S1.4-2014 Part 1: 5.6, ANSI S1.43 (R2007) 6.2

| Level [dB] | Error [dB] | Lower limit [dB] | Upper limit [dB] | Expanded Uncertainty [dB] | Result |
|------------|------------|------------------|------------------|---------------------------|--------|
| 35.00 | 0.64 | -0.70 | 0.70 | 0.16 | Pass |
| 36.00 | 0.49 | -0.70 | 0.70 | 0.16 | Pass |
| 37.00 | 0.35 | -0.70 | 0.70 | 0.16 | Pass |
| 38.00 | 0.30 | -0.70 | 0.70 | 0.16 | Pass |
| 39.00 | 0.27 | -0.70 | 0.70 | 0.16 | Pass |
| 40.00 | 0.14 | -0.70 | 0.70 | 0.16 | Pass |
| 41.00 | 0.13 | -0.70 | 0.70 | 0.16 | Pass |
| 42.00 | 0.09 | -0.70 | 0.70 | 0.16 | Pass |
| 43.00 | 0.09 | -0.70 | 0.70 | 0.17 | Pass |
| 44.00 | 0.03 | -0.70 | 0.70 | 0.17 | Pass |
| 45.00 | 0.04 | -0.70 | 0.70 | 0.16 | Pass |
| 46.00 | 0.04 | -0.70 | 0.70 | 0.16 | Pass |
| 47.00 | 0.02 | -0.70 | 0.70 | 0.16 | Pass |
| 48.00 | 0.01 | -0.70 | 0.70 | 0.16 | Pass |
| 49.00 | 0.00 | -0.70 | 0.70 | 0.16 | Pass |
| 50.00 | -0.03 | -0.70 | 0.70 | 0.16 | Pass |
| 51.00 | -0.04 | -0.70 | 0.70 | 0.16 | Pass |
| 52.00 | -0.03 | -0.70 | 0.70 | 0.16 | Pass |
| 53.00 | -0.04 | -0.70 | 0.70 | 0.16 | Pass |
| 54.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 55.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 56.00 | -0.04 | -0.70 | 0.70 | 0.16 | Pass |
| 57.00 | -0.04 | -0.70 | 0.70 | 0.16 | Pass |
| 58.00 | -0.04 | -0.70 | 0.70 | 0.16 | Pass |
| 59.00 | 0.01 | -0.70 | 0.70 | 0.15 | Pass |
| 60.00 | 0.02 | -0.70 | 0.70 | 0.15 | Pass |
| 61.00 | 0.01 | -0.70 | 0.70 | 0.15 | Pass |
| 62.00 | 0.00 | -0.70 | 0.70 | 0.15 | Pass |
| 63.00 | 0.00 | -0.70 | 0.70 | 0.15 | Pass |
| 64.00 | 0.01 | -0.70 | 0.70 | 0.15 | Pass |
| 65.00 | 0.01 | -0.70 | 0.70 | 0.15 | Pass |
| 66.00 | 0.01 | -0.70 | 0.70 | 0.15 | Pass |
| 67.00 | 0.01 | -0.70 | 0.70 | 0.15 | Pass |
| 68.00 | 0.01 | -0.70 | 0.70 | 0.15 | Pass |
| 69.00 | 0.01 | -0.70 | 0.70 | 0.15 | Pass |
| 70.00 | 0.00 | -0.70 | 0.70 | 0.15 | Pass |
| 71.00 | 0.00 | -0.70 | 0.70 | 0.15 | Pass |
| 72.00 | 0.01 | -0.70 | 0.70 | 0.15 | Pass |
| 73.00 | 0.01 | -0.70 | 0.70 | 0.15 | Pass |
| 74.00 | 0.01 | -0.70 | 0.70 | 0.15 | Pass |
| 75.00 | 0.01 | -0.70 | 0.70 | 0.15 | Pass |
| 76.00 | 0.01 | -0.70 | 0.70 | 0.15 | Pass |
| 77.00 | 0.01 | -0.70 | 0.70 | 0.15 | Pass |
| 78.00 | 0.01 | -0.70 | 0.70 | 0.15 | Pass |
| 79.00 | 0.01 | -0.70 | 0.70 | 0.15 | Pass |
| 80.00 | 0.01 | -0.70 | 0.70 | 0.15 | Pass |
| 81.00 | 0.01 | -0.70 | 0.70 | 0.15 | Pass |
| 82.00 | 0.01 | -0.70 | 0.70 | 0.15 | Pass |
| 83.00 | 0.01 | -0.70 | 0.70 | 0.15 | Pass |
| 84.00 | 0.01 | -0.70 | 0.70 | 0.15 | Pass |
| 85.00 | 0.01 | -0.70 | 0.70 | 0.15 | Pass |
| 86.00 | 0.01 | -0.70 | 0.70 | 0.15 | Pass |
| 87.00 | 0.01 | -0.70 | 0.70 | 0.15 | Pass |
| 88.00 | 0.01 | -0.70 | 0.70 | 0.15 | Pass |
| 89.00 | 0.01 | -0.70 | 0.70 | 0.15 | Pass |
| 90.00 | 0.01 | -0.70 | 0.70 | 0.15 | Pass |
| 91.00 | 0.01 | -0.70 | 0.70 | 0.15 | Pass |
| 92.00 | 0.01 | -0.70 | 0.70 | 0.15 | Pass |
| 93.00 | 0.01 | -0.70 | 0.70 | 0.15 | Pass |
| 94.00 | 0.01 | -0.70 | 0.70 | 0.15 | Pass |
| 95.00 | 0.01 | -0.70 | 0.70 | 0.15 | Pass |
| 96.00 | 0.01 | -0.70 | 0.70 | 0.15 | Pass |
| 97.00 | 0.01 | -0.70 | 0.70 | 0.15 | Pass |
| 98.00 | 0.01 | -0.70 | 0.70 | 0.15 | Pass |
| 99.00 | 0.01 | -0.70 | 0.70 | 0.15 | Pass |
| 100.00 | 0.01 | -0.70 | 0.70 | 0.15 | Pass |
| 101.00 | 0.01 | -0.70 | 0.70 | 0.15 | Pass |
| 102.00 | 0.01 | -0.70 | 0.70 | 0.15 | Pass |
| 103.00 | 0.01 | -0.70 | 0.70 | 0.15 | Pass |
| 104.00 | 0.01 | -0.70 | 0.70 | 0.15 | Pass |
| 105.00 | 0.01 | -0.70 | 0.70 | 0.15 | Pass |
| 106.00 | 0.01 | -0.70 | 0.70 | 0.15 | Pass |
| 107.00 | 0.01 | -0.70 | 0.70 | 0.15 | Pass |
| 108.00 | 0.01 | -0.70 | 0.70 | 0.15 | Pass |
| 109.00 | 0.01 | -0.70 | 0.70 | 0.15 | Pass |
| 110.00 | 0.01 | -0.70 | 0.70 | 0.15 | Pass |
| 111.00 | 0.01 | -0.70 | 0.70 | 0.15 | Pass |
| 112.00 | 0.01 | -0.70 | 0.70 | 0.15 | Pass |
| 113.00 | 0.01 | -0.70 | 0.70 | 0.15 | Pass |
| 114.00 | 0.01 | -0.70 | 0.70 | 0.15 | Pass |
| 115.00 | 0.01 | -0.70 | 0.70 | 0.15 | Pass |
| 116.00 | 0.01 | -0.70 | 0.70 | 0.15 | Pass |
| 117.00 | 0.01 | -0.70 | 0.70 | 0.15 | Pass |
| 118.00 | 0.01 | -0.70 | 0.70 | 0.15 | Pass |
| 119.00 | 0.01 | -0.70 | 0.70 | 0.15 | Pass |
| 120.00 | 0.01 | -0.70 | 0.70 | 0.15 | Pass |
| 121.00 | 0.01 | -0.70 | 0.70 | 0.15 | Pass |
| 122.00 | 0.01 | -0.70 | 0.70 | 0.15 | Pass |
| 123.00 | 0.01 | -0.70 | 0.70 | 0.15 | Pass |
| 124.00 | 0.01 | -0.70 | 0.70 | 0.15 | Pass |
| 125.00 | 0.01 | -0.70 | 0.70 | 0.15 | Pass |
| 126.00 | 0.01 | -0.70 | 0.70 | 0.15 | Pass |
| 127.00 | 0.01 | -0.70 | 0.70 | 0.15 | Pass |
| 128.00 | 0.01 | -0.70 | 0.70 | 0.15 | Pass |
| 129.00 | 0.01 | -0.70 | 0.70 | 0.15 | Pass |
| 130.00 | 0.01 | -0.70 | 0.70 | 0.15 | Pass |
| 131.00 | 0.01 | -0.70 | 0.70 | 0.15 | Pass |
| 132.00 | 0.01 | -0.70 | 0.70 | 0.15 | Pass |
| 133.00 | 0.01 | -0.70 | 0.70 | 0.15 | Pass |
| 134.00 | 0.01 | -0.70 | 0.70 | 0.15 | Pass |
| 135.00 | 0.01 | -0.70 | 0.70 | 0.15 | Pass |
| 136.00 | 0.01 | -0.70 | 0.70 | 0.15 | Pass |
| 137.00 | 0.01 | -0.70 | 0.70 | 0.15 | Pass |
| 138.00 | 0.00 | -0.70 | 0.70 | 0.15 | Pass |

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Peak Rise Time

Peak rise time performed according to IEC 60551:2001 9.4.4 and ANSI S1.4:1993 (R2006) 8.4.2

| Amplitude [dB] | Duration [μs] | | Test Result [dB] | Lower limit [dB] | Upper limit [dB] | Expanded Uncertainty [dB] | Result |
|-------------------------------|---------------|----------------|------------------|------------------|------------------|---------------------------|--------|
| 135.95 | 40 | Negative Pulse | 135.14 | 133.65 | 135.65 | 0.15 | Pass |
| | | Positive Pulse | 135.12 | 133.64 | 135.64 | 0.15 | Pass |
| | 30 | Negative Pulse | 134.20 | 133.65 | 135.65 | 0.15 | Pass |
| | | Positive Pulse | 134.20 | 133.64 | 135.64 | 0.15 | Pass |
| - End of measurement results- | | | | | | | |

Positive Pulse Crest Factor

200 μs pulse tests at 2.0, 12.0, 22.0, 32.0 dB below Overload Limit

Crest Factor measured according to IEC 60551:2001 9.4.2 and ANSI S1.4:1993 (R2006) 8.4.2

| Amplitude [dB] | Crest Factor | Test Result [dB] | Limit [dB] | Expanded Uncertainty [dB] | Result |
|---------------------------------|--------------|------------------|------------|---------------------------|--------|
| 135.95 | 3 | OVLD | ±1.00 | 0.15 ± | Pass |
| | 5 | OVLD | ±1.00 | 0.15 ± | Pass |
| 125.95 | 3 | -0.14 | ±1.00 | 0.15 ± | Pass |
| | 5 | -0.15 | ±1.00 | 0.15 ± | Pass |
| 115.95 | 3 | -0.14 | ±1.00 | 0.15 ± | Pass |
| | 5 | -0.14 | ±1.00 | 0.15 ± | Pass |
| 105.95 | 3 | -0.15 | ±1.00 | 0.15 ± | Pass |
| | 5 | -0.13 | ±1.00 | 0.15 ± | Pass |
| -- End of measurement results-- | | | | | |

Negative Pulse Crest Factor

200 μs pulse tests at 2.0, 12.0, 22.0, 32.0 dB below Overload Limit

Crest Factor measured according to IEC 60551:2001 9.4.2 and ANSI S1.4:1993 (R2006) 8.4.2

| Amplitude [dB] | Crest Factor | Test Result [dB] | Limit [dB] | Expanded Uncertainty [dB] | Result |
|---------------------------------|--------------|------------------|------------|---------------------------|--------|
| 135.95 | 3 | OVLD | ±1.00 | 0.15 ± | Pass |
| | 5 | OVLD | ±1.00 | 0.15 ± | Pass |
| 125.95 | 3 | -0.12 | ±1.00 | 0.15 ± | Pass |
| | 5 | -0.13 | ±1.00 | 0.15 ± | Pass |
| 115.95 | 3 | -0.13 | ±1.00 | 0.15 ± | Pass |
| | 5 | -0.13 | ±1.00 | 0.15 ± | Pass |
| 105.95 | 3 | -0.14 | ±1.00 | 0.15 ± | Pass |
| | 5 | -0.12 | ±1.00 | 0.15 ± | Pass |
| -- End of measurement results-- | | | | | |

Gain

Gain measured according to IEC 61672-3:2013 17.3 and ANSI S1.4-2014 Part 3: 17.3 and 17.4

| Measurement | Test Result [dB] | Lower limit [dB] | Upper limit [dB] | Expanded Uncertainty [dB] | Result |
|---------------------------------|------------------|------------------|------------------|---------------------------|--------|
| 0 dB Gain | 93.96 | 93.91 | 94.11 | 0.15 | Pass |
| 0 dB Gain, Linearity | 40.26 | 39.41 | 40.81 | 0.16 | Pass |
| OBA Low Range | 94.02 | 93.91 | 94.11 | 0.15 | Pass |
| OBA Normal Range | 94.01 | 93.20 | 94.80 | 0.15 | Pass |
| -- End of measurement results-- | | | | | |

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Broadband Noise Floor

Self-generated noise measured according to IEC 61672-3:2013 11.2 and ANSI S1.4-2014 Part 3: 11.2

| Measurement | Test Result [dB] | Upper limit [dB] | Result |
|----------------------|------------------|------------------|--------|
| A-weight Noise Floor | 26.93 | 36.00 | Pass |
| C-weight Noise Floor | 26.82 | 35.00 | Pass |
| Z-weight Noise Floor | 32.70 | 39.00 | Pass |

-- End of measurement results--

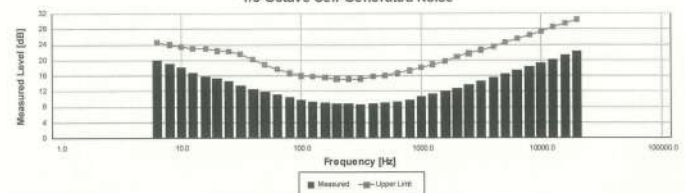
Total Harmonic Distortion

Measured using 1/3-Octave filters

| Measurement | Test Result [dB] | Lower limit [dB] | Upper limit [dB] | Expanded Uncertainty [dB] | Result |
|--------------|------------------|------------------|------------------|---------------------------|--------|
| 10 Hz Signal | 135.67 | 134.15 | 135.75 | 0.15 | Pass |
| THD | -65.74 | -58.00 | -58.00 | 0.01 ± | Pass |
| THD+N | -82.05 | -58.00 | -58.00 | 0.01 ± | Pass |

-- End of measurement results--

1/3-Octave Self-Generated Noise



The SLM is set to low range.

| Frequency [Hz] | Test Result [dB] | Upper limit [dB] | Result |
|---------------------------------|------------------|------------------|--------|
| 6.30 | 19.93 | 24.60 | Pass |
| 8.00 | 19.05 | 24.00 | Pass |
| 10.00 | 18.09 | 23.50 | Pass |
| 12.50 | 16.82 | 23.00 | Pass |
| 16.00 | 15.82 | 22.90 | Pass |
| 20.00 | 15.31 | 22.40 | Pass |
| 25.00 | 14.66 | 22.30 | Pass |
| 31.50 | 13.58 | 21.50 | Pass |
| 40.00 | 12.50 | 20.20 | Pass |
| 50.00 | 11.82 | 19.90 | Pass |
| 63.00 | 11.10 | 17.60 | Pass |
| 80.00 | 10.41 | 16.60 | Pass |
| 100.00 | 9.77 | 15.90 | Pass |
| 125.00 | 9.30 | 15.70 | Pass |
| 160.00 | 9.00 | 15.50 | Pass |
| 200.00 | 8.76 | 14.30 | Pass |
| 250.00 | 8.72 | 15.20 | Pass |
| 315.00 | 8.68 | 15.20 | Pass |
| 400.00 | 8.73 | 15.70 | Pass |
| 500.00 | 8.96 | 16.00 | Pass |
| 630.00 | 9.37 | 16.60 | Pass |
| 800.00 | 9.86 | 17.30 | Pass |
| 1,000.00 | 10.60 | 18.10 | Pass |
| 1,250.00 | 11.29 | 18.90 | Pass |
| 1,600.00 | 12.01 | 19.80 | Pass |
| 2,000.00 | 12.77 | 20.80 | Pass |
| 2,500.00 | 13.64 | 21.70 | Pass |
| 3,150.00 | 14.52 | 22.60 | Pass |
| 4,000.00 | 15.43 | 23.50 | Pass |
| 5,000.00 | 16.38 | 24.50 | Pass |
| 6,300.00 | 17.34 | 25.50 | Pass |
| 8,000.00 | 18.30 | 26.50 | Pass |
| 10,000.00 | 19.27 | 27.40 | Pass |
| 12,500.00 | 20.25 | 28.50 | Pass |
| 16,000.00 | 21.24 | 29.50 | Pass |
| 20,000.00 | 22.23 | 30.40 | Pass |
| -- End of measurement results-- | | | |

Calibration Certificate

Certificate Number 2022003094

Customer:

United Analyst and Engineering Consultant Co Ltd
No. 81 Soi Udonak 41, Sukhumvit Road,
Bangchak, Phra Khanong,
Bangkok, 10260, Thailand

Model Number LxT2

Serial Number 0006692

Test Results Pass

Initial Condition As Manufactured

Description SoundTrack LxT Class 2
Class 2 Sound Level Meter
Firmware Revision: 2.404

Procedure Number D0001.8384

Technician Jacob Cannon

Calibration Date 11 Mar 2022

Calibration Due

Temperature 23.48 °C ± 0.26 °C

Humidity 51.5 %RH ± 2.0 %RH

Static Pressure 87.17 kPa ± 0.13 kPa

Evaluation Method

Tested with:

Data reported in dB re 20 µPa.

Larson Davis CAL200, S/N 9079
Larson Davis PPM-LxT2C, S/N 071861
PCB 375A04, S/N 335076
Larson Davis CAL291, S/N 0106

Compliance Standards

Compliant to Manufacturer Specifications and the following standards when combined with Calibration Certificate from procedure D0001.8378:

| | |
|------------------------|----------------------------|
| IEC 60651:2001 Type 2 | ANSI S1.4-2014 Class 2 |
| IEC 60604:2000 Type 2 | ANSI S1.4 (R2006) Type 2 |
| IEC 61252:2002 | ANSI S1.11 (R2009) Class 2 |
| IEC 61260:2001 Class 2 | ANSI S1.25 (R2007) |
| IEC 61672:2013 Class 2 | ANSI S1.43 (R2007) Type 2 |

Issuing lab certifies that the instrument described above meets or exceeds all specifications as stated in the referenced procedure (unless otherwise noted). It has been calibrated using measurement standards traceable to the International System of Units (SI) through the National Institute of Standards and Technology (NIST), or other national measurement institutes, and meets the requirements of ISO/IEC 17025:2017.

Test points marked with a † in the uncertainties column do not fall within this laboratory's scope of accreditation.

The quality system is registered to ISO 9001:2015.

This calibration is a direct comparison of the unit under test to the listed reference standards and did not involve any sampling plans to complete. No allowance has been made for the instability of the test device due to use, time, etc. Such allowances would be made by the customer as needed.

The uncertainties were computed in accordance with the ISO Guide to the Expression of Uncertainty in Measurement (GUM). A coverage factor of approximately 2 sigma (k=2) has been applied to the standard uncertainty to express the expanded uncertainty at approximately 95% confidence level.

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Correction data from Larson Davis LxT Manual for SoundTrack LxT & SoundExpert LxT, I770.01 Rev J Supporting Firmware Version 2.301, 2015-04-30

-- End of Report--

Signature: Jacob Cannon

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Certificate Number 2022003094

For 1/4" microphones, the Larson Davis ADP024 1/4" to 1/2" adaptor is used with the calibrators and the Larson Davis ADP043 1/4" to 1/2" adaptor is used with the preamplifier.

Calibration Check Frequency: 1000 Hz; Reference Sound Pressure Level: 114 dB re 20 µPa

Periodic tests were performed in accordance with procedures from IEC 61672-3:2013 / ANSI/ASA S1.4-2014/Part 3.

No Pattern approval for IEC 61672-1:2013 / ANSI/ASA S1.4-2014/Part 1 available.

The sound level meter submitted for testing successfully completed the periodic tests of IEC 61672-3:2013 / ANSI/ASA S1.4-2014/Part 3, for the environmental conditions under which the tests were performed. However, no general statement or conclusion can be made about conformance of the sound level meter to the full specifications of IEC 61672-1:2013 / ANSI/ASA S1.4-2014/Part 1 because (a) evidence was not publicly available, from an independent testing organization responsible for pattern approvals, to demonstrate that the model of sound level meter fully conformed to the class 2 specifications in IEC 61672-1:2013 / ANSI/ASA S1.4-2014/Part 1 or correction data for acoustical test of frequency weighting were not provided in the Instruction Manual and (b) because the periodic tests of IEC 61672-3:2013 / ANSI/ASA S1.4-2014/Part 3 cover only a limited subset of the specifications in IEC 61672-1:2013 / ANSI/ASA S1.4-2014/Part 1.

| Description | Standard Used | Cal Date | Cal Due | Cal Standard |
|--|---------------|------------|------------|--------------|
| Larson Davis CAL291 Residual Intensity Calibrator | | 2021-09-10 | 2022-09-10 | 001250 |
| Hart Scientific 2626-H Temperature Probe | | 2021-02-04 | 2022-08-04 | 066767 |
| Larson Davis CAL200 Acoustic Calibrator | | 2021-07-21 | 2022-07-21 | 007027 |
| Larson Davis Model 831 | | 2022-02-21 | 2023-02-21 | 007182 |
| PCB 377A13 1/2 inch Prepolarized Pressure Microphone | | 2022-03-02 | 2023-03-02 | 007185 |
| SRS DS360 Ultra Low Distortion Generator | | 2021-04-13 | 2022-04-13 | 007635 |
| Larson Davis 1/2" Preamplifier for Model 831 Type 1 | | 2021-09-28 | 2022-09-28 | PCB0004783 |

Acoustic Calibration

Measured according to IEC 61672-3:2013 10 and ANSI S1.4-2014 Part 3: 10

| Measurement | Test Result [dB] | Lower Limit [dB] | Upper Limit [dB] | Expanded Uncertainty [dB] | Result |
|-------------|------------------|------------------|------------------|---------------------------|--------|
| 1000 Hz | 114.01 | 113.80 | 114.20 | 0.14 | Pass |

Loaded Circuit Sensitivity

| Measurement | Test Result [dB re 1 V / Pa] | Lower Limit [dB re 1 V / Pa] | Upper Limit [dB re 1 V / Pa] | Expanded Uncertainty [dB] | Result |
|-------------|------------------------------|------------------------------|------------------------------|---------------------------|--------|
| 1000 Hz | -49.51 | -52.44 | -48.33 | 0.14 | Pass |

-- End of measurement results--

Certificate Number 2022003094

Acoustic Signal Tests, C-weighting

Measured according to IEC 61672-3:2013 12 and ANSI S1.4-2014 Part 3: 12 using a comparison coupler with Unit Under Test (UUT) and reference SLM using slow time-weighted sound level for compliance to IEC 61672-1:2013 5.5; ANSI S1.4-2014 Part 1: 5.5

| Frequency [Hz] | Test Result [dB] | Expected [dB] | Lower Limit [dB] | Upper Limit [dB] | Expanded Uncertainty [dB] | Result |
|----------------|------------------|---------------|------------------|------------------|---------------------------|--------|
| 125 | -0.22 | -0.20 | -1.70 | 1.30 | 0.23 | Pass |
| 1000 | 0.12 | 0.00 | -1.00 | 1.00 | 0.23 | Pass |
| 8000 | -3.06 | -3.00 | -6.00 | 2.00 | 0.32 | Pass |

-- End of measurement results--

Self-generated Noise

Measured according to IEC 61672-3:2013 11.1 and ANSI S1.4-2014 Part 3: 11.1

| Measurement | Test Result [dB] |
|-------------|------------------|
| A-weighted | 40.69 |

-- End of measurement results--

-- End of Report--

Signature: Jacob Cannon

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Calibration Certificate

Certificate Number 2022002971

Customer:

United Analyst and Engineering Consultant Co Ltd
No. 81 Soi Udonrak 41, Sukhumvit Road,
Bangchak, Phra Khanong,
Bangkok, 10260, Thailand

Model Number LxT2

Serial Number 0006892

Test Results Pass

Initial Condition As Manufactured

Description SoundTrack LxT Class 2
Class 2 Sound Level Meter
Firmware Revision: 2.404

Procedure Number D0001.8378

Technician Jacob Cannon

Calibration Date 9 Mar 2022

Calibration Due

Temperature 23.91 °C ± 0.25 °C

Humidity 50.6 %RH ± 2.0 %RH

Static Pressure 85.35 kPa ± 0.13 kPa

Evaluation Method Tested electrically using Larson Davis PRLMT2C S/N 071561 and a 12.0 pF capacitor to simulate microphone capacitance. Data reported in dB re 20 µPa assuming a microphone sensitivity of 50.0 mV/Pa.

Compliance Standards Compliant to Manufacturer Specifications and the following standards when combined with Calibration Certificate from procedure D0001.8384:

| | |
|------------------------|----------------------------|
| IEC 60651:2001 Type 2 | ANSI S1.4-2014 Class 2 |
| IEC 60894:2000 Type 2 | ANSI S1.4 (R2006) Type 2 |
| IEC 61252:2002 | ANSI S1.25 (R2007) |
| IEC 61672:2013 Class 2 | ANSI S1.43 (R2007) Type 2 |
| IEC 61260:2001 Class 2 | ANSI S1.11 (R2009) Class 2 |

Issuing lab certifies that the instrument described above meets or exceeds all specifications as stated in the referenced procedure (unless otherwise noted). It has been calibrated using measurement standards traceable to the International System of Units (SI) through the National Institute of Standards and Technology (NIST), or other national measurement institutes, and meets the requirements of ISO/IEC 17025:2017. Test points marked with a ± in the uncertainties column do not fall within this laboratory's scope of accreditation.

The quality system is registered to ISO 9001:2015.

This calibration is a direct comparison of the unit under test to the listed reference standards and did not involve any sampling plans to complete. No allowance has been made for the instability of the test device due to use, time, etc. Such allowances would be made by the customer as needed.

The uncertainties were computed in accordance with the ISO Guide to the Expression of Uncertainty in Measurement (GUM). A coverage factor of approximately 2 sigma (k=2) has been applied to the standard uncertainty to express the expanded uncertainty at approximately 95% confidence level.

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Correction data from Larson Davis LxT Manual for SoundTrack LxT & SoundExpert LxT, I770.01 Rev O Supporting Firmware Version 4.0.5, 2019-09-10

Calibration Check Frequency: 1000 Hz; Reference Sound Pressure Level: 114 dB re 20 µPa

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| Standards Used | | | |
|--|------------|------------|--------------|
| Description | Cal Date | Cal Due | Cal Standard |
| Hart Scientific 2626-H Temperature Probe | 2021-02-04 | 2022-08-04 | 006767 |
| SRS DS360 Ultra Low Distortion Generator | 2021-07-22 | 2023-07-22 | 007174 |

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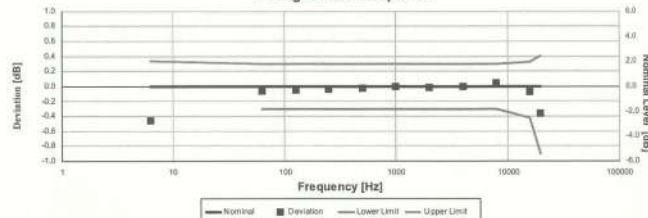
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Certificate Number 2022002971

Z-weight Filter Response



Electrical signal test of frequency weighting performed according to IEC 61672-3:2013 13 and ANSI S1.4-2014 Part 3: 13 for compliance to IEC 61672-1:2013 5.5, IEC 60851:2001 6.1 and 9.2.2, IEC 60894:2000 5, ANSI S1.4:1983 (R2006) 5.1 and 9.2.1, ANSI S1.4-2014 Part 1: 5.5

| Frequency [Hz] | Test Result [dB] | Deviation [dB] | Lower limit [dB] | Upper limit [dB] | Expanded Uncertainty [dB] | Result |
|----------------|------------------|----------------|------------------|------------------|---------------------------|--------|
| 6.31 | -0.45 | -0.45 | -1.11 | 0.33 | 0.15 | Pass |
| 63.10 | -0.06 | -0.06 | -0.30 | 0.30 | 0.15 | Pass |
| 125.89 | -0.05 | -0.05 | -0.30 | 0.30 | 0.15 | Pass |
| 251.19 | -0.04 | -0.04 | -0.30 | 0.30 | 0.15 | Pass |
| 501.19 | -0.03 | -0.03 | -0.30 | 0.30 | 0.15 | Pass |
| 1,000.00 | 0.00 | 0.00 | -0.30 | 0.30 | 0.15 | Pass |
| 1,995.26 | -0.01 | -0.01 | -0.30 | 0.30 | 0.15 | Pass |
| 3,981.07 | 0.00 | 0.00 | -0.30 | 0.30 | 0.15 | Pass |
| 7,943.28 | 0.05 | 0.05 | -0.30 | 0.30 | 0.15 | Pass |
| 15,848.93 | -0.08 | -0.08 | -0.42 | 0.32 | 0.15 | Pass |
| 19,952.62 | -0.36 | -0.36 | -0.91 | 0.41 | 0.15 | Pass |

-- End of measurement results--

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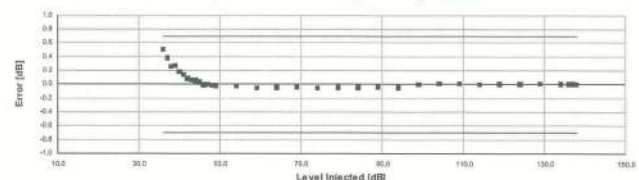
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Certificate Number 2022002971

A-weighted Broadband Log Linearity: 8,000.00 Hz



Broadband level linearity performed according to IEC 61672-3:2013 16 and ANSI S1.4-2014 Part 3: 16 for compliance to IEC 61672-1:2013 5.6, IEC 60894:2000 6.2, IEC 61252:2002 8, ANSI S1.4 (R2006) 6.9, ANSI S1.4-2014 Part 1: 5.6, ANSI S1.43 (R2007) 6.2

| Level [dB] | Error [dB] | Lower limit [dB] | Upper limit [dB] | Expanded Uncertainty [dB] | Result |
|------------|------------|------------------|------------------|---------------------------|--------|
| 36.00 | 0.50 | -0.70 | 0.70 | 0.16 | Pass |
| 37.00 | 0.38 | -0.70 | 0.70 | 0.16 | Pass |
| 38.00 | 0.26 | -0.70 | 0.70 | 0.16 | Pass |
| 39.00 | 0.27 | -0.70 | 0.70 | 0.16 | Pass |
| 40.00 | 0.18 | -0.70 | 0.70 | 0.16 | Pass |
| 41.00 | 0.15 | -0.70 | 0.70 | 0.16 | Pass |
| 42.00 | 0.08 | -0.70 | 0.70 | 0.16 | Pass |
| 43.00 | 0.06 | -0.70 | 0.70 | 0.17 | Pass |
| 44.00 | 0.05 | -0.70 | 0.70 | 0.17 | Pass |
| 45.00 | 0.03 | -0.70 | 0.70 | 0.16 | Pass |
| 46.00 | 0.00 | -0.70 | 0.70 | 0.16 | Pass |
| 47.00 | 0.00 | -0.70 | 0.70 | 0.16 | Pass |
| 48.00 | -0.01 | -0.70 | 0.70 | 0.16 | Pass |
| 49.00 | -0.02 | -0.70 | 0.70 | 0.16 | Pass |
| 50.00 | -0.03 | -0.70 | 0.70 | 0.16 | Pass |
| 51.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 52.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 53.00 | -0.04 | -0.70 | 0.70 | 0.16 | Pass |
| 54.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 55.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 56.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 57.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 58.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 59.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 60.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 61.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 62.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 63.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 64.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 65.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 66.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 67.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 68.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 69.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 70.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 71.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 72.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 73.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 74.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 75.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 76.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 77.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 78.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 79.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 80.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 81.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 82.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 83.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 84.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 85.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 86.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 87.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 88.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 89.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 90.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 91.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 92.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 93.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 94.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 95.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 96.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 97.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 98.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 99.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 100.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 101.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 102.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 103.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 104.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 105.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 106.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 107.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 108.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 109.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 110.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 111.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 112.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 113.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 114.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 115.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 116.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 117.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 118.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 119.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 120.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 121.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 122.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 123.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 124.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 125.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 126.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 127.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 128.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 129.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 130.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 131.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 132.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 133.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 134.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 135.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 136.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 137.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 138.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |

-- End of measurement results--

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Peak Rise Time

Peak rise time performed according to IEC 60651:2001 9.4.4 and ANSI S1.4-1983 (R2006) 8.4.4

| Amplitude [dB] | Duration [µs] | Test Result [dB] | Lower Limit [dB] | Upper Limit [dB] | Expanded Uncertainty [dB] | Result |
|---------------------------------|---------------|------------------|------------------|------------------|---------------------------|-----------|
| 136.95 | 40 | Negative Pulse | 135.03 | 133.55 | 135.55 | 0.15 Pass |
| | | Positive Pulse | 135.12 | 133.64 | 135.64 | 0.15 Pass |
| | 30 | Negative Pulse | 133.78 | 133.55 | 135.64 | 0.15 Pass |
| | | Positive Pulse | 133.90 | 133.64 | 135.64 | 0.15 Pass |
| -- End of measurement results-- | | | | | | |

Positive Pulse Crest Factor

200 µs pulse tests at 2.0, 12.0, 22.0, 32.0 dB below Overload Limit

Crest Factor measured according to IEC 60651:2001 9.4.2 and ANSI S1.4-1983 (R2006) 8.4.2

| Amplitude [dB] | Crest Factor | Test Result [dB] | Limits [dB] | Expanded Uncertainty [dB] | Result |
|---------------------------------|--------------|------------------|-------------|---------------------------|--------|
| 135.95 | 3 | OVLD | ± 1.00 | 0.15 ± | Pass |
| | 5 | OVLD | ± 1.00 | 0.15 ± | Pass |
| 125.95 | 3 | -0.15 | ± 1.00 | 0.15 ± | Pass |
| | 5 | -0.14 | ± 1.00 | 0.16 ± | Pass |
| 115.95 | 3 | -0.15 | ± 1.00 | 0.15 ± | Pass |
| | 5 | -0.14 | ± 1.00 | 0.15 ± | Pass |
| 105.95 | 3 | -0.12 | ± 1.00 | 0.15 ± | Pass |
| | 5 | -0.13 | ± 1.00 | 0.15 ± | Pass |
| -- End of measurement results-- | | | | | |

Negative Pulse Crest Factor

200 µs pulse tests at 2.0, 12.0, 22.0, 32.0 dB below Overload Limit

Crest Factor measured according to IEC 60651:2001 9.4.2 and ANSI S1.4-1983 (R2006) 8.4.2

| Amplitude [dB] | Crest Factor | Test Result [dB] | Limits [dB] | Expanded Uncertainty [dB] | Result |
|-------------------------------|--------------|------------------|-------------|---------------------------|--------|
| 135.95 | 3 | OVLD | ± 1.00 | 0.15 ± | Pass |
| | 5 | OVLD | ± 1.00 | 0.15 ± | Pass |
| 125.95 | 3 | -0.20 | ± 1.00 | 0.15 ± | Pass |
| | 5 | -0.19 | ± 1.00 | 0.15 ± | Pass |
| 115.95 | 3 | -0.21 | ± 1.00 | 0.15 ± | Pass |
| | 5 | -0.18 | ± 1.00 | 0.15 ± | Pass |
| 105.95 | 3 | -0.15 | ± 1.00 | 0.15 ± | Pass |
| | 5 | -0.17 | ± 1.00 | 0.15 ± | Pass |
| — End of measurement results— | | | | | |

Gain

Gain measured according to IEC 61672-3:2013 17.3 and 17.4 and ANSI S1.4-2014 Part 3: 17.3 and 17.4

| Measurement | Test Result [dB] | Lower Limit [dB] | Upper Limit [dB] | Expanded Uncertainty [dB] | Result |
|---------------------------------|------------------|------------------|------------------|---------------------------|--------|
| 0 dB Gain | 93.94 | 93.89 | 94.09 | 0.15 | Pass |
| 0 dB Gain, Linearity | 40.30 | 39.39 | 40.79 | 0.16 | Pass |
| OBA Low Range | 93.99 | 93.89 | 94.09 | 0.15 | Pass |
| OBA Normal Range | 93.99 | 93.20 | 94.80 | 0.15 | Pass |
| -- End of measurement results-- | | | | | |

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Broadband Noise Floor

Self-generated noise measured according to IEC 61672-3:2013 11.2 and ANSI S1.4-2014 Part 3: 11.2

| Measurement | Test Result [dB] | Upper Limit [dB] | Result |
|----------------------|------------------|------------------|--------|
| A-weight Noise Floor | 26.87 | 36.00 | Pass |
| C-weight Noise Floor | 26.80 | 35.00 | Pass |
| Z-weight Noise Floor | 32.77 | 39.00 | Pass |

-- End of measurement results--

Total Harmonic Distortion

Measured using 1/3-Octave Filter

| Measurement | Test Result [dB] | Lower Limit [dB] | Upper Limit [dB] | Expanded Uncertainty [dB] | Result |
|--------------|------------------|------------------|------------------|---------------------------|--------|
| 10 Hz Signal | 135.67 | 134.15 | 135.75 | 0.15 | Pass |
| THD | -67.46 | -58.00 | -58.00 | 0.01 ± | Pass |
| THD+N | -62.99 | -58.00 | -58.00 | 0.01 ± | Pass |

-- End of measurement results--

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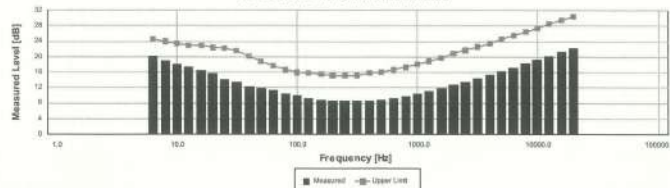
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1/3-Octave Self-Generated Noise



The SLM is set to low range.

| Frequency [Hz] | Test Result [dB] | Upper Limit [dB] | Result |
|---------------------------------|------------------|------------------|--------|
| 6.30 | 20.21 | 24.60 | Pass |
| 8.00 | 19.11 | 24.00 | Pass |
| 10.00 | 18.05 | 23.50 | Pass |
| 12.50 | 17.39 | 23.00 | Pass |
| 16.00 | 16.35 | 22.90 | Pass |
| 20.00 | 15.76 | 22.40 | Pass |
| 25.00 | 14.17 | 22.30 | Pass |
| 31.50 | 13.44 | 21.50 | Pass |
| 40.00 | 12.40 | 20.20 | Pass |
| 50.00 | 11.80 | 18.80 | Pass |
| 63.00 | 11.26 | 17.60 | Pass |
| 80.00 | 10.46 | 16.60 | Pass |
| 100.00 | 10.00 | 15.90 | Pass |
| 125.00 | 9.22 | 15.70 | Pass |
| 160.00 | 8.88 | 15.50 | Pass |
| 200.00 | 8.61 | 15.20 | Pass |
| 250.00 | 8.49 | 15.20 | Pass |
| 315.00 | 8.48 | 15.20 | Pass |
| 400.00 | 8.54 | 15.70 | Pass |
| 500.00 | 8.83 | 16.00 | Pass |
| 630.00 | 9.25 | 16.60 | Pass |
| 800.00 | 9.78 | 17.30 | Pass |
| 1,000.00 | 10.35 | 18.10 | Pass |
| 1,250.00 | 11.10 | 18.90 | Pass |
| 1,600.00 | 11.86 | 19.80 | Pass |
| 2,000.00 | 12.67 | 20.80 | Pass |
| 2,500.00 | 13.54 | 21.70 | Pass |
| 3,150.00 | 14.41 | 22.60 | Pass |
| 4,000.00 | 15.39 | 23.50 | Pass |
| 5,000.00 | 16.36 | 24.50 | Pass |
| 6,300.00 | 17.29 | 25.50 | Pass |
| 8,000.00 | 18.25 | 26.50 | Pass |
| 10,000.00 | 19.28 | 27.40 | Pass |
| 12,500.00 | 20.24 | 28.50 | Pass |
| 16,000.00 | 21.24 | 29.50 | Pass |
| 20,000.00 | 22.22 | 30.40 | Pass |
| -- End of measurement results-- | | | |

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Signature: Jacob Cannon

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Calibration Certificate

Certificate Number 2022002973

Customer:

United Analyst and Engineering Consultant Co Ltd
No. 81 Soi Udonsuk 41, Sukhumvit Road,
Bangchak, Phra Khanong,
Bangkok, 10260, Thailand

Model Number LxT2**Serial Number** 0006693**Test Results** Pass**Initial Condition** As Manufactured

Description SoundTrack LxT Class 2
Class 2 Sound Level Meter
Firmware Revision: 2.404

Procedure Number D0001.8378**Technician** Jacob Cannon**Calibration Date** 9 Mar 2022**Calibration Due****Temperature** 23.73 °C ± 0.25 °C**Humidity** 49.5 %RH ± 2.0 %RH**Static Pressure** 85.37 kPa ± 0.13 kPa

Evaluation Method Tested electrically using Larson Davis PRLXLT2C S/N 071562 and a 12.0 pF capacitor to simulate microphone capacitance. Data reported in dB re 20 µPa assuming a microphone sensitivity of 50.0 mV/Pa.

Compliance Standards Compliant to Manufacturer Specifications and the following standards when combined with Calibration Certificate from procedure D0001.8384:

IEC 60651:2001 Type 2

IEC 60804:2000 Type 2

IEC 61252:2002

IEC 61672:2013 Class 2

IEC 61260:2001 Class 2

ANSI S1.4-2014 Class 2

ANSI S1.4 (R2006) Type 2

ANSI S1.25 (R2007)

ANSI S1.43 (R2007) Type 2

ANSI S1.11 (R2009) Class 2

Issuing lab certifies that the instrument described above meets or exceeds all specifications as stated in the referenced procedure (unless otherwise noted). It has been calibrated using measurement standards traceable to the International System of Units (SI) through the National Institute of Standards and Technology (NIST), or other national measurement institutes, and meets the requirements of ISO/IEC 17025:2017. Test points marked with a ‡ in the uncertainties column do not fall within this laboratory's scope of accreditation.

The quality system is registered to ISO 9001:2015.

This calibration is a direct comparison of the unit under test to the listed reference standards and did not involve any sampling plans to complete. No allowance has been made for the instability of the test device due to use, time, etc. Such allowances would be made by the customer as needed.

The uncertainties were computed in accordance with the ISO Guide to the Expression of Uncertainty in Measurement (GUM). A coverage factor of approximately 2 sigma (k=2) has been applied to the standard uncertainty to express the expanded uncertainty at approximately 95% confidence level.

This report may not be reproduced, except in full, unless permission for the publication of an approved abstract is obtained in writing from the organization issuing this report.

Correction data from Larson Davis LxT Manual for SoundTrack LxT & SoundExpert LxT, I770.01 Rev O Supporting Firmware Version 4.0.5, 2019-09-10

Calibration Check Frequency: 1000 Hz; Reference Sound Pressure Level: 114 dB re 20 µPa

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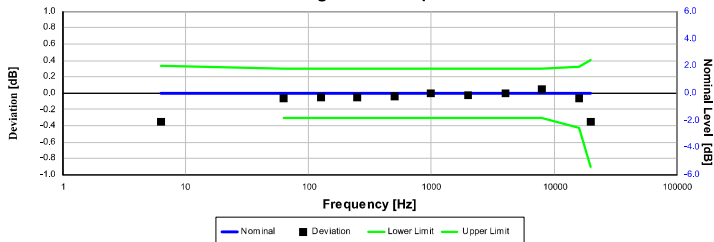
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2022-3-9T18:28:48

Certificate Number 2022002973

Z-weight Filter Response

Electrical signal test of frequency weighting performed according to IEC 61672-3:2013 13 and ANSI S1.4-2014 Part 3: 13 for compliance to IEC 61672-1:2013 5.5; IEC 60651:2001 6.1 and 9.2.2; IEC 60804:2000 5; ANSI S1.4-1983 (R2006) 5.1 and 8.2.1; ANSI S1.4-2014 Part 1: 5.5

| Frequency [Hz] | Test Result [dB] | Deviation [dB] | Lower limit [dB] | Upper limit [dB] | Expanded Uncertainty [dB] | Result |
|----------------|------------------|----------------|------------------|------------------|---------------------------|--------|
| 6.31 | -0.35 | -0.35 | -1.11 | 0.33 | 0.15 | Pass |
| 63.10 | -0.06 | -0.06 | -0.30 | 0.30 | 0.15 | Pass |
| 125.89 | -0.05 | -0.05 | -0.30 | 0.30 | 0.15 | Pass |
| 251.19 | -0.05 | -0.05 | -0.30 | 0.30 | 0.15 | Pass |
| 501.19 | -0.03 | -0.03 | -0.30 | 0.30 | 0.15 | Pass |
| 1,000.00 | 0.00 | 0.00 | -0.30 | 0.30 | 0.15 | Pass |
| 1,995.26 | -0.02 | -0.02 | -0.30 | 0.30 | 0.15 | Pass |
| 3,981.07 | -0.01 | -0.01 | -0.30 | 0.30 | 0.15 | Pass |
| 7,943.28 | 0.04 | 0.04 | -0.30 | 0.30 | 0.15 | Pass |
| 15,848.93 | -0.07 | -0.07 | -0.42 | 0.32 | 0.15 | Pass |
| 19,952.62 | -0.35 | -0.35 | -0.91 | 0.41 | 0.15 | Pass |

- End of measurement results-

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| Standards Used | | | |
|--|------------|------------|--------------|
| Description | Cal Date | Cal Due | Cal Standard |
| Hart Scientific 2626-H Temperature Probe | 2021-02-04 | 2022-08-04 | 006767 |
| SRS DS360 Ultra Low Distortion Generator | 2022-01-03 | 2023-01-03 | 007118 |

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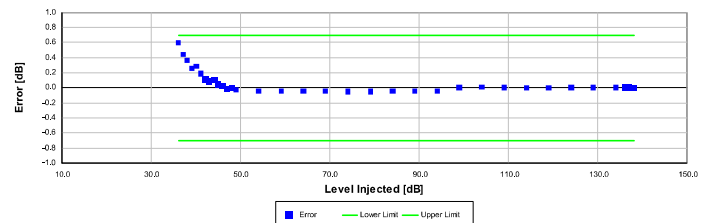
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2022-3-9T18:28:48

Certificate Number 2022002973

A-weighted Broadband Log Linearity: 8,000.00 Hz

Broadband level linearity performed according to IEC 61672-3:2013 16 and ANSI S1.4-2014 Part 3: 16 for compliance to IEC 61672-1:2013 5.6; IEC 60804:2000 6.2; IEC 61252:2002 8; ANSI S1.4 (R2006) 6.9; ANSI S1.4-2014 Part 1: 5.6; ANSI S1.43 (R2007) 6.2

| Level [dB] | Error [dB] | Lower limit [dB] | Upper limit [dB] | Expanded Uncertainty [dB] | Result |
|------------|------------|------------------|------------------|---------------------------|--------|
| 36.00 | 0.60 | -0.70 | 0.70 | 0.16 | Pass |
| 37.00 | 0.44 | -0.70 | 0.70 | 0.16 | Pass |
| 38.00 | 0.37 | -0.70 | 0.70 | 0.16 | Pass |
| 39.00 | 0.26 | -0.70 | 0.70 | 0.16 | Pass |
| 40.00 | 0.28 | -0.70 | 0.70 | 0.16 | Pass |
| 41.00 | 0.19 | -0.70 | 0.70 | 0.16 | Pass |
| 42.00 | 0.11 | -0.70 | 0.70 | 0.16 | Pass |
| 43.00 | 0.08 | -0.70 | 0.70 | 0.17 | Pass |
| 44.00 | 0.10 | -0.70 | 0.70 | 0.17 | Pass |
| 45.00 | 0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 46.00 | 0.02 | -0.70 | 0.70 | 0.16 | Pass |
| 47.00 | -0.01 | -0.70 | 0.70 | 0.16 | Pass |
| 48.00 | 0.00 | -0.70 | 0.70 | 0.16 | Pass |
| 49.00 | -0.03 | -0.70 | 0.70 | 0.16 | Pass |
| 54.00 | -0.04 | -0.70 | 0.70 | 0.16 | Pass |
| 59.00 | -0.04 | -0.70 | 0.70 | 0.16 | Pass |
| 64.00 | -0.04 | -0.70 | 0.70 | 0.16 | Pass |
| 69.00 | -0.04 | -0.70 | 0.70 | 0.16 | Pass |
| 74.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 79.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 84.00 | -0.04 | -0.70 | 0.70 | 0.16 | Pass |
| 89.00 | -0.04 | -0.70 | 0.70 | 0.16 | Pass |
| 94.00 | -0.04 | -0.70 | 0.70 | 0.16 | Pass |
| 99.00 | 0.01 | -0.70 | 0.70 | 0.15 | Pass |
| 104.00 | 0.01 | -0.70 | 0.70 | 0.15 | Pass |
| 109.00 | 0.01 | -0.70 | 0.70 | 0.15 | Pass |
| 114.00 | 0.00 | -0.70 | 0.70 | 0.15 | Pass |
| 119.00 | 0.00 | -0.70 | 0.70 | 0.15 | Pass |
| 124.00 | 0.01 | -0.70 | 0.70 | 0.15 | Pass |
| 129.00 | 0.01 | -0.70 | 0.70 | 0.15 | Pass |
| 134.00 | 0.01 | -0.70 | 0.70 | 0.15 | Pass |
| 136.00 | 0.01 | -0.70 | 0.70 | 0.15 | Pass |
| 137.00 | 0.00 | -0.70 | 0.70 | 0.15 | Pass |
| 138.00 | 0.00 | -0.70 | 0.70 | 0.15 | Pass |

- End of measurement results-

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Peak Rise Time

Peak rise time performed according to IEC 60651:2001 9.4.4 and ANSI S1.4-1983 (R2006) 8.4.4

| Amplitude [dB] | Duration [µs] | | Test Result [dB] | Lower limit [dB] | Upper limit [dB] | Expanded Uncertainty [dB] | Result |
|----------------|---------------|---------------------------------|------------------|------------------|------------------|------------------------------|--------|
| 136.95 | 40 | Negative Pulse | 135.01 | 133.52 | 135.52 | 0.15 | Pass |
| | | Positive Pulse | 134.99 | 133.51 | 135.51 | 0.15 | Pass |
| | 30 | Negative Pulse | 134.07 | 133.52 | 135.52 | 0.15 | Pass |
| | | Positive Pulse | 134.07 | 133.51 | 135.51 | 0.15 | Pass |
| | | -- End of measurement results-- | | | | | |

Positive Pulse Crest Factor

200 µs pulse tests at 2.0, 12.0, 22.0, 32.0 dB below Overload Limit

Crest Factor measured according to IEC 60651:2001 9.4.2 and ANSI S1.4-1983 (R2006) 8.4.2

| Amplitude [dB] | Crest Factor | Test Result [dB] | Limits [dB] | Expanded Uncertainty [dB] | Result |
|---------------------------------|--------------|------------------|-------------|---------------------------|--------|
| 135.95 | 3 | OVL | ± 1.00 | 0.15 ‡ | Pass |
| | 5 | OVL | ± 1.00 | 0.15 ‡ | Pass |
| 125.95 | 3 | -0.13 | ± 1.00 | 0.15 ‡ | Pass |
| | 5 | -0.15 | ± 1.00 | 0.16 ‡ | Pass |
| 115.95 | 3 | -0.14 | ± 1.00 | 0.15 ‡ | Pass |
| | 5 | -0.14 | ± 1.00 | 0.15 ‡ | Pass |
| 105.95 | 3 | -0.15 | ± 1.00 | 0.15 ‡ | Pass |
| | 5 | -0.14 | ± 1.00 | 0.15 ‡ | Pass |
| -- End of measurement results-- | | | | | |

Negative Pulse Crest Factor

200 µs pulse tests at 2.0, 12.0, 22.0, 32.0 dB below Overload Limit

Crest Factor measured according to IEC 60651:2001 9.4.2 and ANSI S1.4-1983 (R2006) 8.4.2

| Amplitude [dB] | Crest Factor | Test Result [dB] | Limits [dB] | Expanded Uncertainty [dB] | Result |
|---------------------------------|--------------|------------------|-------------|---------------------------|--------|
| 135.95 | 3 | OVL | ± 1.00 | 0.15 ‡ | Pass |
| | 5 | OVL | ± 1.00 | 0.15 ‡ | Pass |
| 125.95 | 3 | -0.13 | ± 1.00 | 0.15 ‡ | Pass |
| | 5 | -0.11 | ± 1.00 | 0.15 ‡ | Pass |
| 115.95 | 3 | -0.13 | ± 1.00 | 0.15 ‡ | Pass |
| | 5 | -0.13 | ± 1.00 | 0.15 ‡ | Pass |
| 105.95 | 3 | -0.14 | ± 1.00 | 0.15 ‡ | Pass |
| | 5 | -0.13 | ± 1.00 | 0.15 ‡ | Pass |
| -- End of measurement results-- | | | | | |

Gain

Gain measured according to IEC 61672-3:2013 17.3 and 17.4 and ANSI S1.4-2014 Part 3: 17.3 and 17.4

| Measurement | Test Result [dB] | Lower limit [dB] | Upper limit [dB] | Expanded Uncertainty [dB] | Result |
|---------------------------------|------------------|------------------|------------------|---------------------------|--------|
| 0 dB Gain | 93.96 | 93.92 | 94.12 | 0.15 | Pass |
| 0 dB Gain, Linearity | 40.29 | 39.42 | 40.82 | 0.16 | Pass |
| OBA Low Range | 94.02 | 93.92 | 94.12 | 0.15 | Pass |
| OBA Normal Range | 94.02 | 93.20 | 94.80 | 0.15 | Pass |
| -- End of measurement results-- | | | | | |

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Broadband Noise Floor

Self-generated noise measured according to IEC 61672-3:2013 11.2 and ANSI S1.4-2014 Part 3: 11.2

| Measurement | Test Result [dB] | Upper limit [dB] | Result |
|----------------------|------------------|------------------|--------|
| A-weight Noise Floor | 27.08 | 36.00 | Pass |
| C-weight Noise Floor | 26.90 | 35.00 | Pass |
| Z-weight Noise Floor | 32.76 | 39.00 | Pass |

-- End of measurement results--

Total Harmonic Distortion

Measured using 1/3-Octave filters

| Measurement | Test Result [dB] | Lower Limit [dB] | Upper Limit [dB] | Expanded Uncertainty [dB] | Result |
|--------------|------------------|------------------|------------------|---------------------------|--------|
| 10 Hz Signal | 135.53 | 134.15 | 135.75 | 0.15 | Pass |
| THD | -67.24 | -58.00 | -58.00 | 0.01 ‡ | Pass |
| THD+N | -63.03 | -58.00 | -58.00 | 0.01 ‡ | Pass |

-- End of measurement results--

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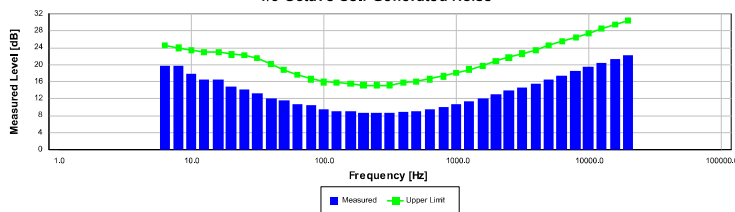
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1/3-Octave Self-Generated Noise



The SLM is set to low range.

| Frequency [Hz] | Test Result [dB] | Upper limit [dB] | Result |
|---------------------------------|------------------|------------------|--------|
| 6.30 | 19.82 | 24.60 | Pass |
| 8.00 | 19.80 | 24.00 | Pass |
| 10.00 | 17.93 | 23.50 | Pass |
| 12.50 | 16.57 | 23.00 | Pass |
| 16.00 | 16.43 | 22.90 | Pass |
| 20.00 | 14.79 | 22.40 | Pass |
| 25.00 | 14.06 | 22.30 | Pass |
| 31.50 | 13.20 | 21.50 | Pass |
| 40.00 | 12.12 | 20.20 | Pass |
| 50.00 | 11.65 | 18.80 | Pass |
| 63.00 | 10.68 | 17.60 | Pass |
| 80.00 | 10.37 | 16.60 | Pass |
| 100.00 | 9.56 | 15.90 | Pass |
| 125.00 | 9.15 | 15.70 | Pass |
| 160.00 | 8.94 | 15.50 | Pass |
| 200.00 | 8.64 | 15.20 | Pass |
| 250.00 | 8.63 | 15.20 | Pass |
| 315.00 | 8.57 | 15.20 | Pass |
| 400.00 | 8.85 | 15.70 | Pass |
| 500.00 | 9.05 | 16.00 | Pass |
| 630.00 | 9.46 | 16.60 | Pass |
| 800.00 | 10.00 | 17.30 | Pass |
| 1,000.00 | 10.69 | 18.10 | Pass |
| 1,250.00 | 11.33 | 18.90 | Pass |
| 1,600.00 | 12.15 | 19.80 | Pass |
| 2,000.00 | 12.96 | 20.80 | Pass |
| 2,500.00 | 13.82 | 21.70 | Pass |
| 3,150.00 | 14.67 | 22.60 | Pass |
| 4,000.00 | 15.61 | 23.50 | Pass |
| 5,000.00 | 16.52 | 24.50 | Pass |
| 6,300.00 | 17.49 | 25.50 | Pass |
| 8,000.00 | 18.47 | 26.50 | Pass |
| 10,000.00 | 19.40 | 27.40 | Pass |
| 12,500.00 | 20.42 | 28.50 | Pass |
| 16,000.00 | 21.33 | 29.50 | Pass |
| 20,000.00 | 22.34 | 30.40 | Pass |
| -- End of measurement results-- | | | |

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Signatory: Jacob Cannon

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2022-3-9T18:28:48

Calibration Certificate

Certificate Number 2022003098

Customer:

United Analyst and Engineering Consultant Co Ltd
No. 81 Soi Udonak 41, Sukhumvit Road,
Bangchak, Phra Khanong,
Bangkok, 10260, Thailand

Model Number LxT2
Serial Number 0006694

Test Results Pass

Initial Condition As Manufactured

Description SoundTrack LxT Class 2
Class 2 Sound Level Meter
Firmware Revision: 2.404

Procedure Number D0001.8384
Technician Jacob Cannon
Calibration Date 11 Mar 2022
Calibration Due
Temperature 23.64 °C ± 0.25 °C
Humidity 55.9 %RH ± 2.0 %RH
Static Pressure 87.2 kPa ± 0.13 kPa

Evaluation Method Tested with: Data reported in dB re 20 µPa.

Larson Davis PRLxT2C, S/N 071563
PCB 375A04, S/N 335078
Larson Davis CAL291, S/N 0108
Larson Davis CAL200, S/N 9079

Compliance Standards Compliant to Manufacturer Specifications and the following standards when combined with Calibration Certificate from procedure D0001.8378:

IEC 60651:2001 Type 2
IEC 60604:2000 Type 2
IEC 61252:2002
IEC 61260:2001 Class 2
IEC 61672:2013 Class 2
ANSI S1.4-2014 Class 2
ANSI S1.4 (R2006) Type 2
ANSI S1.11 (R2009) Class 2
ANSI S1.25 (R2007)
ANSI S1.43 (R2007) Type 2

Issuing lab certifies that the instrument described above meets or exceeds all specifications as stated in the referenced procedure (unless otherwise noted). It has been calibrated using measurement standards traceable to the International System of Units (SI) through the National Institute of Standards and Technology (NIST), or other national measurement institutes, and meets the requirements of ISO/IEC 17025:2017.

Test points marked with a † in the uncertainties column do not fall within this laboratory's scope of accreditation.

The quality system is registered to ISO 9001:2015.

This calibration is a direct comparison of the unit under test to the listed reference standards and did not involve any sampling plans to complete. No allowance has been made for the instability of the test device due to use, time, etc. Such allowances would be made by the customer as needed.

The uncertainties were computed in accordance with the ISO Guide to the Expression of Uncertainty in Measurement (GUM). A coverage factor of approximately 2 sigma (k=2) has been applied to the standard uncertainty to express the expanded uncertainty at approximately 95% confidence level.

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Correction data from Larson Davis LxT Manual for SoundTrack LxT & SoundExpert LxT, I770.01 Rev J Supporting Firmware Version 2.301, 2015-04-30

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For 1/4" microphones, the Larson Davis ADP024 1/4" to 1/2" adaptor is used with the calibrators and the Larson Davis ADP043 1/4" to 1/2" adaptor is used with the preamplifier.

Calibration Check Frequency: 1000 Hz; Reference Sound Pressure Level: 114 dB re 20 µPa

Periodic tests were performed in accordance with procedures from IEC 61672-3:2013 / ANSI/ASA S1.4-2014/Part 3.

No Pattern approval for IEC 61672-1:2013 / ANSI/ASA S1.4-2014/Part 1 available.

The sound level meter submitted for testing successfully completed the periodic tests of IEC 61672-3:2013 / ANSI/ASA S1.4-2014/Part 3, for the environmental conditions under which the tests were performed. However, no general statement or conclusion can be made about conformance of the sound level meter to the full specifications of IEC 61672-1:2013 / ANSI/ASA S1.4-2014/Part 1 because (a) evidence was not publicly available, from an independent testing organization responsible for pattern approvals, to demonstrate that the model of sound level meter fully conformed to the class 2 specifications in IEC 61672-1:2013 / ANSI/ASA S1.4-2014/Part 1 or correction data for acoustical test of frequency weighting were not provided in the Instruction Manual and (b) because the periodic tests of IEC 61672-3:2013 / ANSI/ASA S1.4-2014/Part 3 cover only a limited subset of the specifications in IEC 61672-1:2013 / ANSI/ASA S1.4-2014/Part 1.

| Standards Used | | | |
|--|------------|------------|--------------|
| Description | Cal Date | Cal Due | Cal Standard |
| Larson Davis CAL291 Residual Intensity Calibrator | 2021-09-10 | 2022-09-10 | 001250 |
| Hart Scientific 2626-H Temperature Probe | 2021-02-04 | 2022-08-04 | 006767 |
| Larson Davis CAL200 Acoustic Calibrator | 2021-07-21 | 2022-07-21 | 007027 |
| Larson Davis Model 831 | 2022-02-21 | 2023-02-21 | 007182 |
| PCB 377A13 1/2 inch Prepolarized Pressure Microphone | 2022-03-02 | 2023-03-02 | 007185 |
| SRS DS360 Ultra Low Distortion Generator | 2021-04-13 | 2022-04-13 | 007635 |
| Larson Davis 1/2" Preamplifier for Model 831 Type I | 2021-09-28 | 2022-09-28 | PCB0004783 |

Acoustic Calibration

Measured according to IEC 61672-3:2013 10 and ANSI S1.4-2014 Part 3, 10

| Measurement | Test Result [dB] | Lower Limit [dB] | Upper Limit [dB] | Expanded Uncertainty [dB] | Result |
|-------------|------------------|------------------|------------------|---------------------------|--------|
| 1000 Hz | 114.01 | 113.80 | 114.20 | 0.14 | Pass |

Loaded Circuit Sensitivity

| Measurement | Test Result [dB re 1 V / Pa] | Lower Limit [dB re 1 V / Pa] | Upper Limit [dB re 1 V / Pa] | Expanded Uncertainty [dB] | Result |
|-------------|------------------------------|------------------------------|------------------------------|---------------------------|--------|
| 1000 Hz | -51.12 | -52.44 | -48.33 | 0.14 | Pass |

— End of measurement results—

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Certificate Number 2022003098

Acoustic Signal Tests, C-weighting

Measured according to IEC 61672-3:2013 12 and ANSI S1.4-2014 Part 3, 12 using a comparison coupler with Unit Under Test (UUT) and reference SLM using slow time-weighted sound level for compliance to IEC 61672-1:2013 5.5; ANSI S1.4-2014 Part 1: 5.5

| Frequency [Hz] | Test Result [dB] | Expected [dB] | Lower Limit [dB] | Upper Limit [dB] | Expanded Uncertainty [dB] | Result |
|----------------|------------------|---------------|------------------|------------------|---------------------------|--------|
| 125 | -0.22 | -0.20 | -1.70 | 1.30 | 0.23 | Pass |
| 1000 | 0.16 | 0.00 | -1.00 | 1.00 | 0.23 | Pass |
| 8000 | -2.84 | -3.00 | -8.00 | 2.00 | 0.32 | Pass |

— End of measurement results—

Self-generated Noise

Measured according to IEC 61672-3:2013 11.1 and ANSI S1.4-2014 Part 3, 11.1

| Measurement | Test Result [dB] |
|-------------|------------------|
| A-weighted | 40.78 |

— End of measurement results—

— End of Report—

Signature: Jacob Cannon

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Calibration Certificate

Certificate Number 2022002974

Customer:

United Analyst and Engineering Consultant Co Ltd
No. 81 Soi Udonak 41, Sukhumvit Road,
Bangchak, Phra Khanong,
Bangkok, 10260, Thailand

Model Number LxT2
Serial Number 0006694

Test Results Pass

Initial Condition As Manufactured

Description SoundTrack LxT Class 2
Class 2 Sound Level Meter
Firmware Revision: 2.404

Procedure Number D0001.8378
Technician Jacob Cannon
Calibration Date 9 Mar 2022
Calibration Due
Temperature 23.79 °C ± 0.25 °C
Humidity 55.37 %RH ± 2.0 %RH
Static Pressure 85.37 kPa ± 0.13 kPa

Evaluation Method Tested electrically using Larson Davis PRLxT2C S/N 071563 and a 12.0 pF capacitor to simulate microphone capacitance. Data reported in dB re 20 µPa assuming a microphone sensitivity of 50.0 mV/Pa.

Compliance Standards Compliant to Manufacturer Specifications and the following standards when combined with Calibration Certificate from procedure D0001.8384:

IEC 60651:2001 Type 2
IEC 60604:2000 Type 2
IEC 61252:2002
IEC 61672:2013 Class 2
IEC 61260:2001 Class 2
ANSI S1.4-2014 Class 2
ANSI S1.4 (R2006) Type 2
ANSI S1.25 (R2007)
ANSI S1.43 (R2007) Type 2
ANSI S1.11 (R2009) Class 2

Issuing lab certifies that the instrument described above meets or exceeds all specifications as stated in the referenced procedure (unless otherwise noted). It has been calibrated using measurement standards traceable to the International System of Units (SI) through the National Institute of Standards and Technology (NIST), or other national measurement institutes, and meets the requirements of ISO/IEC 17025:2017. Test points marked with a † in the uncertainties column do not fall within this laboratory's scope of accreditation.

The quality system is registered to ISO 9001:2015.

This calibration is a direct comparison of the unit under test to the listed reference standards and did not involve any sampling plans to complete. No allowance has been made for the instability of the test device due to use, time, etc. Such allowances would be made by the customer as needed.

The uncertainties were computed in accordance with the ISO Guide to the Expression of Uncertainty in Measurement (GUM). A coverage factor of approximately 2 sigma (k=2) has been applied to the standard uncertainty to express the expanded uncertainty at approximately 95% confidence level.

This report may not be reproduced, except in full, unless permission for the publication of an approved abstract is obtained in writing from the organization issuing this report.

Correction data from Larson Davis LxT Manual for SoundTrack LxT & SoundExpert LxT, I770.01 Rev O Supporting Firmware Version 4.0.5, 2019-09-10

Calibration Check Frequency: 1000 Hz; Reference Sound Pressure Level: 114 dB re 20 µPa

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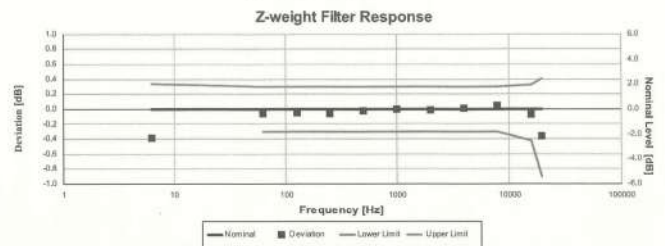


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| Description | Standard Used | Cal Date | Cal Due | Cal Standard |
|---|---------------|------------|------------|--------------|
| Hart Scientific 2626-II Temperature Probe | | 2021-02-04 | 2022-08-04 | 006767 |
| SRS DS360 Ultra Low Distortion Generator | | 2021-07-22 | 2022-07-22 | 007174 |



Electrical signal test of frequency weighting performed according to IEC 61672-3:2013 13 and ANSI S1.4-2014 Part 3: 13 for compliance to IEC 61672-1:2013 5.5, IEC 60651:2001 6.1 and 9.2.2; IEC 60804:2000 5, ANSI S1.4-1983 (R2006) 5.1 and 8.2.1; ANSI S1.4-2014 Part 1: 5.5

| Frequency [Hz] | Test Result [dB] | Deviation [dB] | Lower limit [dB] | Upper limit [dB] | Expanded Uncertainty [dB] | Result |
|----------------|------------------|----------------|------------------|------------------|---------------------------|--------|
| 6.31 | -0.39 | -0.39 | -1.11 | 0.33 | 0.15 | Pass |
| 63.10 | -0.06 | -0.06 | -0.30 | 0.30 | 0.15 | Pass |
| 125.89 | -0.05 | -0.05 | -0.30 | 0.30 | 0.15 | Pass |
| 251.19 | -0.06 | -0.06 | -0.30 | 0.30 | 0.15 | Pass |
| 501.19 | -0.03 | -0.03 | -0.30 | 0.30 | 0.15 | Pass |
| 1,000.00 | 0.00 | 0.00 | -0.30 | 0.30 | 0.15 | Pass |
| 1,995.26 | -0.01 | -0.01 | -0.30 | 0.30 | 0.15 | Pass |
| 3,981.07 | 0.01 | 0.01 | -0.30 | 0.30 | 0.15 | Pass |
| 7,943.28 | 0.05 | 0.05 | -0.30 | 0.30 | 0.15 | Pass |
| 15,848.93 | -0.08 | -0.08 | -0.42 | 0.32 | 0.15 | Pass |
| 19,952.62 | -0.36 | -0.36 | -0.91 | 0.41 | 0.15 | Pass |

— End of measurement results—

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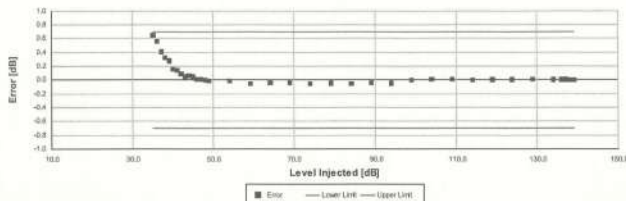
2023-3-PT18.27.21

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Certificate Number 2022002974

A-weighted Broadband Log Linearity: 8,000.00 Hz



Broadband level linearity performed according to IEC 61672-3:2013 16 and ANSI S1.4-2014 Part 3: 16 for compliance to IEC 61672-1:2013 5.6, IEC 60804:2000 6.2, IEC 61252:2002 8, ANSI S1.4 (R2006) 6.9, ANSI S1.4-2014 Part 1: 5.6, ANSI S1.43 (R2007) 6.2

| Level [dB] | Error [dB] | Lower limit [dB] | Upper limit [dB] | Expanded Uncertainty [dB] | Result |
|------------|------------|------------------|------------------|---------------------------|--------|
| 35.00 | 0.65 | -0.70 | 0.70 | 0.16 | Pass |
| 36.00 | 0.58 | -0.70 | 0.70 | 0.16 | Pass |
| 37.00 | 0.41 | -0.70 | 0.70 | 0.16 | Pass |
| 38.00 | 0.32 | -0.70 | 0.70 | 0.16 | Pass |
| 39.00 | 0.28 | -0.70 | 0.70 | 0.16 | Pass |
| 40.00 | 0.15 | -0.70 | 0.70 | 0.16 | Pass |
| 41.00 | 0.14 | -0.70 | 0.70 | 0.16 | Pass |
| 42.00 | 0.09 | -0.70 | 0.70 | 0.16 | Pass |
| 43.00 | 0.04 | -0.70 | 0.70 | 0.17 | Pass |
| 44.00 | 0.06 | -0.70 | 0.70 | 0.16 | Pass |
| 45.00 | 0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 46.00 | 0.01 | -0.70 | 0.70 | 0.16 | Pass |
| 47.00 | 0.01 | -0.70 | 0.70 | 0.16 | Pass |
| 48.00 | 0.00 | -0.70 | 0.70 | 0.16 | Pass |
| 49.00 | -0.01 | -0.70 | 0.70 | 0.16 | Pass |
| 50.00 | -0.02 | -0.70 | 0.70 | 0.16 | Pass |
| 51.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 52.00 | -0.04 | -0.70 | 0.70 | 0.16 | Pass |
| 53.00 | -0.04 | -0.70 | 0.70 | 0.16 | Pass |
| 54.00 | -0.04 | -0.70 | 0.70 | 0.16 | Pass |
| 55.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 56.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 57.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 58.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 59.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 60.00 | -0.04 | -0.70 | 0.70 | 0.16 | Pass |
| 61.00 | -0.04 | -0.70 | 0.70 | 0.16 | Pass |
| 62.00 | -0.04 | -0.70 | 0.70 | 0.16 | Pass |
| 63.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 64.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 65.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 66.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 67.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 68.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 69.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 70.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 71.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 72.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 73.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 74.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 75.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 76.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 77.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 78.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 79.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 80.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 81.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 82.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 83.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 84.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 85.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 86.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 87.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 88.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 89.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 90.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 91.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 92.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 93.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 94.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 95.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 96.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 97.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 98.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 99.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 100.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 101.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 102.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 103.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 104.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 105.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 106.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 107.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 108.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 109.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 110.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 111.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 112.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 113.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 114.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 115.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 116.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 117.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 118.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 119.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 120.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 121.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 122.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 123.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 124.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 125.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 126.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 127.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 128.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 129.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 130.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 131.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 132.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 133.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 134.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 135.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |

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2023-3-PT18.27.21

Certificate Number 2022002974

Peak Rise Time

Peak rise time performed according to IEC 60651:2001 9.4.4 and ANSI S1.4-1983 (R2006) 8.4.4

| Amplitude [dB] | Duration [μs] | | Test Result [dB] | Lower limit [dB] | Upper limit [dB] | Expanded Uncertainty [dB] | Result |
|-------------------------------|---------------|----------------|------------------|------------------|------------------|---------------------------|--------|
| 136.95 | 40 | Negative Pulse | 134.96 | 133.48 | 135.48 | 0.15 | Pass |
| | | Positive Pulse | 134.95 | 133.50 | 135.50 | 0.15 | Pass |
| | 30 | Negative Pulse | 134.03 | 133.48 | 135.48 | 0.15 | Pass |
| | | Positive Pulse | 134.05 | 133.50 | 135.50 | 0.15 | Pass |
| = End of measurement results. | | | | | | | |

Positive Pulse Crest Factor

200 μs pulse tests at 2.0, 12.0, 22.0, 32.0 dB below Overload Limit

| Amplitude [dB] | Crest Factor | Test Result [dB] | Limits [dB] | Expanded Uncertainty [dB] | Result |
|----------------|--------------|------------------|-------------|---------------------------|--------|
| 135.95 | 3 | OVLD | ± 1.00 | 0.15 ± | Pass |
| | 5 | OVLD | ± 1.00 | 0.15 ± | Pass |
| 125.95 | 3 | -0.15 | ± 1.00 | 0.15 ± | Pass |
| | 5 | -0.15 | ± 1.00 | 0.15 ± | Pass |
| 115.95 | 3 | -0.16 | ± 1.00 | 0.15 ± | Pass |
| | 5 | -0.13 | ± 1.00 | 0.15 ± | Pass |
| 105.95 | 3 | -0.13 | ± 1.00 | 0.15 ± | Pass |
| | 5 | -0.14 | ± 1.00 | 0.15 ± | Pass |

Negative Pulse Crest Factor

200 μs pulse tests at 2.0, 12.0, 22.0, 32.0 dB below Overload Limit

| Amplitude [dB] | Crest Factor | Test Result [dB] | Limits [dB] | Expanded Uncertainty [dB] | Result |
|----------------|--------------|------------------|-------------|---------------------------|--------|
| 135.95 | 3 | OVLD | ± 1.00 | 0.15 ± | Pass |
| | 5 | OVLD | ± 1.00 | 0.15 ± | Pass |
| 125.95 | 3 | -0.17 | ± 1.00 | 0.15 ± | Pass |
| | 5 | -0.17 | ± 1.00 | 0.15 ± | Pass |
| 115.95 | 3 | -0.16 | ± 1.00 | 0.15 ± | Pass |
| | 5 | -0.15 | ± 1.00 | 0.15 ± | Pass |
| 105.95 | 3 | -0.16 | ± 1.00 | 0.15 ± | Pass |
| | 5 | -0.17 | ± 1.00 | 0.15 ± | Pass |

Gain

Gain measured according to IEC 61672-3:2013 17.3 and 17.4 and ANSI S1.4-2014 Part 3: 17.3 and 17.4

| Measurement | Test Result [dB] | Lower limit [dB] | Upper limit [dB] | Expanded Uncertainty [dB] | Result |
|----------------------|------------------|------------------|------------------|---------------------------|--------|
| 0 dB Gain | 93.94 | 93.89 | 94.09 | 0.15 | Pass |
| 0 dB Gain, Linearity | 40.26 | 39.39 | 40.79 | 0.16 | Pass |
| OBA Low Range | 93.99 | 93.89 | 94.09 | 0.15 | Pass |
| OBA Normal Range | 93.99 | 93.20 | 94.80 | 0.15 | Pass |

— End of measurement results—

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Broadband Noise Floor

Self-generated noise measured according to IEC 61672-3:2013 11.2 and ANSI S1.4-2014 Part 3: 11.2

| Measurement | Test Result [dB] | Upper Limit [dB] | Result |
|----------------------|------------------|------------------|--------|
| A-weight Noise Floor | 27.00 | 36.00 | Pass |
| C-weight Noise Floor | 26.90 | 35.00 | Pass |
| Z-weight Noise Floor | 32.83 | 39.00 | Pass |

- End of measurement results -

Total Harmonic Distortion

Measured using 1/3-Octave filters

| Measurement | Test Result [dB] | Lower Limit [dB] | Upper Limit [dB] | Expanded Uncertainty [dB] | Result |
|--------------|------------------|------------------|------------------|---------------------------|--------|
| 10 Hz Signal | 135.53 | 134.15 | 135.75 | 0.15 | Pass |
| THD | -65.89 | -58.00 | -58.00 | 0.01 ‡ | Pass |
| THD+N | -62.16 | -58.00 | -58.00 | 0.01 ‡ | Pass |

- End of measurement results -

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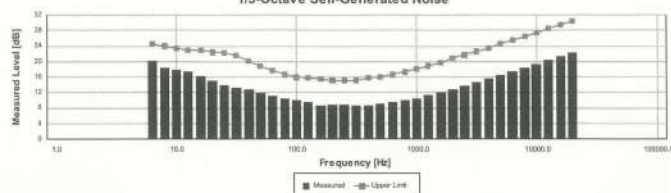
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1/3-Octave Self-Generated Noise



The SLM is set to low range.

| Frequency [Hz] | Test Result [dB] | Upper Limit [dB] | Result |
|----------------|------------------|------------------|--------|
| 6.30 | 20.27 | 24.60 | Pass |
| 8.00 | 18.34 | 24.00 | Pass |
| 10.00 | 17.91 | 23.50 | Pass |
| 12.50 | 17.29 | 23.00 | Pass |
| 16.00 | 16.26 | 22.90 | Pass |
| 20.00 | 15.07 | 22.40 | Pass |
| 25.00 | 13.95 | 22.30 | Pass |
| 31.50 | 13.28 | 21.50 | Pass |
| 40.00 | 12.72 | 20.20 | Pass |
| 50.00 | 11.82 | 18.80 | Pass |
| 63.00 | 11.17 | 17.60 | Pass |
| 80.00 | 10.50 | 16.60 | Pass |
| 100.00 | 9.94 | 15.90 | Pass |
| 125.00 | 9.53 | 15.70 | Pass |
| 160.00 | 8.63 | 15.50 | Pass |
| 200.00 | 8.09 | 15.20 | Pass |
| 250.00 | 8.71 | 15.20 | Pass |
| 315.00 | 8.54 | 15.20 | Pass |
| 400.00 | 8.68 | 15.70 | Pass |
| 500.00 | 8.98 | 16.00 | Pass |
| 630.00 | 9.43 | 16.60 | Pass |
| 800.00 | 9.93 | 17.30 | Pass |
| 1,000.00 | 10.44 | 18.10 | Pass |
| 1,250.00 | 11.27 | 18.90 | Pass |
| 1,600.00 | 12.00 | 19.80 | Pass |
| 2,000.00 | 12.86 | 20.80 | Pass |
| 2,500.00 | 13.72 | 21.70 | Pass |
| 3,150.00 | 14.59 | 22.60 | Pass |
| 4,000.00 | 15.48 | 23.50 | Pass |
| 5,000.00 | 16.42 | 24.50 | Pass |
| 6,300.00 | 17.46 | 25.50 | Pass |
| 8,000.00 | 18.37 | 26.50 | Pass |
| 10,000.00 | 19.35 | 27.40 | Pass |
| 12,500.00 | 20.37 | 28.50 | Pass |
| 16,000.00 | 21.36 | 29.50 | Pass |
| 20,000.00 | 22.33 | 30.40 | Pass |

- End of measurement results -

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Calibration Certificate

Certificate Number 2022003099

Customer:

United Analyst and Engineering Consultant Co Ltd
No. 81 Soi Udomrak 41, Sukhumvit Road,
Bangchak, Phra Khanong,
Bangkok, 10260, Thailand

Model Number LxT2

Serial Number 0006895

Test Results Pass

Initial Condition As Manufactured

Description SoundTrack LxT Class 2
Class 2 Sound Level Meter
Firmware Revision: 2.404

Procedure Number D0001.8384

Technician Jacob Cannon

Calibration Date 11 Mar 2022

Calibration Due

Temperature 23.59 °C ± 0.26 °C

Humidity 52.1 %RH ± 2.0 %RH

Static Pressure 87.19 kPa ± 0.13 kPa

Evaluation Method

Tested with:

Larson Davis CAL291, S/N 0108
Larson Davis CAL200, S/N 9079
Larson Davis PRMLX2ZC, S/N 071564
PCB 375A04, S/N 335079

Data reported in dB re 20 µPa.

Compliance Standards

Compliant to Manufacturer Specifications and the following standards when combined with Calibration Certificate from procedure D0001.8378:

IEC 60651:2001 Type 2

IEC 60804:2000 Type 2

IEC 61252:2002

IEC 61260:2001 Class 2

IEC 61672:2013 Class 2

ANSI S1.4-2014 Class 2

ANSI S1.4 (R2006) Type 2

ANSI S1.11 (R2009) Class 2

ANSI S1.25 (R2007)

ANSI S1.43 (R2007) Type 2

Issuing lab certifies that the instrument described above meets or exceeds all specifications as stated in the referenced procedure (unless otherwise noted). It has been calibrated using measurement standards traceable to the International System of Units (SI) through the National Institute of Standards and Technology (NIST), or other national measurement institutes, and meets the requirements of ISO/IEC 17025:2017.

Test points marked with a ‡ in the uncertainties column do not fall within this laboratory's scope of accreditation.

The quality system is registered to ISO 9001:2015.

This calibration is a direct comparison of the unit under test to the listed reference standards and did not involve any sampling plans to complete. No allowance has been made for the instability of the test device due to: use, time, etc. Such allowances would be made by the customer as needed.

The uncertainties were computed in accordance with the ISO Guide to the Expression of Uncertainty in Measurement (GUM). A coverage factor of approximately 2 sigma (k=2) has been applied to the standard uncertainty to express the expanded uncertainty at approximately 95% confidence level.

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Correction data from Larson Davis LxT Manual for SoundTrack LxT & SoundExpert LxT, 1770.01 Rev J Supporting Firmware Version 2.301, 2015-04-30

Signature: Jacob Cannon

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For 1/4" microphones, the Larson Davis ADP024 1/4" to 1/2" adaptor is used with the calibrators and the Larson Davis ADP043 1/4" to 1/2" adaptor is used with the preamplifier.

Calibration Check Frequency: 1000 Hz, Reference Sound Pressure Level: 114 dB re 20 µPa

Periodic tests were performed in accordance with procedures from IEC 61672-3:2013 / ANSI/ASA S1.4-2014/Part3.

No Pattern approval for IEC 61672-1:2013 / ANSI/ASA S1.4-2014/Part 1 available.

The sound level meter submitted for testing successfully completed the periodic tests of IEC 61672-3:2013 / ANSI/ASA S1.4-2014/Part 3, for the environmental conditions under which the tests were performed. However, no general statement or conclusion can be made about conformance of the sound level meter to the full specifications of IEC 61672-1:2013 / ANSI/ASA S1.4-2014/Part 1 because (a) evidence was not publicly available, from an independent testing organization responsible for pattern approvals, to demonstrate that the model of sound level meter fully conformed to the class 2 specifications in IEC 61672-1:2013 / ANSI/ASA S1.4-2014/Part 1 or correction data for acoustical test of frequency weighting were not provided in the Instruction Manual and (b) because the periodic tests of IEC 61672-3:2013 / ANSI/ASA S1.4-2014/Part 3 cover only a limited subset of the specifications in IEC 61672-1:2013 / ANSI/ASA S1.4-2014/Part 1.

| Standards Used | | | |
|--|------------|------------|--------------|
| Description | Cal Date | Cal Due | Cal Standard |
| Larson Davis CAL291 Residual Intensity Calibrator | 2021-09-10 | 2022-09-10 | 001250 |
| Hart Scientific 2626-H Temperature Probe | 2021-02-04 | 2022-08-04 | 006767 |
| Larson Davis CAL200 Acoustic Calibrator | 2021-07-21 | 2022-07-21 | 007027 |
| Larson Davis Model 831 | 2022-02-21 | 2023-02-21 | 007182 |
| PCB 377A13 1/2 inch Prepolarized Pressure Microphone | 2022-03-02 | 2023-03-02 | 007185 |
| SRS DS360 Ultra Low Distortion Generator | 2021-04-13 | 2022-04-13 | 007635 |
| Larson Davis 1/2" Preamplifier for Model 831 Type 1 | 2021-09-28 | 2022-09-28 | PCB0004783 |

Acoustic Calibration

Measured according to IEC 61672-3:2013 10 and ANSI S1.4-2014 Part 3: 10

| Measurement | Test Result [dB] | Lower Limit [dB] | Upper Limit [dB] | Expanded Uncertainty [dB] | Result |
|-------------|------------------|------------------|------------------|---------------------------|--------|
| 1000 Hz | 114.01 | 113.80 | 114.20 | 0.14 | Pass |

Loaded Circuit Sensitivity

| Measurement | Test Result [dB re 1 V / Pa] | Lower Limit [dB re 1 V / Pa] | Upper Limit [dB re 1 V / Pa] | Expanded Uncertainty [dB] | Result |
|-------------|------------------------------|------------------------------|------------------------------|---------------------------|--------|
| 1000 Hz | -50.73 | -52.44 | -48.33 | 0.14 | Pass |

— End of measurement results—

Acoustic Signal Tests, C-weighting

Measured according to IEC 61672-3:2013 12 and ANSI S1.4-2014 Part 3: 12 using a comparison coupler with Unit Under Test (UUT) and reference SLM using slow time-weighted sound level for compliance to IEC 61672-1:2013 5.5, ANSI S1.4-2014 Part 1: 5.5

| Frequency [Hz] | Test Result [dB] | Expected [dB] | Lower Limit [dB] | Upper Limit [dB] | Expanded Uncertainty [dB] | Result |
|----------------|------------------|---------------|------------------|------------------|---------------------------|--------|
| 125 | -0.21 | -0.20 | -1.70 | 1.30 | 0.23 | Pass |
| 1000 | 0.15 | 0.00 | -1.00 | 1.00 | 0.23 | Pass |
| 8000 | -2.92 | -3.00 | -8.00 | 2.00 | 0.32 | Pass |

— End of measurement results—

Self-generated Noise

Measured according to IEC 61672-3:2013 11.1 and ANSI S1.4-2014 Part 3: 11.1

| Measurement | Test Result [dB] |
|-------------|------------------|
| A-weighted | 46.79 |

— End of measurement results—

— End of Report—

Signature: Jacob Cannon

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Calibration Certificate

Certificate Number 2022002980

Customer:

United Analyst and Engineering Consultant Co Ltd
No. 81 Soi Udonvuk 41, Sukhumvit Road,
Bangchak, Phra Khanong,
Bangkok, 10260, Thailand

Model Number LxT2
Serial Number 0006695
Test Results Pass

Initial Condition As Manufactured

Description SoundTrack LxT Class 2
Class 2 Sound Level Meter
Firmware Revision: 2.404

Procedure Number D0001.8378
Technician Jacob Cannon
Calibration Date 10 Mar 2022
Calibration Due
Temperature 23.95 °C ± 0.25 °C
Humidity 52.2 %RH ± 2.0 %RH
Static Pressure 85.9 kPa ± 0.13 kPa

Evaluation Method Tested electrically using Larson Davis PRMLX2C S/N 071564 and a 12.0 pF capacitor to simulate microphone capacitance. Data reported in dB re 20 µPa assuming a microphone sensitivity of 50.0 mV/Pa.

Compliance Standards Compliant to Manufacturer Specifications and the following standards when combined with Calibration Certificate from procedure D0001.8384:

| | |
|------------------------|----------------------------|
| IEC 60851:2001 Type 2 | ANSI S1.4-2014 Class 2 |
| IEC 60804:2000 Type 2 | ANSI S1.4 (R2006) Type 2 |
| IEC 61252:2002 | ANSI S1.25 (R2007) |
| IEC 61672:2013 Class 2 | ANSI S1.43 (R2007) Type 2 |
| IEC 61260:2001 Class 2 | ANSI S1.11 (R2009) Class 2 |

Issuing lab certifies that the instrument described above meets or exceeds all specifications as stated in the referenced procedure (unless otherwise noted). It has been calibrated using measurement standards traceable to the International System of Units (SI) through the National Institute of Standards and Technology (NIST), or other national measurement institutes, and meets the requirements of ISO/IEC 17025:2017. Test points marked with a ± in the uncertainties column do not fall within this laboratory's scope of accreditation.

The quality system is registered to ISO 9001:2015.

This calibration is a direct comparison of the unit under test to the listed reference standards and did not involve any sampling plans to complete. No allowance has been made for the instability of the test device due to use, time, etc. Such allowances would be made by the customer as needed.

The uncertainties were computed in accordance with the ISO Guide to the Expression of Uncertainty in Measurement (GUM). A coverage factor of approximately 2 sigma (k=2) has been applied to the standard uncertainty to express the expanded uncertainty at approximately 95% confidence level.

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Correction data from Larson Davis LxT Manual for SoundTrack LxT & SoundExpert LxT, 1770.01 Rev O Supporting Firmware Version 4.0.5, 2019-09-10

Calibration Check Frequency: 1000 Hz, Reference Sound Pressure Level: 114 dB re 20 µPa

| Standards Used | | | |
|--|------------|------------|--------------|
| Description | Cal Date | Cal Due | Cal Standard |
| Hart Scientific 2626-H Temperature Probe | 2021-02-04 | 2022-08-04 | 006767 |
| SRS DS360 Ultra Low Distortion Generator | 2021-07-22 | 2022-07-22 | 007174 |

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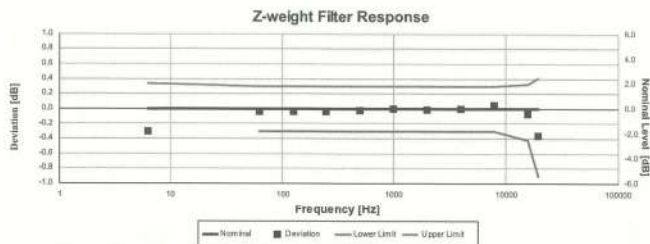


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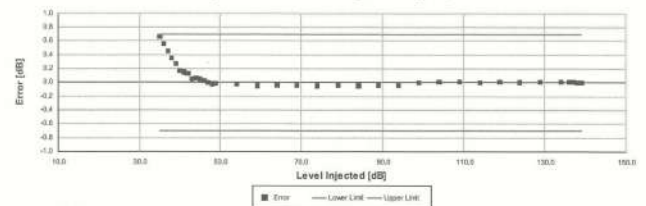


Electrical signal test of frequency weighting performed according to IEC 61672-3:2013 13 and ANSI S1.4-2014 Part 3: 13 for compliance to IEC 61672-1:2013 5.5, IEC 60651:2001 6.1 and 9.2.2, IEC 6004:2000 5, ANSI S1.4:1983 (R2006) 5.1 and 8.2.1, ANSI S1.4-2014 Part 1: 5.5

| Frequency [Hz] | Test Result [dB] | Deviation [dB] | Lower limit [dB] | Upper limit [dB] | Expanded Uncertainty [dB] | Result |
|----------------|------------------|----------------|------------------|------------------|---------------------------|--------|
| 6.31 | -0.30 | -0.30 | -1.11 | 0.33 | 0.15 | Pass |
| 63.10 | -0.04 | -0.04 | -0.30 | 0.30 | 0.15 | Pass |
| 125.89 | -0.04 | -0.04 | -0.30 | 0.30 | 0.15 | Pass |
| 251.19 | -0.04 | -0.04 | -0.30 | 0.30 | 0.15 | Pass |
| 501.19 | -0.03 | -0.02 | -0.30 | 0.30 | 0.15 | Pass |
| 1,000.00 | 0.00 | 0.00 | -0.30 | 0.30 | 0.15 | Pass |
| 1,995.26 | -0.01 | -0.01 | -0.30 | 0.30 | 0.15 | Pass |
| 3,981.07 | 0.00 | 0.00 | -0.30 | 0.30 | 0.15 | Pass |
| 7,943.26 | 0.05 | 0.04 | -0.30 | 0.30 | 0.15 | Pass |
| 15,848.93 | -0.08 | -0.08 | -0.42 | 0.32 | 0.15 | Pass |
| 19,952.62 | -0.36 | -0.36 | -0.91 | 0.41 | 0.15 | Pass |

— End of measurement results—

A-weighted Broadband Log Linearity: 8,000.00 Hz



Broadband level linearity performed according to IEC 61672-3:2013 16 and ANSI S1.4-2014 Part 3: 16 for compliance to IEC 61672-1:2013 5.6, IEC 6004:2000 6.2, IEC 61252:2002 8, ANSI S1.4 (R2006) 6.9, ANSI S1.4-2014 Part 1: 5.6, ANSI S1.43 (R2007) 6.2

| Level [dB] | Error [dB] | Lower limit [dB] | Upper limit [dB] | Expanded Uncertainty [dB] | Result |
|------------|------------|------------------|------------------|---------------------------|--------|
| 35.00 | 0.67 | -0.70 | 0.70 | 0.16 | Pass |
| 36.00 | 0.56 | -0.70 | 0.70 | 0.16 | Pass |
| 37.00 | 0.46 | -0.70 | 0.70 | 0.16 | Pass |
| 38.00 | 0.35 | -0.70 | 0.70 | 0.16 | Pass |
| 39.00 | 0.27 | -0.70 | 0.70 | 0.16 | Pass |
| 40.00 | 0.17 | -0.70 | 0.70 | 0.16 | Pass |
| 41.00 | 0.15 | -0.70 | 0.70 | 0.16 | Pass |
| 42.00 | 0.12 | -0.70 | 0.70 | 0.17 | Pass |
| 43.00 | 0.05 | -0.70 | 0.70 | 0.17 | Pass |
| 44.00 | 0.07 | -0.70 | 0.70 | 0.17 | Pass |
| 45.00 | 0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 46.00 | 0.03 | -0.70 | 0.70 | 0.16 | Pass |
| 47.00 | 0.00 | -0.70 | 0.70 | 0.16 | Pass |
| 48.00 | -0.02 | -0.70 | 0.70 | 0.16 | Pass |
| 49.00 | -0.02 | -0.70 | 0.70 | 0.16 | Pass |
| 50.00 | -0.03 | -0.70 | 0.70 | 0.16 | Pass |
| 51.00 | -0.05 | -0.70 | 0.70 | 0.16 | Pass |
| 52.00 | -0.04 | -0.70 | 0.70 | 0.16 | Pass |
| 53.00 | -0.04 | -0.70 | 0.70 | 0.16 | Pass |
| 54.00 | -0.04 | -0.70 | 0.70 | 0.16 | Pass |
| 55.00 | -0.04 | -0.70 | 0.70 | 0.16 | Pass |
| 56.00 | -0.04 | -0.70 | 0.70 | 0.16 | Pass |
| 57.00 | -0.04 | -0.70 | 0.70 | 0.16 | Pass |
| 58.00 | -0.04 | -0.70 | 0.70 | 0.16 | Pass |
| 59.00 | -0.04 | -0.70 | 0.70 | 0.16 | Pass |
| 60.00 | -0.04 | -0.70 | 0.70 | 0.16 | Pass |
| 61.00 | -0.04 | -0.70 | 0.70 | 0.16 | Pass |
| 62.00 | -0.04 | -0.70 | 0.70 | 0.16 | Pass |
| 63.00 | -0.04 | -0.70 | 0.70 | 0.16 | Pass |
| 64.00 | -0.04 | -0.70 | 0.70 | 0.16 | Pass |
| 65.00 | -0.04 | -0.70 | 0.70 | 0.16 | Pass |
| 66.00 | -0.04 | -0.70 | 0.70 | 0.16 | Pass |
| 67.00 | -0.04 | -0.70 | 0.70 | 0.16 | Pass |
| 68.00 | -0.04 | -0.70 | 0.70 | 0.16 | Pass |
| 69.00 | -0.04 | -0.70 | 0.70 | 0.16 | Pass |
| 70.00 | -0.04 | -0.70 | 0.70 | 0.16 | Pass |
| 71.00 | -0.04 | -0.70 | 0.70 | 0.16 | Pass |
| 72.00 | -0.04 | -0.70 | 0.70 | 0.16 | Pass |
| 73.00 | -0.04 | -0.70 | 0.70 | 0.16 | Pass |
| 74.00 | -0.04 | -0.70 | 0.70 | 0.16 | Pass |
| 75.00 | -0.04 | -0.70 | 0.70 | 0.16 | Pass |
| 76.00 | -0.04 | -0.70 | 0.70 | 0.16 | Pass |
| 77.00 | -0.04 | -0.70 | 0.70 | 0.16 | Pass |
| 78.00 | -0.04 | -0.70 | 0.70 | 0.16 | Pass |
| 79.00 | -0.04 | -0.70 | 0.70 | 0.16 | Pass |
| 80.00 | -0.04 | -0.70 | 0.70 | 0.16 | Pass |
| 81.00 | -0.04 | -0.70 | 0.70 | 0.16 | Pass |
| 82.00 | -0.04 | -0.70 | 0.70 | 0.16 | Pass |
| 83.00 | -0.04 | -0.70 | 0.70 | 0.16 | Pass |
| 84.00 | -0.04 | -0.70 | 0.70 | 0.16 | Pass |
| 85.00 | -0.04 | -0.70 | 0.70 | 0.16 | Pass |
| 86.00 | -0.04 | -0.70 | 0.70 | 0.16 | Pass |
| 87.00 | -0.04 | -0.70 | 0.70 | 0.16 | Pass |
| 88.00 | -0.04 | -0.70 | 0.70 | 0.16 | Pass |
| 89.00 | -0.04 | -0.70 | 0.70 | 0.16 | Pass |
| 90.00 | -0.04 | -0.70 | 0.70 | 0.16 | Pass |
| 91.00 | -0.04 | -0.70 | 0.70 | 0.16 | Pass |
| 92.00 | -0.04 | -0.70 | 0.70 | 0.16 | Pass |
| 93.00 | -0.04 | -0.70 | 0.70 | 0.16 | Pass |
| 94.00 | -0.04 | -0.70 | 0.70 | 0.16 | Pass |
| 95.00 | -0.04 | -0.70 | 0.70 | 0.16 | Pass |
| 96.00 | -0.04 | -0.70 | 0.70 | 0.16 | Pass |
| 97.00 | -0.04 | -0.70 | 0.70 | 0.16 | Pass |
| 98.00 | -0.04 | -0.70 | 0.70 | 0.16 | Pass |
| 99.00 | -0.04 | -0.70 | 0.70 | 0.16 | Pass |
| 100.00 | -0.04 | -0.70 | 0.70 | 0.16 | Pass |
| 101.00 | -0.04 | -0.70 | 0.70 | 0.16 | Pass |
| 102.00 | -0.04 | -0.70 | 0.70 | 0.16 | Pass |
| 103.00 | -0.04 | -0.70 | 0.70 | 0.16 | Pass |
| 104.00 | -0.04 | -0.70 | 0.70 | 0.16 | Pass |
| 105.00 | -0.04 | -0.70 | 0.70 | 0.16 | Pass |
| 106.00 | -0.04 | -0.70 | 0.70 | 0.16 | Pass |
| 107.00 | -0.04 | -0.70 | 0.70 | 0.16 | Pass |
| 108.00 | -0.04 | -0.70 | 0.70 | 0.16 | Pass |
| 109.00 | -0.04 | -0.70 | 0.70 | 0.16 | Pass |
| 110.00 | -0.04 | -0.70 | 0.70 | 0.16 | Pass |
| 111.00 | -0.04 | -0.70 | 0.70 | 0.16 | Pass |
| 112.00 | -0.04 | -0.70 | 0.70 | 0.16 | Pass |
| 113.00 | -0.04 | -0.70 | 0.70 | 0.16 | Pass |
| 114.00 | -0.04 | -0.70 | 0.70 | 0.16 | Pass |
| 115.00 | -0.04 | -0.70 | 0.70 | 0.16 | Pass |
| 116.00 | -0.04 | -0.70 | 0.70 | 0.16 | Pass |
| 117.00 | -0.04 | -0.70 | 0.70 | 0.16 | Pass |
| 118.00 | -0.04 | -0.70 | 0.70 | 0.16 | Pass |
| 119.00 | -0.04 | -0.70 | 0.70 | 0.16 | Pass |
| 120.00 | -0.04 | -0.70 | 0.70 | 0.16 | Pass |
| 121.00 | -0.04 | -0.70 | 0.70 | 0.16 | Pass |
| 122.00 | -0.04 | -0.70 | 0.70 | 0.16 | Pass |
| 123.00 | -0.04 | -0.70 | 0.70 | 0.16 | Pass |
| 124.00 | -0.04 | -0.70 | 0.70 | 0.16 | Pass |
| 125.00 | -0.04 | -0.70 | 0.70 | 0.16 | Pass |
| 126.00 | -0.04 | -0.70 | 0.70 | 0.16 | Pass |
| 127.00 | -0.04 | -0.70 | 0.70 | 0.16 | Pass |
| 128.00 | -0.04 | -0.70 | 0.70 | 0.16 | Pass |
| 129.00 | -0.04 | -0.70 | 0.70 | 0.16 | Pass |
| 130.00 | -0.04 | -0.70 | 0.70 | 0.16 | Pass |
| 131.00 | -0.04 | -0.70 | 0.70 | 0.16 | Pass |
| 132.00 | -0.04 | -0.70 | 0.70 | 0.16 | Pass |
| 133.00 | -0.04 | -0.70 | 0.70 | 0.16 | Pass |
| 134.00 | -0.04 | -0.70 | 0.70 | 0.16 | Pass |
| 135.00 | -0.04 | -0.70 | 0.70 | 0.16 | Pass |
| 136.00 | -0.04 | -0.70 | 0.70 | 0.16 | Pass |
| 137.00 | -0.04 | -0.70 | 0.70 | 0.16 | Pass |
| 138.00 | -0.04 | -0.70 | 0.70 | 0.16 | Pass |
| 139.00 | -0.04 | -0.70 | 0.70 | 0.16 | Pass |

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716-684-0001



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— End of measurement results—

Peak Rise Time

Peak rise time performed according to IEC 60651:2001 9.4.4 and ANSI S1.4:1983 (R2006) 8.4.4

| Amplitude [dB] | Duration [μs] | | Test Result [dB] | Lower limit [dB] | Upper limit [dB] | Expanded Uncertainty [dB] | Result |
|-----------------------------------|---------------|----------------|------------------|------------------|------------------|------------------------------|--------|
| 135.95 | 40 | Negative Pulse | 134.90 | 133.42 | 135.42 | 0.15 | Pass |
| | | Positive Pulse | 134.93 | 133.45 | 135.45 | 0.15 | Pass |
| | 30 | Negative Pulse | 133.98 | 133.42 | 135.42 | 0.15 | Pass |
| | | Positive Pulse | 133.97 | 133.45 | 135.45 | 0.15 | Pass |
| ... End of measurement results... | | | | | | | |

— End of measurement results—

Positive Pulse Crest Factor

200 μs pulse tests at 2.0, 12.0, 22.0, 32.0 dB below Overload Limit

Crest Factor measured according to IEC 60651:2001 8.4.2 and ANSI S1.4:1983 (R2006) 8.4.2

| Amplitude [dB] | Crest Factor | Test Result [dB] | Limits [dB] | Expanded Uncertainty [dB] | Result |
|----------------|--------------|------------------|-------------|---------------------------|--------|
| 135.95 | 3 | OVL | ± 1.00 | 0.15 ± | Pass |
| | 5 | OVL | ± 1.00 | 0.15 ± | Pass |
| 125.95 | 3 | -0.14 | ± 1.00 | 0.15 ± | Pass |
| | 5 | -0.13 | ± 1.00 | 0.16 ± | Pass |
| 115.95 | 3 | -0.15 | ± 1.00 | 0.15 ± | Pass |
| | 5 | -0.14 | ± 1.00 | 0.15 ± | Pass |
| 105.95 | 3 | -0.12 | ± 1.00 | 0.15 ± | Pass |
| | 5 | -0.14 | ± 1.00 | 0.15 ± | Pass |

— End of measurement results—

Negative Pulse Crest Factor

200 μs pulse tests at 2.0, 12.0, 22.0, 32.0 dB below Overload Limit

Crest Factor measured according to IEC 60651:2001 8.4.2 and ANSI S1.4:1983 (R2006) 8.4.2

| Amplitude [dB] | Crest Factor | Test Result [dB] | Limits [dB] | Expanded Uncertainty [dB] | Result |
|----------------|--------------|------------------|-------------|---------------------------|--------|
| 135.95 | 3 | OVL | ± 1.00 | 0.15 ± | Pass |
| | 5 | OVL | ± 1.00 | 0.15 ± | Pass |
| 125.95 | 3 | -0.17 | ± 1.00 | 0.15 ± | Pass |
| | 5 | -0.16 | ± 1.00 | 0.15 ± | Pass |
| 115.95 | 3 | -0.18 | ± 1.00 | 0.15 ± | Pass |
| | 5 | -0.17 | ± 1.00 | 0.15 ± | Pass |
| 105.95 | 3 | -0.15 | ± 1.00 | 0.15 ± | Pass |
| | 5 | -0.16 | ± 1.00 | 0.15 ± | Pass |

— End of measurement results—

Gain

Gain measured according to IEC 61672-3:2013 17.3 and 17.4 and ANSI S1.4-2014 Part 3: 17.3 and 17.4

| Measurement | Test Result [dB] | Lower limit [dB] | Upper limit [dB] | Expanded Uncertainty [dB] | Result |
|----------------------|------------------|------------------|------------------|---------------------------|--------|
| 0 dB Gain | 93.94 | 93.89 | 94.09 | 0.15 | Pass |
| 0 dB Gain, Linearity | 40.24 | 39.39 | 40.79 | 0.16 | Pass |
| OBA Low Range | 93.99 | 93.89 | 94.09 | 0.15 | Pass |
| OBA Normal Range | 93.98 | 93.20 | 94.80 | 0.15 | Pass |

— End of measurement results—

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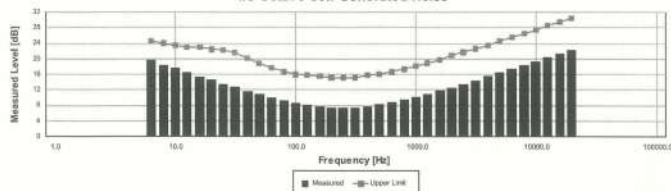
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1/3-Octave Self-Generated Noise



The SLIM is set to low range.

| Frequency [Hz] | Test Result [dB] | Upper Limit [dB] | Result |
|----------------|------------------|------------------|--------|
| 6.30 | 19.80 | 24.60 | Pass |
| 8.00 | 18.31 | 24.00 | Pass |
| 10.00 | 17.59 | 23.50 | Pass |
| 12.50 | 16.50 | 23.00 | Pass |
| 16.00 | 15.41 | 22.90 | Pass |
| 20.00 | 14.52 | 22.40 | Pass |
| 25.00 | 13.40 | 22.30 | Pass |
| 31.50 | 12.87 | 21.50 | Pass |
| 40.00 | 11.60 | 20.20 | Pass |
| 50.00 | 10.89 | 18.80 | Pass |
| 63.00 | 10.00 | 17.60 | Pass |
| 80.00 | 9.34 | 16.60 | Pass |
| 100.00 | 8.61 | 15.90 | Pass |
| 125.00 | 8.12 | 15.70 | Pass |
| 160.00 | 7.68 | 15.50 | Pass |
| 200.00 | 7.42 | 15.20 | Pass |
| 250.00 | 7.39 | 15.20 | Pass |
| 315.00 | 7.39 | 15.20 | Pass |
| 400.00 | 7.76 | 15.70 | Pass |
| 500.00 | 8.25 | 16.00 | Pass |
| 630.00 | 8.82 | 16.60 | Pass |
| 800.00 | 9.48 | 17.30 | Pass |
| 1,000.00 | 10.17 | 18.10 | Pass |
| 1,250.00 | 10.99 | 18.90 | Pass |
| 1,600.00 | 11.76 | 19.80 | Pass |
| 2,000.00 | 12.63 | 20.80 | Pass |
| 2,500.00 | 13.52 | 21.70 | Pass |
| 3,150.00 | 14.48 | 22.60 | Pass |
| 4,000.00 | 15.47 | 23.50 | Pass |
| 5,000.00 | 16.42 | 24.50 | Pass |
| 6,300.00 | 17.34 | 25.50 | Pass |
| 8,000.00 | 18.38 | 26.50 | Pass |
| 10,000.00 | 19.35 | 27.40 | Pass |
| 12,500.00 | 20.34 | 28.50 | Pass |
| 16,000.00 | 21.33 | 29.50 | Pass |
| 20,000.00 | 22.34 | 30.40 | Pass |

-- End of measurement results --

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DMM01-8407 Rev F

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-- End of Report --

Signatory: *Jacob Cannon*

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DMM01-8407 Rev F

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TECHNOLOGY PROMOTION ASSOCIATION (THAI AND JAPAN)
CORPORATE SERVICES & EQUIPMENT CALIBRATION AND TESTING SERVICES
534/9 PATTANAKARN ROAD SOI 13, SUANLUANG, SUANLUANG BANGKOK 10250
TEL: 0-2717-3000-29 FAX: 0-2719-3485



Cert.No.: 23CH529
Page.: 1 of 3

Certificate of Calibration

Equipment : pH Meter
Manufacturer : Ecosense
Model : pH100A
Serial No. : JC04740
ID No. : UAE EFM 062/2566(EFM pH 05/66)
Conclusion As-Received: Used item
Received Date : 28 April 2023
Calibration Date : 27-28 April 2023
Reference : 2304-0707/WSC-7
Submitted by : United Analyst and Engineering Consultant Co., Ltd
3 Soi Udomsuk 41, Sukhumvit Road,
Bangkok, Phrakhanong, Bangkok 10260
Ambient Temperature : (25 ± 2.5) °C
Relative Humidity : (50 ± 15) %
Calibration Procedure : In-house method
- CP-CHs by direct measurement with standard voltage calibrator and direct measurement with certified reference material (CRM)
- CP-CHs by comparison with standard thermometer

Calibrated by : Warakorn Lemgagrakul

Approved by : *Malee Butkruea*
Approved Signatory

✓ Malee Butkruea
() Saithip Meangmai
() Warakorn Lemgagrakul

Issue Date : 9 May 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 & Equipment Calibration and Testing Services.

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Cert.No.: 23CH529
Page.: 2 of 3

Condition of this calibration result

- Reference Standard Instrument

| Instrument | Serial No. | ID No. | Cert. No. | Due Date |
|--------------------------------|------------|----------|-----------|-------------|
| 1) Document Process Calibrator | 54030049 | 130RC116 | 22E2769 | 24 Aug 2023 |
| 2) Ref. Standard Thermometer | 4982054 | 110RC044 | 2211306 | 27 Oct 2023 |

This certification is traceable to the international System of Unit maintained at:
Traceable to National Institute of Metrology (Thailand), NIMT
- Certified Reference Materials : The measurement results are traceable to SI through CPA chem Ltd.,
ANSI-ASQ National Accreditation Board, Accredited No. AR-1835

| Buffer Solution | Manufacturer | Lot No. | Exp. date |
|-----------------|--------------|---------|--------------|
| pH 4.008 | CPA chem | 863832 | 28 Dec 2024 |
| pH 6.867 | CPA chem | 826589 | 09 July 2023 |
| pH 10.010 | CPA chem | 863835 | 28 Dec 2023 |

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)(7.10)

| Unit Under Calibration | Nominal Value | Standard Voltage Input | Actual Reading | | Uncertainty of Measurement (±mV) | Coverage factor k |
|---------------------------|---------------|------------------------|----------------|-------|-------------------------------------|----------------------|
| | | | mV | pH | | |
| pH Meter S/N : JC04740 | 4.00 | 177.48 | 177 | 4.01 | 0.58 | 2.00 |
| | 7.00 | 0.00 | 0 | 7.00 | 0.58 | 2.00 |
| | 7.00 | 0.00 | 0 | 7.00 | 0.58 | 2.00 |
| | 10.00 | -177.48 | -177 | 10.01 | 0.58 | 2.00 |

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Cert.No.: 23CH529
Page: 3 of 3

Calibration Results

Function : pH Measurement

Performing three buffers standard curve by using buffer nominal pH (4.7)(7.10)

| Unit Under Calibration | Standard pH Buffer Solution | Actual pH Reading | Actual mV Reading (mV) | Uncertainty of pH measurement (°) | Coverage factor k |
|--------------------------------------|-----------------------------|-------------------|------------------------|-----------------------------------|-------------------|
| pH Electrode S/N. 230308SIA605377 | 4.008 | 4.01 | 173 | 0.0071 | 2.00 |
| | 5.987 | 7.00 | -1 | 0.011 | 2.00 |
| | 6.987 | 6.98 | 0 | 0.011 | 2.00 |
| | 10.010 | 10.01 | -178 | 0.011 | 2.07 |

Function: Temperature Measurement

(*) Without adjustment

This equipment was connected with Temperature Probe

Model :

Serial No. :

230308SIA605377

Dimension of probe:

Length :

110 mm

Diameter :

12 mm

Immersion Depth :

100 mm

| Calibration Point (°C) | Standard Temperature (°C) | UUC* Reading (°C) | Error (°C) | Uncertainty of measurement (± °C) | Coverage factor k |
|------------------------|---------------------------|-------------------|------------|-----------------------------------|-------------------|
| 25.0 | 25.003 | 25.0 | -0.003 | 0.13 | 2.00 |
| 30.0 | 30.001 | 30.0 | -0.001 | 0.13 | 2.00 |
| 35.0 | 35.003 | 35.0 | -0.003 | 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 %

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SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

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



Cert. No. : ACL23129
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24
Serial No.: 00409023 / 185669 / 90468
ID No.: UAE.EFM.011/2564

Condition As Found : GOOD

Customer : UNITED ANALYST AND ENGINEERING CONSULTANT (UAE)
81 SOI UDOMSUK 41, SUKHUMVIT ROAD,
BANGCHAK SUB-DISTRICT,
PHRAKHANONG DISTRICT, BANGKOK 10260
THAILAND.

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

Received Date : 18 APRIL 2023
Calibration Date : 24-26 APRIL 2023
Date of Issue : 27 APRIL 2023

Calibrated by : Nathakorn Pisutpaisan

Approved by :

T. Petchurai
(Thanakul Petchurai)

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

QF-TS12-04-04-020664

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SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

Continuation of Calibration Certificate

Cert. No. : ACL23129
Job No. : VC66AC0048
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

This equipment was calibrated by based on IEC-61672-3 (2013) Standard for sound level meter (SLM).

The SLM had tests to Acoustical and Electrical signal tests of frequency weighting with Anechoic chamber and Reference Standard Instruments.

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

Condition of this result of calibration :

1. Reference Standard Instruments :

| Instrument | Model | Serial No. | Cert. No. | Due Date |
|-------------------------|----------|------------|----------------|-----------|
| Waveform Generator | 33210A | MY48017076 | EF-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 | A2100114 | EF-0011-23 | 08-FEB-24 |
| Condenser Microphone | 4180 | 2977900 | AA-1001-23 | 14-FEB-24 |
| Measuring Amplifier | NA-42KA1 | 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).

SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

Continuation of Calibration Certificate

Cert. No. : ACL23129
Job No. : VC66AC0048
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.

QF-TS12-04-04-020664

เอกสารไม่ควบคุม

T. Petchurai

QF-TS12-04-04-020664

เอกสารไม่ควบคุม

T. Petchurai

Continuation of Calibration Certificate

Cert. No. : ACL23129
Job No. : VC66AC0048
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Result of calibration :

1. Absolute sensitivity

| Reference Acoustic Signal (dB) | Measured Value (dB) | Deviation (dB) | Acceptance Limit (dB) |
|--|-----------------------------|---------------------|-------------------------------|
| 93.9 (93.98) | 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 | 11.6 |
| C - weight | 17.6 |
| Flat | 23.4 |

3. Acoustical signal tests of frequency weightings

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

| Frequency (Hz) | Deviation from various frequency weighting response curve (dB) | | | |
|---------------------|--|----------|----------|----------------------|
| | Flat | C-weight | A-weight | Acceptance Limits |
| 125 | 0.2 | 0.2 | 0.2 | ± 1.5 |
| 1000 | 0.0 | 0.0 | 0.0 | ± 1.0 |
| 8000 | 0.9 | 1.0 | 1.0 | ±5.0 |

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เอกสารไม่ควบคุม
S. Petch

Continuation of Calibration Certificate

Cert. No. : ACL23129
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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 | 39.0 | 0.0 | ± 1.1 |
| 34.0 | 34.0 | 0.0 | ± 1.1 |
| 30.0 | 30.0 | 0.0 | ± 1.1 |
| 29.0 | 29.0 | 0.0 | ± 1.1 |
| 28.0 | 28.0 | 0.0 | ± 1.1 |
| 27.0 | 27.1 | 0.1 | ± 1.1 |
| 26.0 | 26.0 | 0.0 | ± 1.1 |
| 25.0 | 25.1 | 0.1 | ± 1.1 |

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S. Petch

Continuation of Calibration Certificate

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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 | 0.1 | 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 |

QF-TS12-04-04-020664

เอกสารไม่ควบคุม
S. Petch

Continuation of Calibration Certificate

Cert. No. : ACL23129
Job No. : VC66AC0048
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8. Level linearity including the level range control

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

9. Tone burst response

| Time Weighting | Tone burst duration, Tb (ms) | Cycle | Anticipated Value (dB) | Measured Value (dB) | Deviated Value (dB) | Acceptance Limits (dB) |
|-------------------|--------------------------------------|-------|--------------------------------|-----------------------------|-----------------------------|--------------------------------|
| | | | | | | |
| Fast | 0.25 | 1 | 108.0 | 107.9 | -0.1 | 1.5 ; -5.0 |
| | 2 | 8 | 117.0 | 117.0 | 0.0 | 1.0 ; -2.5 |
| | 200 | 800 | 134.0 | 134.1 | 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 |

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11. Overload indication

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

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T. Petchur

451-451/1 Sirinthorn Rd., Bangbunru, Bangplud Bangkok 10700 THAILAND.
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Cert. No. : ACL23064
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24
Serial No. : 00409176 / 185835 / 90622
ID No. : UAE.EFM.015/2564

Condition As Found : GOOD

Customer : UNITED ANALYST AND ENGINEERING CONSULTANT (UAE)
81 SOI UDOMSUK 41, SUKHUMVIT ROAD,
BANGCHAK SUB-DISTRICT,
PHRAKHANONG DISTRICT, BANGKOK 10260
THAILAND.

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

Received Date : 18 JANUARY 2023
Calibration Date : 20 JANUARY 2023
Date of Issue : 23 JANUARY 2023

Calibrated by : Nathakorn Pisutpaisan

Approved by :

T. Petchur
(Thanakul Petchur)

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

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เอกสารไม่ควบคุม

T. Petchur

Continuation of Calibration Certificate

Cert. No. : ACL23064
Job No. : VC66AC0027
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

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

Condition of this result of calibration :

1. Reference Standard Instruments :

| Instrument | Model | Serial No. | Cert. No. | Due Date |
|-------------------------|----------|------------|----------------|-----------|
| Waveform Generator | 33210A | MY48017076 | EF-0007-22 | 04-Feb-23 |
| Waveform Generator | 33511B | MY52302742 | EF-0008-22 | 04-Feb-23 |
| Digital Multimeter | 33461A | MY53220104 | EEL_BP_04/0265 | 09-Feb-23 |
| Digital Multimeter | 33461A | MY53220076 | EEL_BP_03/0265 | 09-Feb-23 |
| Digital Multimeter | 34461A | MY60024273 | EEL_BP_05/0265 | 09-Feb-23 |
| Programmable Attenuator | MAT-1670 | 62100114 | EE-0009-22 | 07-Feb-23 |
| Condenser Microphone | 4180 | 2977900 | AA-1013-22 | 24-Feb-23 |
| Measuring Amplifier | NA-42KA1 | 34560495 | AA-3005-22 | 22-Feb-23 |

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

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

3.1 National Institute of Metrology (Thailand).

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

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T. Petchur

Continuation of Calibration Certificate

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Summary of Measurement Result :

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

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เอกสารไม่ควบคุม

T. Petchur

Continuation of Calibration Certificate

Cert. No. : ACL23064
Job No. : VC66AC0027
Pages : 4 of 8

Result of calibration :

1. Absolute sensitivity

| Reference Acoustic Signal (dB) | Measured Value (dB) | Deviation (dB) | Acceptance Limit (dB) |
|--------------------------------|---------------------|----------------|-----------------------|
| 93.9 (93.95) | 93.9 | 0.0 | ±0.3 |

2. Self-generated noise

2.1 Normal test

| Measured Value (dB) |
|---------------------|
| 15.9 |

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

| Frequency Weighting | Measured value (dB) |
|---------------------|---------------------|
| A-weight | 12.5 |
| C-weight | 18.3 |
| Flat | 24.1 |

3. Acoustical signal tests of frequency weightings

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

| Frequency (Hz) | Deviation from various frequency weighting response curve (dB) | | | |
|----------------|--|----------|----------|-------------------|
| | Flat | C-weight | A-weight | Acceptance Limits |
| 125 | 0.2 | 0.2 | 0.2 | ± 1.5 |
| 1000 | 0.0 | 0.0 | 0.0 | ± 1.0 |
| 8000 | 2.0 | 2.1 | 2.1 | ±5.0 |

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7. Petch

Continuation of Calibration Certificate

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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 | 27.1 | 0.1 | ± 1.1 |
| 26.0 | 26.1 | 0.1 | ± 1.1 |
| 25.0 | 25.1 | 0.1 | ± 1.1 |

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Continuation of Calibration Certificate

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

5.2 Time weighting at 1 kHz

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

6. Long-term stability

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

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8. Level linearity including the level range control

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

9. Tone burst response

| Time Weighting | Tone burst duration, Tb (ms) | Cycle | Anticipated Value (dB) | Measured Value (dB) | Deviated Value (dB) | Acceptance Limits (dB) |
|----------------|------------------------------|-------|------------------------|---------------------|---------------------|------------------------|
| Fast | 0.25 | 1 | 108.0 | 107.9 | -0.1 | 1.5 ; -5.0 |
| | 2 | 8 | 117.0 | 117.0 | 0.0 | 1.0 ; -2.5 |
| | 200 | 800 | 134.0 | 134.1 | 0.1 | ±1.0 |
| Slow | 2 | 8 | 108.0 | 108.0 | 0.0 | 1.5 ; -5.0 |
| | 200 | 800 | 127.6 | 127.6 | 0.0 | ±1.0 |
| | 0.25 | 1 | 99.0 | 98.9 | -0.1 | 1.5 ; -5.0 |
| SEL | 2 | 8 | 108.0 | 108.0 | 0.0 | 1.0 ; -2.5 |
| | 200 | 800 | 128.0 | 128.1 | 0.1 | ±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 | - |
| One | 136.4 | 135.6 | -0.8 | ±3.0 |

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

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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 | 136.9 | 0.1 | ±0.3 |

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

End of Calibration Certificate

QF-TS12-04-04-020664

เอกสารไม่ควบคุม

T. Petchur

Continuation of Calibration Certificate

Cert. No. : ACL23063
Job No. : VC66AC0027
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

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

Condition of this result of calibration :

1. Reference Standard Instruments :

| Instrument | Model | Serial No. | Cert. No. | Due Date |
|-------------------------|----------|------------|----------------|-----------|
| Waveform Generator | 33210A | MY48017076 | EF-0007-22 | 04-Feb-23 |
| Waveform Generator | 33511B | MY52302742 | EF-0008-22 | 04-Feb-23 |
| Digital Multimeter | 33461A | MY53220104 | EEL_BP_04/0265 | 09-Feb-23 |
| Digital Multimeter | 33461A | MY53220076 | EEL_BP_03/0265 | 09-Feb-23 |
| Digital Multimeter | 34461A | MY60024273 | EEL_BP_05/0265 | 09-Feb-23 |
| Programmable Attenuator | MAT-1070 | 62100114 | FF-0009-22 | 07-Feb-23 |
| Condenser Microphone | 4180 | 2977900 | AA-1013-22 | 24-Feb-23 |
| Measuring Amplifier | NA-42KAL | 34560495 | AA-3005-22 | 22-Feb-23 |

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

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

3.1 National Institute of Metrology (Thailand).

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

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เอกสารไม่ควบคุม

T. Petchur

451-451/1 Sirinthorn Rd, Banglumru, Bangkok 10700 THAILAND.
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Cert. No. : ACL23063
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24
Serial No. : 00409050 / 189687 / 90495
ID No. : UAE.EFM.012/2564

Condition As Found : GOOD

Customer : UNITED ANALYST AND ENGINEERING CONSULTANT (UAE)
81 SOI UDOMSUK 41, SUKHUMVIT ROAD,
BANGCHAK SUB-DISTRICT,
PHRAKHANONG DISTRICT, BANGKOK 10260
THAILAND.

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

Received Date : 18 JANUARY 2023
Calibration Date : 20 JANUARY 2023
Date of Issue : 23 JANUARY 2023

Calibrated by : Nathakorn Pisutpaisan

Approved by :

T. Petchur
(Thanakul Petchurai)

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

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เอกสารไม่ควบคุม

Continuation of Calibration Certificate

Cert. No. : ACL23063
Job No. : VC66AC0027
Pages : 3 of 8

Summary of Measurement Result :

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

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เอกสารไม่ควบคุม

T. Petchur

Continuation of Calibration Certificate

Cert. No. : ACL23063
Job No. : VC66AC0027
Pages : 4 of 8

Result of calibration :

1. Absolute sensitivity

| Reference Acoustic Signal (dB) | Measured Value (dB) | Deviation (dB) | Acceptance Limit (dB) |
|--------------------------------|---------------------|----------------|-----------------------|
| 93.9 (93.95) | 93.9 | 0.0 | ±0.3 |

2. Self-generated noise

2.1 Normal test

| Measured Value (dB) |
|---------------------|
| 13.8 |

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 | 16.6 |
| Flat | 22.4 |

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 | 0.2 | 0.2 | 0.2 | ± 1.5 |
| 1000 | 0.0 | 0.0 | 0.0 | ± 1.0 |
| 8000 | -0.6 | -0.5 | -0.5 | ±5.0 |

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เอกสารไม่ควบคุม
7. Rth

Continuation of Calibration Certificate

Cert. No. : ACL23063
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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 | 89.1 | 0.1 | ± 1.1 |
| 84.0 | 84.1 | 0.1 | ± 1.1 |
| 79.0 | 79.0 | 0.0 | ± 1.1 |
| 74.0 | 74.1 | 0.1 | ± 1.1 |
| 69.0 | 69.1 | 0.1 | ± 1.1 |
| 64.0 | 64.0 | 0.0 | ± 1.1 |
| 59.0 | 59.1 | 0.1 | ± 1.1 |
| 54.0 | 54.0 | 0.0 | ± 1.1 |
| 49.0 | 49.0 | 0.0 | ± 1.1 |
| 44.0 | 44.0 | 0.0 | ± 1.1 |
| 39.0 | 39.0 | 0.0 | ± 1.1 |
| 34.0 | 34.1 | 0.1 | ± 1.1 |
| 30.0 | 30.1 | 0.1 | ± 1.1 |
| 29.0 | 29.1 | 0.1 | ± 1.1 |
| 28.0 | 28.1 | 0.1 | ± 1.1 |
| 27.0 | 27.1 | 0.1 | ± 1.1 |
| 26.0 | 26.1 | 0.1 | ± 1.1 |
| 25.0 | 25.1 | 0.1 | ± 1.1 |

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เอกสารไม่ควบคุม
7. Rth

Continuation of Calibration Certificate

Cert. No. : ACL23063
Job No. : VC66AC0027
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long-term stability

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

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7. Rth

Continuation of Calibration Certificate

Cert. No. : ACL23063
Job No. : VC66AC0027
Pages : 7 of 8

8. Level linearity including the level range control

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

9. Tone burst response

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

10. Peak C sound level

| Number of cycle in test signal | Anticipated Value (dB) | Measured Value, L _{peak} (dB) | Deviated Value (dB) | Acceptance Limits (dB) |
|--------------------------------|------------------------|--|---------------------|------------------------|
| Continuous | 133.0 | 133.0 | 0.0 | - |
| One | 136.4 | 136.4 | 0.0 | ±3.0 |

| Number of cycle in test signal | Anticipated Value (dB) | Measured Value (dB) | Deviated Value (dB) | Acceptance Limits (dB) |
|--------------------------------|------------------------|---------------------|---------------------|------------------------|
| Continuous | 133.0 | 133.1 | 0.1 | - |
| Positive half cycle | 135.4 | 135.3 | -0.1 | ±2.0 |
| Negative half cycle | 135.4 | 135.3 | -0.1 | ±2.0 |

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Continuation of Calibration Certificate

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11. Overload indication

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

12. High level stability

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

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

End of Calibration Certificate

QF-TS12-04-04-020664

เอกสารไม่ควบคุม

T. Petchur

Continuation of Calibration Certificate

Cert. No. : ACL23028
Job No. : VC66AC0023
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

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

Condition of this result of calibration :

1. Reference Standard Instruments :

| Instrument | Model | Serial No. | Cert. No. | Due Date |
|-------------------------|----------|------------|----------------|-----------|
| Waveform Generator | 33210A | MY48017076 | EF-0007-22 | 04-Feb-23 |
| Waveform Generator | 33511B | MY52302742 | EF-0008-22 | 04-Feb-23 |
| Digital Multimeter | 33461A | MY53220104 | EEL_BP_04/0265 | 09-Feb-23 |
| Digital Multimeter | 33461A | MY53220076 | EEL_BP_03/0265 | 09-Feb-23 |
| Digital Multimeter | 34461A | MY60024273 | EEL_BP_05/0265 | 09-Feb-23 |
| Programmable Attenuator | MAT-1070 | 42100114 | EF-0006-22 | 07-Feb-23 |
| Condenser Microphone | 4180 | 2977900 | AA-1013-22 | 24-Feb-23 |
| Measuring Amplifier | NA-42KAI | 34560495 | AA-3005-22 | 22-Feb-23 |

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

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

3.1 National Institute of Metrology (Thailand).

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

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T. Petchur



451-451/1 Sindhorn Rd., Bangbunru, Bangplud Bangkok 10700 THAILAND.
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Cert. No. : ACL23028
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42/ Microphone UC-52 / Preampifier NH-24
Serial No.: 00609500 / 189689 / 01126
ID No.:

Condition As Found : GOOD

Customer : UNITED ANALYST AND ENGINEERING CONSULTANT (UAE)
81 SOI UDOMSUK 41, SUKHUMVIT ROAD,
BANGCHAK SUB-DISTRICT,
PHRAKHANONG DISTRICT, BANGKOK 10260
THAILAND.

Location : -
Ambient Temperature : (23.0 ± 3) °C
Pressure : (101.3 ± 3) kPa
Relative Humidity : (50.0 ± 20) %
Received Date : 06 JANUARY 2023
Calibration Date : 10-12 JANUARY 2023
Date of Issue : 16 JANUARY 2023

Calibrated by : Nathakorn Pisutpaisan

Approved by :

T. Petchur
(Thanakul Petchurai)

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Continuation of Calibration Certificate

Cert. No. : ACL23028
Job No. : VC66AC0023
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Summary of Measurement Result :

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

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T. Petchur

Continuation of Calibration Certificate

Cert. No. : ACL23028
Job No. : VC66AC0023
Pages : 4 of 8

Result of calibration :

1. Absolute sensitivity

| Reference Acoustic Signal (dB) | Measured Value (dB) | Deviation (dB) | Acceptance Limit (dB) |
|--|-----------------------------|---------------------|-------------------------------|
| 93.9 (93.95) | 93.9 | 0.0 | ±0.3 |

2. Self-generated noise

2.1 Normal test

| Measured Value (dB) |
|--------------------------|
| 17.5 |

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

| Frequency Weighting | Measured value (dB) |
|------------------------|--------------------------|
| A - weight | 14.1 |
| C - weight | 20.6 |
| Flat | 26.3 |

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) | | | |
|---------------------|--|----------|----------|----------------------|
| | Flat | C-weight | A-weight | Acceptance Limits |
| 125 | 0.0 | 0.0 | 0.0 | ± 1.5 |
| 1000 | 0.0 | 0.0 | 0.0 | ± 1.0 |
| 8000 | 0.2 | 0.3 | 0.3 | ±5.0 |

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เอกสารไม่ควบคุม

7. Peter

Continuation of Calibration Certificate

Cert. No. : ACL23028
Job No. : VC66AC0023
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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 | 131.9 | -0.1 | ± 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 | 34.1 | 0.1 | ± 1.1 |
| 30.0 | 30.1 | 0.1 | ± 1.1 |
| 29.0 | 29.2 | 0.2 | ± 1.1 |
| 28.0 | 28.2 | 0.2 | ± 1.1 |
| 27.0 | 27.3 | 0.3 | ± 1.1 |
| 26.0 | 26.3 | 0.3 | ± 1.1 |
| 25.0 | 25.4 | 0.4 | ± 1.1 |

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7. Peter

Continuation of Calibration Certificate

Cert. No. : ACL23028
Job No. : VC66AC0023
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4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long - term stability

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

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7. Peter

Continuation of Calibration Certificate

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8. Level linearity including the level range control

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

9. Tone burst response

| Time Weighting | Tone burst duration, Tb (ms) | Cycle | Anticipated Value (dB) | Measured Value (dB) | Deviated Value (dB) | Acceptance Limits (dB) |
|-------------------|--------------------------------------|-------|--------------------------------|-----------------------------|-----------------------------|--------------------------------|
| Fast | 0.25 | 1 | 108.0 | 107.9 | -0.1 | 1.5 ; -5.0 |
| | 2 | 8 | 117.0 | 117.0 | 0.0 | 1.0 ; -2.5 |
| | 200 | 800 | 134.0 | 134.0 | 0.0 | ±1.0 |
| Slow | 2 | 8 | 108.0 | 108.0 | 0.0 | 1.5 ; -5.0 |
| | 200 | 800 | 127.6 | 127.6 | 0.0 | ±1.0 |
| 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 | - |
| One | 136.4 | 136.3 | -0.1 | ±3.0 |

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

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7. Peter

Continuation of Calibration Certificate

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Job No. : VC66AC0023
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11. Overload indication

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

12. High level stability

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

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

End of Calibration Certificate

QF-TS12-04-04-020664

เอกสารไม่ควบคุม

T. Petchur

Continuation of Calibration Certificate

Cert. No. : ACL23029
Job No. : VC66AC0023
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

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

Condition of this result of calibration :

1. Reference Standard Instruments :

| Instrument | Model | Serial No. | Cert. No. | Due Date |
|-------------------------|----------|------------|----------------|-----------|
| Waveform Generator | 33210A | MY48017076 | EF-0007-22 | 04-Feb-23 |
| Waveform Generator | 33511B | MY52302742 | EF-0008-22 | 04-Feb-23 |
| Digital Multimeter | 33461A | MY53220104 | EEL_BP_04/0265 | 09-Feb-23 |
| Digital Multimeter | 33461A | MY53220076 | EEL_BP_03/0265 | 09-Feb-23 |
| Digital Multimeter | 34461A | MY60024273 | EEL_BP_05/0265 | 09-Feb-23 |
| Programmable Attenuator | MAT-1070 | 43100114 | EF-0008-22 | 05-Feb-23 |
| Condenser Microphone | 4180 | 2977900 | AA-1013-22 | 24-Feb-23 |
| Measuring Amplifier | NA-42KAI | 34560495 | AA-3005-22 | 22-Feb-23 |

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

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

3.1 National Institute of Metrology (Thailand).

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

QF-TS12-04-04-020664

เอกสารไม่ควบคุม

T. Petchur

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



Cert. No. : ACL23029
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24
Serial No. : 00709651 / 188529 / 00801
ID No. : -

Condition As Found : GOOD

Customer : UNITED ANALYST AND ENGINEERING CONSULTANT (UAE)
81 SOI UDOMSUK 41, SUKHUMVIT ROAD,
BANGCHAK SUB-DISTRICT,
PHRAKHANONG DISTRICT, BANGKOK 10260
THAILAND.

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

Received Date : 06 JANUARY 2023
Calibration Date : 10 -12 JANUARY 2023
Date of Issue : 16 JANUARY 2023

Calibrated by : Nathakorn Pisutpaisan

Approved by :

T. Petchur
(Thanakul Petchurai)

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

QF-TS12-04-04-020664

เอกสารไม่ควบคุม

Continuation of Calibration Certificate

Cert. No. : ACL23029
Job No. : VC66AC0023
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 | ✓ | - | 0.4 | 0.7 |
| 4. Electrical signal tests of frequency weightings | | | | |
| For 10 Hz to 4 kHz | ✓ | - | 0.3 | 0.6 |
| For > 4 kHz to 10 kHz | ✓ | - | 0.3 | 0.7 |
| For > 10 kHz to 20 kHz | - | - | - | 1.0 |
| 5. Frequency and time weightings at 1 kHz | ✓ | - | 0.2 | 0.2 |
| 6. Long - term stability | ✓ | - | 0.1 | 0.1 |
| 7. Level linearity on the reference level range | ✓ | - | 0.2 | 0.3 |
| 8. Level linearity including the level range control | ✓ | - | 0.2 | 0.3 |
| 9. Tone burst response | ✓ | - | 0.2 | 0.3 |
| 10. Peak C sound level | ✓ | - | 0.2 | 0.35 |
| 11. Overload indication | ✓ | - | 0.2 | 0.25 |
| 12. High level stability | ✓ | - | 0.1 | 0.1 |

QF-TS12-04-04-020664

เอกสารไม่ควบคุม

T. Petchur

Continuation of Calibration Certificate

Cert. No. : ACL23029
Job No. : VC66AC0023
Pages : 4 of 8

Result of calibration :

1. Absolute sensitivity

| Reference Acoustic Signal (dB) | Measured Value (dB) | Deviation (dB) | Acceptance Limit (dB) |
|--|-----------------------------|---------------------|-------------------------------|
| 93.9 (93.95) | 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 | 21.1 |
| C - weight | 27.7 |
| Flat | 32.4 |

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 | 0.6 | 0.5 | 0.5 | ± 1.5 |
| 1000 | 0.0 | 0.0 | 0.0 | ± 1.0 |
| 8000 | 0.6 | 0.6 | 0.6 | ±5.0 |

QF-TS12-04-04-020664

เอกสารไม่ควบคุม

T. Reth.

Continuation of Calibration Certificate

Cert. No. : ACL23029
Job No. : VC66AC0023
Pages : 6 of 8

7. Level linearity on the reference level range

| Anticipated Value (dB) | Measured Value (dB) | Deviated Value (dB) | Acceptance Limits (dB) |
|--------------------------------|-----------------------------|-----------------------------|--------------------------------|
| 137.0 | 137.0 | 0.0 | ± 1.1 |
| 136.0 | 136.1 | 0.1 | ± 1.1 |
| 135.0 | 135.1 | 0.1 | ± 1.1 |
| 134.0 | 134.1 | 0.1 | ± 1.1 |
| 133.0 | 133.0 | 0.0 | ± 1.1 |
| 132.0 | 132.0 | 0.0 | ± 1.1 |
| 131.0 | 131.0 | 0.0 | ± 1.1 |
| 129.0 | 129.0 | 0.0 | ± 1.1 |
| 124.0 | 124.0 | 0.0 | ± 1.1 |
| 119.0 | 119.1 | 0.1 | ± 1.1 |
| 114.0 | 114.1 | 0.1 | ± 1.1 |
| 109.0 | 109.1 | 0.1 | ± 1.1 |
| 104.0 | 104.1 | 0.1 | ± 1.1 |
| 99.0 | 99.1 | 0.1 | ± 1.1 |
| 94.0 | 94.0 | 0.0 | ± 1.1 |
| 89.0 | 89.0 | 0.0 | ± 1.1 |
| 84.0 | 84.0 | 0.0 | ± 1.1 |
| 79.0 | 79.0 | 0.0 | ± 1.1 |
| 74.0 | 74.0 | 0.0 | ± 1.1 |
| 69.0 | 69.0 | 0.0 | ± 1.1 |
| 64.0 | 64.0 | 0.0 | ± 1.1 |
| 59.0 | 59.0 | 0.0 | ± 1.1 |
| 54.0 | 54.0 | 0.0 | ± 1.1 |
| 49.0 | 49.0 | 0.0 | ± 1.1 |
| 44.0 | 44.0 | 0.0 | ± 1.1 |
| 39.0 | 39.0 | 0.0 | ± 1.1 |
| 34.0 | 34.0 | 0.0 | ± 1.1 |
| 30.0 | 30.0 | 0.0 | ± 1.1 |
| 29.0 | 28.9 | -0.1 | ± 1.1 |
| 28.0 | 28.0 | 0.0 | ± 1.1 |
| 27.0 | 26.9 | -0.1 | ± 1.1 |
| 26.0 | 26.0 | 0.0 | ± 1.1 |
| 25.0 | 24.9 | -0.1 | ± 1.1 |

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เอกสารไม่ควบคุม

T. Reth.

Continuation of Calibration Certificate

Cert. No. : ACL23029
Job No. : VC66AC0023
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

| Frequency Weighting | Measured Value (dB) | Deviated Value (dB) | Acceptance Limits (dB) |
|------------------------|-----------------------------|-----------------------------|--------------------------------|
| Fast | 94.0 | 0.0 | - |
| Slow | 93.9 | 0.0 | ± 0.1 |
| Leq | 94.0 | 0.0 | ± 0.1 |

6. Long - term stability

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

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เอกสารไม่ควบคุม

T. Reth.

Continuation of Calibration Certificate

Cert. No. : ACL23029
Job No. : VC66AC0023
Pages : 7 of 8

8. Level linearity including the level range control

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

9. Tone burst response

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

10. Peak C sound level

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

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

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T. Reth.

Continuation of Calibration Certificate

Cert. No. : ACL23029
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Pages : 8 of 8

11. Overload indication

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

12. High level stability

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

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

End of Calibration Certificate

QF-TS12-04-04-020664

เอกสารไม่ควบคุม

T. Petchur

Continuation of Calibration Certificate

Cert. No. : ACL23119
Job No. : VC66AC0044
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

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

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

Condition of this result of calibration :

1. Reference Standard Instruments :

| Instrument | Model | Serial No. | Cert. No. | Due Date |
|-------------------------|----------|------------|----------------|-----------|
| Waveform Generator | 33210A | MY48017076 | EF-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).

QF-TS12-04-04-020664

เอกสารไม่ควบคุม

T. Petchur



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

Cert. No. : ACL23119
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24
Serial No. : 01010780 / 194535 / 14658
ID No. : UAE.EFM.083/2565

Condition As Found : GOOD

Customer : UNITED ANALYST AND ENGINEERING CONSULTANT (UAE)
81 SOI UDOMSUK 41, SUKHUMVIT ROAD,
BANGCHAK SUB-DISTRICT,
PHRAKHANONG DISTRICT, BANGKOK 10260
THAILAND.

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

Received Date : 05 APRIL 2023
Calibration Date : 10-11 APRIL 2023
Date of Issue : 18 APRIL 2023

Calibrated by : Nathakorn Pisutpaisan

Approved by :

T. Petchur
(Thanakul Petchurai)

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

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Continuation of Calibration Certificate

Cert. No. : ACL23119
Job No. : VC66AC0044
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.

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เอกสารไม่ควบคุม

T. Petchur

Continuation of Calibration Certificate

Cert. No. : ACL23119
Job No. : VC66AC0044
Pages : 4 of 8

Result of calibration :

1. Absolute sensitivity

| Reference Acoustic Signal (dB) | Measured Value (dB) | Deviation (dB) | Acceptance Limit (dB) |
|--|-----------------------------|---------------------|-------------------------------|
| 93.9 (93.95) | 93.9 | 0.0 | ±0.3 |

2. Self-generated noise

2.1 Normal test

| Measured Value (dB) |
|--------------------------|
| 14.6 |

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

| Frequency Weighting | Measured value (dB) |
|------------------------|--------------------------|
| A - weight | 10.8 |
| C - weight | 16.8 |
| Flat | 22.6 |

3. Acoustical signal tests of frequency weightings

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

| Frequency (Hz) | Deviation from various frequency weighting response curve (dB) | | | |
|---------------------|--|----------|----------|----------------------|
| | Flat | C-weight | A-weight | Acceptance Limits |
| 125 | 0.3 | 0.3 | 0.3 | ±1.5 |
| 1000 | 0.0 | 0.0 | 0.0 | ±1.0 |
| 8000 | 0.5 | 0.6 | 0.6 | ±5.0 |

QF-TS12-04-04-020664

เอกสารไม่ควบคุม
P. Petch.

Continuation of Calibration Certificate

Cert. No. : ACL23119
Job No. : VC66AC0044
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 | 39.0 | 0.0 | ±1.1 |
| 34.0 | 34.0 | 0.0 | ±1.1 |
| 30.0 | 30.3 | 0.3 | ±1.1 |
| 29.0 | 29.3 | 0.3 | ±1.1 |
| 28.0 | 28.4 | 0.4 | ±1.1 |
| 27.0 | 27.2 | 0.2 | ±1.1 |
| 26.0 | 26.6 | 0.6 | ±1.1 |
| 25.0 | 25.8 | 0.8 | ±1.1 |

QF-TS12-04-04-020664

เอกสารไม่ควบคุม
P. Petch.

Continuation of Calibration Certificate

Cert. No. : ACL23119
Job No. : VC66AC0044
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 |

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P. Petch.

Continuation of Calibration Certificate

Cert. No. : ACL23119
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8. Level linearity including the level range control

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

9. Tone burst response

| Time Weighting | Tone burst duration, Tb (ms) | Cycle | Anticipated Value (dB) | Measured Value (dB) | Deviated Value (dB) | Acceptance Limits (dB) |
|-------------------|--------------------------------------|-------|--------------------------------|-----------------------------|-----------------------------|--------------------------------|
| Fast | 0.25 | 1 | 108.0 | 107.9 | -0.1 | 1.5 ; -5.0 |
| | 2 | 8 | 117.0 | 117.0 | 0.0 | 1.0 ; -2.5 |
| | 200 | 800 | 134.0 | 134.0 | 0.0 | ±1.0 |
| Slow | 2 | 8 | 108.0 | 108.0 | 0.0 | 1.5 ; -5.0 |
| | 200 | 800 | 127.6 | 127.6 | 0.0 | ±1.0 |
| 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 | 135.6 | -0.8 | ±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 |

QF-TS12-04-04-020664

เอกสารไม่ควบคุม
P. Petch.

Continuation of Calibration Certificate

Cert. No. : ACL23119
Job No. : VC66AC0044
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 | 89.7 | 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 : UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.
Address : 81 Soi Udomsak 41, Sukhumvit Road, Bangkok, Pakkong, Bangkok 10260
Certificate No : 23-NDM-011
Request No : Req-2023-0035

Unit Under Calibration Details

Measurement item : Noise dosimeter
Manufacturer : SVANTEK
Model : SV 1048
Serial Number : 106069
ID : -
Resolution : 0.1 dB
Microphone Class : 2
Microphone Model : SV 2705
Microphone S/N : 106312
Preamplifier Model : -
Preamplifier S/N : -
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 : 10 January 2023
Calibrated Date : 24 January 2023
Calibration Procedure : In-house method CP-NDM-01 based on IEC 61252 : 2017
Location of Calibration : Lab Acoustic

Reference Standard

| Instrument | Brand | Model | S/N | Due calibration | Traceability |
|---------------------------|--------|-----------|--------|-----------------|--------------|
| Multifrequency Calibrator | Quest | Quest-cal | 188272 | 29 June 2023 | TSI |
| Standard Microphone | GRAS | 40AN | 188273 | 6 October 2023 | GRAS |
| Sine Generator | Svante | Svante401 | 131 | 12 October 2023 | WK Electric |
| Timer | EXTech | - | 05-ACT | 24 March 2022 | TPA |

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. Noppadol Luangrit
Calibration Officer

Approved By :
Mr. Paol Mathavorn
Calibration Engineer Supervisor
Issue Date : 24 January 2023

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the calibration laboratory.

QF-TS12-04-04-020664

เอกสารไม่ควบคุม
7. R. R. R.

เอกสารไม่ควบคุม

Certificate No : 23-NDM-011
Request No : Req-2023-0035

1. Absolute acoustical sensitivity

| UUC Setting | Time | | Exposure Measurement | | | UNCERTAINTY (%) | Tolerances Limit (%) |
|--------------------|--------|-----|-------------------------|-------------------------|-----------|-----------------|----------------------|
| | Ref | UUC | Ref (Pa ² h) | UUC (Pa ² h) | Error (%) | | |
| Calibrator Setting | (s) | (s) | | | | | |
| 1000 Hz 114 dB | 120.00 | 120 | 3.19 | 3.20 | +0.31 | 3.0 | -21, +26 |

Note : Absolute sensitivity was established by the use of Sound Calibrator Brand SVANTEK, Model SV 35A, SN. 18079

2. Frequency weightings

| UUC Setting | Deviation from various Frequency Weighting | | UNCERTAINTY (± dB) | Tolerances Limit (± dB) |
|-------------------|--|------|----------------------|---------------------------|
| | A | C | | |
| FAST / A / 60-140 | | | | |
| STD Setting (dB) | (dB) | | | |
| *63 Hz | 0.3 | 0.3 | 0.40 | 2.0 |
| 125 Hz | 0.3 | 0.2 | 0.40 | 1.5 |
| 250 Hz | 0.0 | 0.0 | 0.40 | 1.5 |
| 500 Hz | -0.1 | -0.1 | 0.40 | 1.5 |
| 1000 Hz | 0.0 | 0.0 | 0.40 | - |
| 2000 Hz | -0.1 | -0.1 | 0.40 | 2.0 |
| 4000 Hz | 1.3 | 1.3 | 0.40 | 3.0 |
| 8000 Hz | -1.6 | -1.6 | 0.40 | 5.0 |

Certificate No : 23-NDM-011
Request No : Req-2023-0035

3. Linearity of response to steady signals

a. Sound exposure meter, linearity of response for changes of input sinusoidal signal level

| UUC Setting | Ref (dB) | FAST / A / High | | | | | | | |
|-----------------------|--------------|-----------------|------|-------|-------|-------|-------|-------|-------|
| | | 60.0 | 80.0 | 90.0 | 100.0 | 110.0 | 114.0 | 120.0 | 130.0 |
| 1000 Hz | Level A (dB) | 58.8 | 80.1 | 90.1 | 100.0 | 110.0 | 114.0 | 119.9 | 129.9 |
| | Error (dB) | -0.2 | 0.1 | 0.1 | 0.0 | 0.0 | 0.0 | -0.1 | -0.1 |
| | Ref (dB) | 88.9 | 88.9 | 108.9 | 112.9 | 118.9 | 128.9 | 138.9 | 148.9 |
| 8000 Hz | Level A (dB) | | | | 89.0 | 98.9 | 108.9 | 112.9 | 118.9 |
| | Error (dB) | | | | 0.1 | 0.0 | 0.0 | 0.0 | -0.1 |
| | Ref (dB) | | | | 87.8 | 93.8 | 103.8 | 113.8 | 123.8 |
| 63 Hz | Level A (dB) | | | | | | | | |
| | Error (dB) | | | | | | | | |
| | Ref (dB) | | | | | | | | |
| Tolerances Limit (dB) | | 1.0 | | | | | | | |
| UNCERTAINTY (dB) | | 0.27 | | | | | | | |

b. Sound exposure meter linearity of error

| UUC Setting | Time | | Exposure Measurement | | | UNCERTAINTY (%) | Tolerances Limit (%) |
|--------------------|------|-----|-------------------------|-------------------------|-----------|-----------------|----------------------|
| | Ref | UUC | Ref (Pa ² h) | UUC (Pa ² h) | Error (%) | | |
| Calibrator Setting | (s) | (s) | | | | | |
| 1000 Hz 110 dB | 27 | 27 | 0.30 | 0.30 | 0.00 | 4.3 | -21, +26 |
| 1000 Hz 110 dB | 45 | 45 | 0.50 | 0.50 | 0.00 | | |
| 1000 Hz 110 dB | 90 | 90 | 1.00 | 0.99 | -1.00 | | |
| 1000 Hz 110 dB | 180 | 180 | 2.00 | 1.98 | -1.00 | | |
| 1000 Hz 120 dB | 36 | 36 | 4.00 | 4.03 | +0.75 | | |
| 1000 Hz 120 dB | 72 | 72 | 8.00 | 8.05 | +0.63 | 3.8 | |
| 1000 Hz 120 dB | 90 | 90 | 10.00 | 10.13 | +1.30 | | |
| 1000 Hz 120 dB | 180 | 180 | 20.00 | 20.22 | +1.10 | | |
| 1000 Hz 120 dB | 360 | 360 | 40.00 | 40.34 | +0.85 | | |
| 1000 Hz 120 dB | 720 | 720 | 80.00 | 80.49 | +0.61 | | |

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the calibration laboratory.

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The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the calibration laboratory.

เอกสารไม่ควบคุม

Certificate No : 23-NDM-011
Request No : Req-2023-0055

4. Response to short duration
a. Response for sinusoidal signals - reference level

| UUC Setting | Time | | Exposure Measurement | | | UNCERTAINTY (%) | Tolerances Limit (Pa·h) |
|--------------------|------|------|----------------------|---------------|-----------------|--------------------|-------------------------------|
| | Ref | UUC | Ref (Pa·h) | UUC (Pa·h) | Error (Pa·h) | | |
| FAST / A / 60-140 | (s) | (s) | (Pa·h) | (Pa·h) | (Pa·h) | (%) | (Pa·h) |
| Calibrator Setting | (s) | (s) | (Pa·h) | (Pa·h) | (Pa·h) | (%) | (Pa·h) |
| 4000 Hz 95 dB | 2846 | 2846 | 1.00 | 0.98 | -0.02 | 0.01 | -0.29 ~ +0.41 |

b. Sound exposure meter response for series of toneburst impulses

| UUC Setting | Time | | Exposure Measurement | | | UNCERTAINTY (%) | Tolerances Limit (%) |
|--------------------|------|------|----------------------|---------------|--------------|--------------------|----------------------------|
| | Ref | UUC | Ref (Pa·h) | UUC (Pa·h) | Error (%) | | |
| FAST / A / 60-140 | (s) | (s) | (Pa·h) | (Pa·h) | (%) | (%) | (%) |
| Calibrator Setting | (s) | (s) | (Pa·h) | (Pa·h) | (%) | (%) | (%) |
| Burst 1 ms, 95 dB | 2846 | 2846 | 1.00 | 0.98 | -2.00 | 3.0 | -21 ~ +26 |
| Burst 1 ms, 100 dB | 900 | 900 | 1.00 | 0.98 | -2.00 | 3.0 | -21 ~ +41 |
| Burst 1 ms, 108 dB | 143 | 143 | 1.00 | 0.99 | -1.00 | 3.0 | -21 ~ +41 |

5. Response to unipolar pulse

| UUC Setting | Time | | Exposure Measurement | | | UNCERTAINTY (%) | Tolerances Limit (%) |
|------------------------|------|-----|----------------------|---------------|------------------|--------------------|----------------------------|
| | Ref | UUC | Ref (Pa·h) | UUC (Pa·h) | Different (%) | | |
| FAST / A / 60-140 | (s) | (s) | (Pa·h) | (Pa·h) | (%) | (%) | (%) |
| Calibrator Setting | (s) | (s) | (Pa·h) | (Pa·h) | (%) | (%) | (%) |
| Continuous Rectangle + | 7 | 7 | 10.86 | 10.86 | 0.00 | 2.4 | -21 ~ +26 |
| Continuous Rectangle - | 7 | 7 | 10.86 | 10.86 | 0.00 | 2.4 | -21 ~ +26 |

* Indicates non accredited

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.

เอกสารไม่ควบคุม

Certificate of Calibration

Customer

Name : UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.
Address : 81 Sri Udomsuk 41, Sukhumvit Road, Bangchak, Prakanong, Bangkok 10260

Certificate No : 23-NDM-091
Request No : Req-2023-0902

Unit Under Calibration Details

Measurement item : Noise Dosimeter
Microphone Model : SV 270S
Manufacturer : SVANTEK
Microphone S/N : 133718
Model : SV 104S
Serial Number : 128372
Serial Number : 128372
ID : -
Resolution : 0.1 dB
Pre-amplifier Model : -
Pre-amplifier S/N : -
Instrument Status : New

Calibration Environment and Details


Temperature : 23 °C ± 2 °C
Humidity : 50 % RH ± 20 % RH
Barometric Pressure : 1013 hPa ± 10 hPa
Received Date : 24 April 2023
Calibrated Date : 9 May 2023
Calibration Procedure : In-house method CP-NDM-01 based on IEC 61252 : 2017
Location of Calibration : Lab Acoustic


Reference Standard

| Instrument | Brand | Model | SN | Due calibration | Traceability |
|---------------------------|--------|-----------|--------|-----------------|--------------|
| Multifrequency Calibrator | Quest | Quest-val | 186272 | 29 June 2023 | TSI |
| Standard Microphone | GRAS | 40AN | 186273 | 6 October 2023 | GRAS |
| Sine Generator | Svante | Svnt401 | 131 | 12 October 2023 | WK Electric |
| Timer | EXTech | - | 05-ACT | 20 March 2024 | TPA |

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 Luangrat
Calibration Officer

Approved By : 
Mr. Paci Mathavorn
Calibration Engineer Supervisor
Issue Date : 9 May 2023

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.

เอกสารไม่ควบคุม

Certificate No : 23-NDM-091
Request No : Req-2023-0902

1. Absolute acoustical sensitivity

| UUC Setting | Time | | Exposure Measurement | | | UNCERTAINTY (%) | Tolerances Limit (%) |
|--------------------|------|-----|----------------------|---------------|--------------|--------------------|----------------------------|
| | Ref | UUC | Ref (Pa·h) | UUC (Pa·h) | Error (%) | | |
| FAST / A / 60-140 | (s) | (s) | (Pa·h) | (Pa·h) | (%) | (%) | (%) |
| Calibrator Setting | (s) | (s) | (Pa·h) | (Pa·h) | (%) | (%) | (%) |
| 1000 Hz 114 dB | 120 | 120 | 3.19 | 3.13 | -1.88 | 3.1 | -21 ~ +26 |

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

2. Frequency weightings

| UUC Setting | Deviation from various Frequency Weighting | | UNCERTAINTY (± dB) | Tolerances Limit (± dB) |
|---------------|---|------|-----------------------|-------------------------------|
| | A | C | | |
| FAST / 60-140 | (dB) | (dB) | (± dB) | (± dB) |
| STD Setting | (dB) | (dB) | (± dB) | (± dB) |
| *63 Hz | 0.4 | 0.5 | 0.40 | 2.0 |
| 125 Hz | 0.2 | 0.6 | 0.40 | 1.5 |
| 250 Hz | 0.1 | 0.6 | 0.40 | 1.5 |
| 500 Hz | 0.1 | 0.5 | 0.40 | 1.5 |
| 1000 Hz | 0.0 | 0.0 | 0.40 | - |
| 2000 Hz | -0.3 | 0.1 | 0.40 | 2.0 |
| 4000 Hz | 0.6 | 0.8 | 0.40 | 3.0 |
| 8000 Hz | -1.7 | -1.9 | 0.40 | 5.0 |

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.

เอกสารไม่ควบคุม

Certificate No : 23-NDM-091
Request No : Req-2023-0902

3. Linearity of response to steady signals

a. Sound exposure meter, linearity of response for changes of input sinusoidal signal level

| UUC Setting | Time | | Exposure Measurement | | | UNCERTAINTY (%) | Tolerances Limit (%) |
|------------------|------|------|----------------------|---------------|--------------|--------------------|----------------------------|
| | Ref | UUC | Ref (Pa·h) | UUC (Pa·h) | Error (%) | | |
| FAST / A / High | (dB) | (dB) | (Pa·h) | (Pa·h) | (%) | (%) | (%) |
| 1000 Hz | (dB) | (dB) | (Pa·h) | (Pa·h) | (%) | (%) | (%) |
| Level A | (dB) | (dB) | (Pa·h) | (Pa·h) | (%) | (%) | (%) |
| Error | (dB) | (dB) | (Pa·h) | (Pa·h) | (%) | (%) | (%) |
| 8000 Hz | (dB) | (dB) | (Pa·h) | (Pa·h) | (%) | (%) | (%) |
| Level A | (dB) | (dB) | (Pa·h) | (Pa·h) | (%) | (%) | (%) |
| Error | (dB) | (dB) | (Pa·h) | (Pa·h) | (%) | (%) | (%) |
| 63 Hz | (dB) | (dB) | (Pa·h) | (Pa·h) | (%) | (%) | (%) |
| Level A | (dB) | (dB) | (Pa·h) | (Pa·h) | (%) | (%) | (%) |
| Error | (dB) | (dB) | (Pa·h) | (Pa·h) | (%) | (%) | (%) |
| Tolerances Limit | (dB) | (dB) | (Pa·h) | (Pa·h) | (%) | (%) | (%) |
| UNCERTAINTY | (dB) | (dB) | (Pa·h) | (Pa·h) | (%) | (%) | (%) |

b. Sound exposure meter linearity of error

| UUC Setting | Time | | Exposure Measurement | | | UNCERTAINTY (%) | Tolerances Limit (%) |
|--------------------|------|-----|----------------------|---------------|--------------|--------------------|----------------------------|
| | Ref | UUC | Ref (Pa·h) | UUC (Pa·h) | Error (%) | | |
| FAST / A / 60-140 | (s) | (s) | (Pa·h) | (Pa·h) | (%) | (%) | (%) |
| Calibrator Setting | (s) | (s) | (Pa·h) | (Pa·h) | (%) | (%) | (%) |
| 1000 Hz 110 dB | 27 | 27 | 0.30 | 0.30 | 0.00 | 5.6 | -21 ~ +26 |
| 1000 Hz 110 dB | 45 | 45 | 0.30 | 0.30 | 0.00 | 5.6 | -21 ~ +26 |
| 1000 Hz 110 dB | 90 | 90 | 1.00 | 0.99 | -1.00 | 5.6 | -21 ~ +26 |
| 1000 Hz 110 dB | 180 | 180 | 2.00 | 1.98 | -1.00 | 5.6 | -21 ~ +26 |
| 1000 Hz 120 dB | 36 | 36 | 4.00 | 4.03 | +0.75 | 82.6 | -21 ~ +26 |
| 1000 Hz 120 dB | 72 | 72 | 8.00 | 8.05 | +0.63 | 82.6 | -21 ~ +26 |
| 1000 Hz 120 dB | 90 | 90 | 10.00 | 9.90 | -1.00 | 82.6 | -21 ~ +26 |
| 1000 Hz 120 dB | 180 | 180 | 20.00 | 19.76 | -1.20 | 82.6 | -21 ~ +26 |
| 1000 Hz 120 dB | 360 | 360 | 40.00 | 40.34 | +0.85 | 82.6 | -21 ~ +26 |
| 1000 Hz 120 dB | 720 | 720 | 80.00 | 80.49 | +0.61 | 82.6 | -21 ~ +26 |

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.

เอกสารไม่ควบคุม

Certificate No : Z3-NDM-081
Request No : Req-2023-0902

4. Response to short duration

a. Response for sinusoidal signals - reference level

| UUC Setting | Time | | Exposure Measurement | | | UNCERTAINTY | Tolerances Limit |
|--------------------|------|------|----------------------|----------------------|----------------------|-------------|----------------------|
| | Ref | UUC | Ref | UUC | Error | | |
| Calibrator Setting | (s) | (s) | (Pa ² ·h) | (Pa ² ·h) | (Pa ² ·h) | (%) | (Pa ² ·h) |
| 4000 Hz 95 dB | 2846 | 2846 | 1.00 | 1.00 | 0.00 | 0.052 | -0.29 ~ +0.41 |

b. Sound exposure meter response for series of toneburst impulses

| UUC Setting | Time | | Exposure Measurement | | | UNCERTAINTY | Tolerances Limit |
|--------------------|------|------|----------------------|----------------------|-------|-------------|------------------|
| | Ref | UUC | Ref | UUC | Error | | |
| Calibrator Setting | (s) | (s) | (Pa ² ·h) | (Pa ² ·h) | (%) | (%) | (%) |
| Burst 1 ms, 95 dB | 2846 | 2846 | 1.00 | 1.00 | 0.00 | 5.6 | -21 ~ +26 |
| Burst 1 ms, 100 dB | 900 | 900 | 1.00 | 1.00 | 0.00 | | -29 ~ +41 |
| Burst 1 ms, 106 dB | 143 | 143 | 1.00 | 1.01 | +1.00 | | -29 ~ +41 |

5. Response to unipolar pulse

| UUC Setting | Time | | Exposure Measurement | | | UNCERTAINTY | Tolerances Limit |
|------------------------|------|-----|----------------------|----------------------|-----------|-------------|------------------|
| | Ref | UUC | Ref | UUC | Different | | |
| Calibrator Setting | (s) | (s) | (Pa ² ·h) | (Pa ² ·h) | (%) | (%) | (%) |
| Continuous Rectangle + | 29 | | 10.37 | 10.37 | 0.00 | 3.7 | -21 ~ +26 |
| Continuous Rectangle - | | | 10.37 | | | | |

* Indicates non accredited

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.

เอกสารไม่ควรถูก

Certificate of Calibration

Customer

Name : UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.
Address : 81 Soi Udomsak 41, Sukhumvit Road, Bangkok, Prakanong, Bangkok 10560

Certificate No : Z3-NDM-088
Request No : Req-2023-0902

Unit Under Calibration Details

Measurement item : Noise Dosimeter
Microphone Class : 2
Manufacturer : SVANTEK
Microphone Model : SV 27B5
Model : SV 104S
Microphone S/N : 133702
Serial Number : 128560
Preamplifier Model : -
ID : -
Preamplifier S/N : -
Resolution : 0.1 dB
Instrument Status : New

Calibration Environment and Details


Temperature : 23 °C ± 2 °C
Humidity : 50 %RH ± 20 %RH
Barometric Pressure : 1013 hPa ± 10 hPa
Received Date : 25 April 2023
Calibrated Date : 8 May 2023
Calibration Procedure : In-house method CP-NDM-01 based on IEC 61252 : 2017
Location of Calibration : Lab Acoustic

Reference Standard

| Instrument | Brand | Model | SN | Due calibration | Traceability |
|----------------------------|---------|-----------|--------|-----------------|--------------|
| Multi-frequency Calibrator | Quint | Quint-cal | 188272 | 29 June 2023 | TISI |
| Standard Microphone | GRAS | 40AN | 188273 | 6 October 2023 | GRAS |
| Size Generator | SvanteK | Svan401 | 131 | 12 October 2023 | WK Electric |
| Timer | EXTech | - | 05-ACT | 20 March 2024 | TPA |

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 Luangrat
Calibration Officer

Approved By : 
Mr. Pacht Mahavorn
Calibration Engineer Supervisor
Issue Date : 8 May 2023

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.

เอกสารไม่ควรถูก

Certificate No : Z3-NDM-083
Request No : Req-2023-0902

1. Absolute acoustical sensitivity

| UUC Setting | Time | | Exposure Measurement | | | UNCERTAINTY | Tolerances Limit |
|--------------------|------|-----|----------------------|----------------------|-------|-------------|------------------|
| | Ref | UUC | Ref | UUC | Error | | |
| Calibrator Setting | (s) | (s) | (Pa ² ·h) | (Pa ² ·h) | (%) | (%) | (%) |
| 1000 Hz 114 dB | 120 | 120 | 3.19 | 3.20 | +0.31 | 3.1 | -21 ~ +26 |

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

2. Frequency weightings

| UUC Setting | Deviation from various Frequency Weighting | | UNCERTAINTY | Tolerances Limit |
|-------------------|--|------|-------------|------------------|
| | A | C | | |
| FAST / A / 60-140 | (dB) | (dB) | (± dB) | (± dB) |
| STD Setting | | | | |
| *63 Hz | 0.2 | 0.3 | 0.40 | 2.0 |
| 125 Hz | -0.1 | 0.4 | 0.40 | 1.5 |
| 250 Hz | -0.3 | 0.2 | 0.40 | 1.5 |
| 500 Hz | -0.2 | 0.2 | 0.40 | 1.5 |
| 1000 Hz | 0.0 | 0.0 | 0.40 | - |
| 2000 Hz | 0.4 | 0.8 | 0.40 | 2.0 |
| 4000 Hz | 1.7 | 1.9 | 0.40 | 3.0 |
| 8000 Hz | -2.0 | -2.2 | 0.40 | 5.0 |

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.

เอกสารไม่ควรถูก

Certificate No : Z3-NDM-088
Request No : Req-2023-0902

3. Linearity of response to steady signals

a. Sound exposure meter, linearity of response for changes of input sinusoidal signal level

| UUC Setting | Ref | FAST / A / High | | | | | | | |
|------------------|---------|-----------------|------|------|-------|-------|-------|-------|-------|
| | | (dB) | 60.0 | 80.0 | 90.0 | 100.0 | 110.0 | 114.0 | 120.0 |
| 1000 Hz | Level A | (dB) | 55.9 | 80.0 | 90.0 | 100.0 | 110.0 | 114.0 | 120.0 |
| | Error | (dB) | -0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | -0.1 |
| | Error | (dB) | -0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | -0.1 |
| 8000 Hz | Ref | (dB) | 88.9 | 98.9 | 108.9 | 112.9 | 118.9 | 128.9 | 138.9 |
| | Level A | (dB) | 88.9 | 98.9 | 108.9 | 112.9 | 118.9 | 128.9 | 138.9 |
| | Error | (dB) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | -0.1 | -0.1 |
| 63 Hz | Ref | (dB) | 87.8 | 93.8 | 103.8 | 113.8 | 118.8 | 123.8 | 128.8 |
| | Level A | (dB) | 87.8 | 93.8 | 103.8 | 113.8 | 118.8 | 123.8 | 128.8 |
| | Error | (dB) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Tolerances Limit | | (±dB) | 1.0 | | | | | | |
| UNCERTAINTY | | (±dB) | 0.3 | | | | | | |

b. Sound exposure meter linearity of error

| UUC Setting | Time | | Exposure Measurement | | | UNCERTAINTY | Tolerances Limit |
|--------------------|------|-----|----------------------|----------------------|-------|-------------|------------------|
| | Ref | UUC | Ref | UUC | Error | | |
| Calibrator Setting | (s) | (s) | (Pa ² ·h) | (Pa ² ·h) | (%) | (%) | (%) |
| 1000 Hz 110 dB | 27 | 27 | 0.30 | 0.30 | 0.00 | 5.6 | -21 ~ +26 |
| 1000 Hz 110 dB | 45 | 45 | 0.50 | 0.50 | 0.00 | | |
| 1000 Hz 110 dB | 90 | 90 | 1.00 | 1.01 | +1.00 | | |
| 1000 Hz 110 dB | 180 | 180 | 2.00 | 2.02 | +1.00 | | |
| 1000 Hz 120 dB | 36 | 36 | 4.00 | 3.94 | -1.50 | | |
| 1000 Hz 120 dB | 72 | 72 | 8.00 | 7.87 | -1.63 | 5.6 | -21 ~ +26 |
| 1000 Hz 120 dB | 90 | 90 | 10.00 | 9.90 | -1.00 | | |
| 1000 Hz 120 dB | 180 | 180 | 20.00 | 19.76 | -1.20 | | |
| 1000 Hz 120 dB | 360 | 360 | 40.00 | 39.42 | -1.43 | | |
| 1000 Hz 120 dB | 720 | 720 | 80.00 | 78.66 | -1.68 | | |

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.

เอกสารไม่ควรถูก

Certificate No : 23-NDM-098
Request No : Req-2023-0902

4. Response to short duration

a. Response for sinusoidal signals - reference level

| UUC Setting | Time | | Exposure Measurement | | | UNCERTAINTY | Tolerances Limit |
|--------------------|------|------|----------------------|---------------------|---------------------|-------------|------------------|
| | Ref | UUC | Ref | UUC | Error | | |
| Calibrator Setting | (s) | (s) | (Pa ² h) | (Pa ² h) | (Pa ² h) | (%) | (%) |
| 4000 Hz 95 dB | 2846 | 2846 | 1.00 | 0.99 | -0.01 | 0.052 | -0.29 ~ -0.41 |

b. Sound exposure meter response for series of toneburst impulses

| UUC Setting | Time | | Exposure Measurement | | | UNCERTAINTY | Tolerances Limit |
|--------------------|------|------|----------------------|---------------------|-------|-------------|------------------|
| | Ref | UUC | Ref | UUC | Error | | |
| Calibrator Setting | (s) | (s) | (Pa ² h) | (Pa ² h) | (%) | (%) | (%) |
| Burst 1 ms, 93 dB | 2846 | 2846 | 1.00 | 0.99 | -1.00 | 5.6 | -21 ~ -26 |
| Burst 1 ms, 100 dB | 900 | 900 | 1.00 | 0.99 | -1.00 | | -29 ~ -41 |
| Burst 1 ms, 108 dB | 143 | 143 | 1.00 | 1.00 | 0.00 | | -29 ~ -41 |

5. Response to unipolar pulse

| UUC Setting | Time | | Exposure Measurement | | | UNCERTAINTY | Tolerances Limit |
|------------------------|------|-----|----------------------|---------------------|-----------|-------------|------------------|
| | Ref | UUC | Ref | UUC | Different | | |
| Calibrator Setting | (s) | (s) | (Pa ² h) | (Pa ² h) | (%) | (%) | (%) |
| Continuous Rectangle + | 29 | 29 | 10.37 | 10.37 | 0.00 | 3.7 | -21 ~ -26 |
| Continuous Rectangle - | | | 10.37 | | | | |

* Indicates non accredited

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.

เอกสารไม่ควรถูก

Certificate of Calibration

Customer

Name : UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.
Address : 81 Soi Udomsak 41, Sukhumvit Road, Bangchak, Prakanong, Bangkok 10260

Certificate No : 23-NDM-094
Request No : Req-2023-0902

Unit Under Calibration Details

Measurement item : Noise Dosimeter
Manufacturer : SVANTEK
Model : SV 1048S
Serial Number : 128473
ID : -
Resolution : 0.1 dB
Microphone Class : 2
Microphone Model : SV 278S
Microphone S/N : 103527
Preamplifier Model : -
Preamplifier S/N : -
Instrument Status : New

Calibration Environment and Details


Temperature : 23 °C ± 2 °C
Humidity : 50 %RH ± 20 %RH
Barometric Pressure : 1013 hPa ± 10 hPa
Received Date : 23 April 2023
Calibrated Date : 9 May 2023
Calibration Procedure : In-house method CP-NDM-01 based on IEC 61252 : 2017
Location of Calibration : Lab Anisole


Reference Standard

| Instrument | Brand | Model | SN | Due calibration | Traceability |
|---------------------------|---------|-----------|--------|-----------------|--------------|
| Multifrequency Calibrator | Quest | Quest-cal | 188272 | 29 June 2023 | TSI |
| Standard Microphone | GRAS | 40AN | 188273 | 6 October 2023 | GRAS |
| Size Generator | Svantek | Svan401 | 131 | 12 October 2023 | WK Electric |
| Timer | EXTech | - | 05-ACT | 20 March 2024 | TPA |

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 Luangrat
Calibration Officer

Approved By : 
Mr. Pacin Mathavorn
Calibration Engineer Supervisor
Issue Date : 9 May 2023

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.

เอกสารไม่ควรถูก

Certificate No : 23-NDM-094
Request No : Req-2023-0902

1. Absolute acoustical sensitivity

| UUC Setting | Time | | Exposure Measurement | | | UNCERTAINTY | Tolerances Limit |
|--------------------|------|-----|----------------------|---------------------|-------|-------------|------------------|
| | Ref | UUC | Ref | UUC | Error | | |
| Calibrator Setting | (s) | (s) | (Pa ² h) | (Pa ² h) | (%) | (%) | (%) |
| 1000 Hz 114 dB | 120 | 120 | 3.19 | 3.13 | -1.88 | 3.1 | -21 ~ -26 |

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

2. Frequency weightings

| UUC Setting | Deviation from various Frequency Weighting | | UNCERTAINTY | Tolerances Limit |
|---------------|--|------|-------------|------------------|
| | A | C | | |
| FAST / 60-140 | (dB) | (dB) | (± dB) | (± dB) |
| STD Setting | | | | |
| 763 Hz | 0.1 | 0.2 | 0.40 | 2.0 |
| 125 Hz | -0.4 | 0.0 | 0.40 | 1.5 |
| 250 Hz | -0.4 | 0.1 | 0.40 | 1.5 |
| 500 Hz | -0.2 | 0.2 | 0.40 | 1.5 |
| 1000 Hz | 0.0 | 0.0 | 0.40 | - |
| 2000 Hz | 0.4 | 0.8 | 0.40 | 2.0 |
| 4000 Hz | 2.1 | 2.1 | 0.40 | 3.0 |
| 8000 Hz | -2.2 | -2.2 | 0.40 | 5.0 |

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.

เอกสารไม่ควรถูก

Certificate No : 23-NDM-094
Request No : Req-2023-0902

3. Linearity of response to steady signals

a. Sound exposure meter, linearity of response for changes of input sinusoidal signal level

| UUC Setting | FAST / A / High | | | | | | | | | | | |
|------------------|-----------------|------|------|------|------|-------|-------|-------|-------|-------|-------|-------|
| | Ref | (dB) | 40.0 | 80.0 | 80.0 | 100.0 | 110.0 | 114.0 | 120.0 | 130.0 | 140.0 | |
| 1000 Hz | Level A | (dB) | 60.3 | 80.2 | 90.2 | 100.0 | 110.0 | 114.0 | 120.0 | 130.0 | 140.0 | |
| | Error | (dB) | 0.3 | 0.2 | 0.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| | | (dB) | | | | | | | | | | |
| 8000 Hz | Ref | (dB) | | | | 98.9 | 98.9 | 108.9 | 112.0 | 118.9 | 128.9 | 138.9 |
| | Level A | (dB) | | | | 89.0 | 98.9 | 108.9 | 112.0 | 118.9 | 128.9 | 138.9 |
| | Error | (dB) | | | | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | -0.1 |
| 63 Hz | Ref | (dB) | | | | | | | 87.8 | 93.8 | 103.8 | 113.8 |
| | Level A | (dB) | | | | | | | 87.8 | 93.8 | 103.8 | 113.8 |
| | Error | (dB) | | | | | | | 0.0 | 0.0 | 0.0 | 0.0 |
| Tolerances Limit | | | | | | | | | | | | 1.0 |
| UNCERTAINTY | | | | | | | | | | | | 0.3 |

b. Sound exposure meter linearity of error

| UUC Setting | Time | | Exposure Measurement | | | UNCERTAINTY | Tolerances |
|--------------------|------|-----|----------------------|---------------------|-------|-------------|------------|
| FAST / A / 60-140 | Ref | UUC | Ref | UUC | Error | | Limit |
| Calibrator Setting | (s) | (s) | (Pa ² h) | (Pa ² h) | (%) | (%) | (%) |
| 1000 Hz 119 dB | 27 | 27 | 0.30 | 0.30 | 0.00 | 5.6 | -21, +26 |
| 1000 Hz 119 dB | 45 | 45 | 0.50 | 0.50 | 0.00 | | |
| 1000 Hz 119 dB | 90 | 90 | 1.00 | 0.99 | -1.00 | | |
| 1000 Hz 119 dB | 180 | 180 | 2.00 | 1.98 | -1.00 | | |
| 1000 Hz 120 dB | 36 | 36 | 4.00 | 4.03 | +0.75 | | |
| 1000 Hz 120 dB | 72 | 72 | 8.00 | 8.05 | +0.63 | 5.6 | |
| 1000 Hz 120 dB | 90 | 90 | 10.00 | 10.13 | +1.30 | | |
| 1000 Hz 120 dB | 180 | 180 | 20.00 | 20.22 | +1.10 | | |
| 1000 Hz 120 dB | 360 | 360 | 40.00 | 40.34 | +0.85 | | |
| 1000 Hz 120 dB | 720 | 720 | 80.00 | 80.49 | +0.61 | | |

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.

เอกสารไม่ควรถูก

Certificate No : 23-NDM-090
Request No : Req-2023-0902

4. Response to short duration

a. Response for sinusoidal signals - reference level

| UUC Setting | Time | | Exposure Measurement | | | UNCERTAINTY | Tolerances Limit |
|--------------------|------|------|----------------------|----------------------|----------------------|-------------|------------------|
| | Ref | UUC | Ref | UUC | Error | | |
| FAST / A / 60-140 | (s) | (s) | (Pa ² /h) | (Pa ² /h) | (Pa ² /h) | (%) | (%) |
| Calibrator Setting | 60 | 60 | (Pa ² /h) | (Pa ² /h) | (Pa ² /h) | (%) | (%) |
| 4000 Hz 95 dB | 2846 | 2846 | 1.00 | 0.98 | -0.02 | 0.052 | -0.29 ~ +0.41 |

b. Sound exposure meter response for series of toneburst impulses

| UUC Setting | Time | | Exposure Measurement | | | UNCERTAINTY | Tolerances |
|--------------------|------|------|----------------------|----------------------|-------|-------------|------------|
| FAST / A / 60-140 | Ref | UUC | Ref | UUC | Error | | Limit |
| Calibrator Setting | (s) | (s) | (Pa ² /h) | (Pa ² /h) | (%) | (%) | (%) |
| Burst 1 ms, 95 dB | 2846 | 2846 | 1.00 | 0.99 | -2.00 | 5.6 | -21 ~ +26 |
| Burst 1 ms, 100 dB | 900 | 900 | 1.00 | 0.98 | -2.00 | | -29 ~ +41 |
| Burst 1 ms, 108 dB | 143 | 143 | 1.00 | 0.99 | -1.00 | | -29 ~ +41 |

5. Response to unipolar pulse

| UUC Setting | Time | Exposure Measurement | | | UNCERTAINTY | Tolerances |
|------------------------|------|----------------------|-----------|-------|-------------|------------|
| FAST / A / 60-140 | UUC | UUC | Different | Limit | | |
| Calibrator Setting | (s) | (Pa ³ /h) | (%) | (%) | (%) | |
| Continuous Rectangle + | 28 | 10.13 | 0.00 | 3.7 | -21 ~ +26 | |
| Continuous Rectangle - | | 10.13 | | | | |

* Indicates non accredited

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.

เอกสารไม่ควรถูก

Certificate of Calibration

Customer

Name : UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.
Address : 81 Soi Udomsak 41, Sukhumvit Road, Bangkok, Prakanong, Bangkok 10260

Certificate No : 23-NDM-090
Request No : Req-2023-0902

Unit Under Calibration Details

Measurement item : Noise Dosimeter
Microphone Class : 2
Manufacturer : SVANTEK
Microphone Model : SV 27S
Model : SV 104S
Microphone S/N : 133712
Serial Number : 128367
Preamplifier Model : -
ID : -
Preamplifier S/N : -
Resolution : 0.1 dB
Instrument Status : New

Calibration Environment and Details


Temperature : 23 °C ± 2 °C
Humidity : 50 %RH ± 20 %RH
Barometric Pressure : 1013 hPa ± 10 hPa
Received Date : 24 April 2023
Calibrated Date : 8 May 2023
Calibration Procedure : In-house method CP-NDM-01 based on IEC 61252 : 2017
Location of Calibration : Lab Acoustic


Reference Standard

| Instrument | Brand | Model | SN. | Due calibration | Traceability |
|---------------------------|----------|-------------|--------|-----------------|--------------|
| Multifrequency Calibrator | Quant | Quantcal | 188272 | 29 June 2023 | TISI |
| Standard Microphone | GRAS | 40AN | 188273 | 6 October 2023 | GRAS |
| Sine Generator | Svanteck | Svanteck401 | 131 | 12 October 2023 | WK Electric |
| Timer | EXTECH | - | 05-ACT | 20 March 2024 | TPA |

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. Noppadol Luangrit
Calibration Officer

Approved By : 
Mr. Pachi Mahavorn
Calibration Engineer Supervisor

Issue Date : 8 May 2023

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.

เอกสารไม่ควรถูก

Certificate No : 23-NDM-090
Request No : Req-2023-0902

1. Absolute acoustical sensitivity

| UUC Setting | Time | | Exposure Measurement | | | UNCERTAINTY | Tolerances |
|--------------------|------|-----|----------------------|---------------------|-------|-------------|------------|
| FAST / A / 60-140 | Ref | UUC | Ref | UUC | Error | | |
| Calibrator Setting | (s) | (s) | (Pa ² h) | (Pa ² h) | (%) | (%) | (%) |
| 1000 Hz 114 dB | 120 | 120 | 3.19 | 3.20 | +0.31 | 3.1 | -21, +26 |

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

2. Frequency weightings

| UUC Setting | Deviation from various Frequency Weighting | | UNCERTAINTY | Tolerances Limit |
|---------------|--|------|-------------|------------------|
| | A | C | | |
| FAST / 60-140 | (dB) | (dB) | (± dB) | (± dB) |
| STD Setting | (dB) | (dB) | (± dB) | (± dB) |
| 90 Hz | -0.1 | 0.0 | 0.40 | 2.0 |
| 125 Hz | 0.1 | 0.5 | 0.40 | 1.5 |
| 250 Hz | -0.1 | 0.4 | 0.40 | 1.5 |
| 500 Hz | 0.0 | 0.4 | 0.40 | 1.5 |
| 1000 Hz | 0.0 | 0.0 | 0.40 | - |
| 2000 Hz | -0.4 | 0.0 | 0.40 | 2.0 |
| 4000 Hz | 0.9 | 1.1 | 0.40 | 3.0 |
| 8000 Hz | -1.9 | -2.0 | 0.40 | 5.0 |

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.

เอกสารไม่ควรถูก

Certificate No : 23-NDM-090
Request No : Req-2023-0902

3. Linearity of response to steady signals

a. Sound exposure meter, linearity of response for changes of input sinusoidal signal level

| UUC Setting | Ref | FAST / A / High | | | | | | | | | | | |
|------------------|---------|-----------------|------|------|-------|-------|-------|-------|-------|-------|-------|-------|--|
| | | (dB) | 60.0 | 80.0 | 90.0 | 100.0 | 110.0 | 114.0 | 120.0 | 130.0 | 140.0 | | |
| 1000 Hz | Level A | (dB) | 98.8 | 80.0 | 90.0 | 100.1 | 110.0 | 114.0 | 120.0 | 130.0 | 140.0 | | |
| | Error | (dB) | -0.2 | 0.0 | 0.0 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | |
| | Ref | (dB) | 98.8 | 98.9 | 108.9 | 112.9 | 118.9 | 128.9 | 138.9 | | | | |
| 8000 Hz | Level A | (dB) | | | | 98.9 | 98.9 | 108.9 | 112.9 | 118.9 | 128.9 | | |
| | Error | (dB) | | | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | -0.1 | | |
| | Ref | (dB) | | | | 98.8 | 98.8 | 108.8 | 112.8 | 118.8 | 128.8 | | |
| 63 Hz | Level A | (dB) | | | | | | | 87.8 | 93.8 | 103.8 | 113.8 | |
| | Error | (dB) | | | | | | | 0.0 | 0.0 | 0.0 | 0.0 | |
| | Ref | (dB) | | | | | | | 87.8 | 93.8 | 103.8 | 113.8 | |
| Tolerances Limit | | (±dB) | 1.0 | | | | | | | | | | |
| UNCERTAINTY | | (±dB) | 0.3 | | | | | | | | | | |

b. Sound exposure meter linearity of error

| UUC Setting | | Time | | Exposure Measurement | | | UNCERTAINTY | Tolerances Limit |
|--------------------|-----|------|----------------------|----------------------|-------|-----|-------------|------------------|
| FAST / A / 60-140 | Ref | UUC | Ref | UUC | Error | | | |
| Calibrator Setting | (s) | (s) | (Pa ² /h) | (Pa ² /h) | (%) | (%) | | (%) |
| 1000 Hz 110 dB | 27 | 27 | 0.30 | 0.30 | 0.00 | 5.6 | -21, +26 | |
| 1000 Hz 110 dB | 45 | 45 | 0.30 | 0.30 | 0.00 | | | |
| 1000 Hz 110 dB | 90 | 90 | 1.00 | 0.99 | -1.00 | | | |
| 1000 Hz 110 dB | 180 | 180 | 2.00 | 1.98 | -1.00 | | | |
| 1000 Hz 120 dB | 36 | 36 | 4.00 | 4.03 | +0.75 | | | |
| 1000 Hz 120 dB | 72 | 72 | 8.00 | 8.05 | +0.63 | | | |
| 1000 Hz 120 dB | 90 | 90 | 10.00 | 10.13 | +1.30 | 5.6 | | |
| 1000 Hz 120 dB | 180 | 180 | 20.00 | 20.22 | +1.10 | | | |
| 1000 Hz 120 dB | 360 | 360 | 40.00 | 40.34 | +0.85 | | | |
| 1000 Hz 120 dB | 720 | 720 | 80.00 | 80.49 | +0.61 | | | |

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.

เอกสารไม่ควรถูก

Certificate No : 23-NDM-090
Request No : Req-2023-0902

4. Response to short duration

a. Response for sinusoidal signals - reference level

| UUC Setting | Time | | Exposure Measurement | | | UNCERTAINTY | Tolerances Limit |
|--------------------|------|------|----------------------|----------------------|----------------------|----------------------|----------------------|
| | Ref | UUC | Ref | UUC | Error | | |
| Calibrator Setting | (s) | (s) | (Pa ¹ /h) | (Pa ¹ /h) | (Pa ¹ /h) | (Pa ¹ /h) | (Pa ² /h) |
| 4000 Hz 95 dB | 2846 | 2846 | 1.00 | 0.98 | -0.02 | 0.052 | -0.29 ~ +0.41 |

b. Sound exposure meter response for series of toneburst impulses

| UUC Setting | Time | | Exposure Measurement | | | UNCERTAINTY | Tolerances Limit |
|--------------------|------|------|----------------------|----------------------|-------|-------------|------------------|
| | Ref | UUC | Ref | UUC | Error | | |
| Calibrator Setting | (s) | (s) | (Pa ¹ /h) | (Pa ¹ /h) | (%) | (%) | (%) |
| Burst 1 ms, 95 dB | 2846 | 2846 | 1.00 | 0.98 | -2.00 | 5.6 | -21 ~ +26 |
| Burst 1 ms, 100 dB | 900 | 900 | 1.00 | 0.95 | -2.00 | | -29 ~ +41 |
| Burst 1 ms, 108 dB | 143 | 143 | 1.00 | 0.99 | -1.00 | | -29 ~ +41 |

5. Response to unipolar pulse

| UUC Setting | Time | | Exposure Measurement | | | UNCERTAINTY | Tolerances Limit |
|------------------------|------|-----|----------------------|----------------------|-----------|-------------|------------------|
| | Ref | UUC | Ref | UUC | Different | | |
| Calibrator Setting | (s) | (s) | (Pa ¹ /h) | (Pa ¹ /h) | (%) | (%) | (%) |
| Continuous Rectangle + | 28 | | 10.13 | 10.13 | 0.00 | 3.7 | -21 ~ +26 |
| Continuous Rectangle - | | | 10.13 | | | | |

* Indicates non accredited

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.

เอกสารไม่ควรถูก

Certificate of Calibration

Customer

Name UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.
Address 81 Soi Udomrak 41, Sukhumvit Road, Bangkok, Prakanong, Bangkok 10260

Certificate No : 23-NDM-092
Request No : Req-2023-0902

Unit Under Calibration Details

Measurement Item : Noise Dosimeter
Microphone Class : 2
Manufacturer : SVANTEK
Microphone Model : SV 27S
Model : SV 104S
Microphone S/N : 132945
Serial Number : 128431
Preamp Model : -
ID : -
Preamp S/N : -
Resolution : 0.1 dB
Instrument Status : New

Calibration Environment and Details


Temperature : 23 °C ± 2 °C
Humidity : 50 %RH ± 20 %RH
Barometric Pressure : 1013 hPa ± 10 hPa
Received Date : 24 April 2023
Calibrated Date : 9 May 2023
Calibration Procedure : In-house method CP-NDM-01 based on IEC 61252 : 2017
Location of Calibration : Lab Acoustic


Reference Standard

| Instrument | Brand | Model | SN | Due calibration | Traceability |
|---------------------------|---------|----------|--------|-----------------|--------------|
| Multifrequency Calibrator | Qunt | Quac-cal | 188272 | 29 June 2023 | TSI |
| Standard Microphone | GRAS | 40AN | 188273 | 6 October 2023 | GRAS |
| Size Generator | SvanteK | Svan401 | 131 | 12 October 2023 | WK Electric |
| Timer | EXTech | - | 05-ACT | 20 March 2024 | TPA |

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 Luangarn
Calibration Officer

Approved By : 
Mr. Pacht Mathavorn
Calibration Engineer Supervisor
Issue Date : 9 May 2023

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.

เอกสารไม่ควรถูก

Certificate No : 23-NDM-092
Request No : Req-2023-0902

1. Absolute acoustical sensitivity

| UUC Setting | Time | | Exposure Measurement | | | UNCERTAINTY | Tolerances Limit |
|--------------------|------|-----|----------------------|----------------------|-------|-------------|------------------|
| | Ref | UUC | Ref | UUC | Error | | |
| Calibrator Setting | (s) | (s) | (Pa ¹ /h) | (Pa ¹ /h) | (%) | (%) | (%) |
| 1000 Hz 114 dB | 120 | 120 | 3.19 | 3.20 | +0.31 | 3.1 | -21 ~ +26 |

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

2. Frequency weightings

| UUC Setting | Deviation from various Frequency Weighting | | UNCERTAINTY | Tolerances Limit |
|---------------|--|------|-------------|------------------|
| | A | C | | |
| FAST / 60-140 | (dB) | (dB) | (± dB) | (± dB) |
| STD Setting | (dB) | (dB) | (± dB) | (± dB) |
| 763 Hz | 0.1 | 0.2 | 0.40 | 2.0 |
| 125 Hz | -0.3 | 0.1 | 0.40 | 1.5 |
| 250 Hz | -0.1 | 0.4 | 0.40 | 1.5 |
| 380 Hz | -0.1 | 0.3 | 0.40 | 1.5 |
| 1000 Hz | 0.0 | 0.0 | 0.40 | - |
| 2000 Hz | 0.1 | 0.5 | 0.40 | 2.0 |
| 4000 Hz | 1.8 | 1.6 | 0.40 | 3.0 |
| 8000 Hz | -2.0 | -2.2 | 0.40 | 5.0 |

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.

เอกสารไม่ควรถูก

Certificate No : 23-NDM-092
Request No : Req-2023-0902

3. Linearity of response to steady signals

a. Sound exposure meter, linearity of response for changes of input sinusoidal signal level

| UUC Setting | Ref | FAST / A / High | | | | | | | | | |
|------------------|---------|-----------------|------|------|-------|-------|-------|-------|-------|-------|-------|
| | | (dB) | 40.0 | 80.0 | 90.0 | 100.0 | 110.0 | 114.0 | 120.0 | 130.0 | 140.0 |
| 1000 Hz | Level A | (dB) | 60.2 | 80.3 | 90.1 | 100.0 | 110.0 | 114.0 | 120.0 | 130.0 | 140.0 |
| | Error | (dB) | 0.2 | 0.3 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | Ref | (dB) | 88.9 | 98.9 | 108.9 | 112.9 | 118.9 | 128.9 | 138.9 | | |
| 8000 Hz | Level A | (dB) | | | | 80.0 | 99.0 | 108.9 | 112.9 | 118.9 | 128.9 |
| | Error | (dB) | | | | 0.1 | 0.1 | 0.0 | 0.0 | 0.0 | -0.1 |
| | Ref | (dB) | | | | 87.8 | 93.8 | 103.8 | 113.8 | | |
| 63 Hz | Level A | (dB) | | | | | | | 87.8 | 93.8 | 103.8 |
| | Error | (dB) | | | | | | | 0.0 | 0.0 | 0.0 |
| | Ref | (dB) | | | | | | | 87.8 | 93.8 | 103.8 |
| Tolerances Limit | | (±dB) | 1.0 | | | | | | | | |
| UNCERTAINTY | | (±dB) | 0.3 | | | | | | | | |

b. Sound exposure meter linearity of error

| UUC Setting | Time | | Exposure Measurement | | | UNCERTAINTY | Tolerances |
|--------------------|------|-----|----------------------|----------------------|-------|-------------|------------|
| | Ref | UUC | Ref | UUC | Error | | |
| | (s) | (s) | (Pa ¹ /h) | (Pa ¹ /h) | (%) | | |
| FAST / A / 60-140 | | | | | | | |
| Calibrator Setting | | | | | | | |
| 1000 Hz 119 dB | 27 | 27 | 0.30 | 0.30 | 0.00 | 5.6 | -21, +26 |
| 1000 Hz 110 dB | 45 | 45 | 0.50 | 0.50 | 0.00 | | |
| 1000 Hz 110 dB | 90 | 90 | 1.00 | 1.01 | +1.00 | | |
| 1000 Hz 110 dB | 180 | 180 | 2.00 | 2.02 | +1.00 | | |
| 1000 Hz 120 dB | 36 | 36 | 4.00 | 4.03 | +0.75 | | |
| 1000 Hz 120 dB | 72 | 72 | 8.00 | 8.05 | +0.63 | 5.6 | |
| 1000 Hz 120 dB | 90 | 90 | 10.00 | 10.13 | +1.30 | | |
| 1000 Hz 120 dB | 180 | 180 | 20.00 | 20.22 | +1.10 | | |
| 1000 Hz 120 dB | 360 | 360 | 40.00 | 40.34 | +0.85 | | |
| 1000 Hz 120 dB | 720 | 720 | 80.00 | 80.49 | +0.61 | | |

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.

เอกสารไม่ควรถูก

Certificate No : 23-NDM-092
Request No : Req-2023-0902

4. Response to short duration

a. Response for sinusoidal signals - reference level

| UUC Setting | Time | | Exposure Measurement | | | UNCERTAINTY | Tolerances Limit |
|--------------------|------|------|----------------------|---------------------|---------------------|-------------|---------------------|
| | Ref | UUC | Ref | UUC | Error | | |
| Calibrator Setting | (a) | (b) | (Pa ² h) | (Pa ² h) | (Pa ² h) | (%) | (Pa ² h) |
| 4000 Hz 95 dB | 2846 | 2846 | 1.00 | 0.98 | -0.02 | 0.052 | -0.29 ~ +0.41 |

b. Sound exposure meter response for series of toneburst impulses

| UUC Setting | Time | | Exposure Measurement | | | UNCERTAINTY | Tolerances Limit |
|--------------------|------|------|----------------------|---------------------|-------|-------------|------------------|
| | Ref | UUC | Ref | UUC | Error | | |
| Calibrator Setting | (a) | (b) | (Pa ² h) | (Pa ² h) | (%) | (%) | (%) |
| Burst 1 ms, 95 dB | 2846 | 2846 | 1.00 | 0.98 | -2.00 | 5.6 | -21 ~ +26 |
| Burst 1 ms, 100 dB | 900 | 900 | 1.00 | 0.98 | -2.00 | | -29 ~ +41 |
| Burst 1 ms, 108 dB | 143 | 143 | 1.00 | 0.99 | -1.00 | | -29 ~ +41 |

5. Response to unipolar pulse

| UUC Setting | Time | | Exposure Measurement | | UNCERTAINTY | Tolerances Limit |
|------------------------|------|-----|----------------------|-----------|-------------|------------------|
| | Ref | UUC | UUC | Different | | |
| Calibrator Setting | (a) | (b) | (Pa ² h) | (%) | (%) | (%) |
| Continuous Rectangle + | 29 | | 10.13 | 0.00 | 3.7 | -21 ~ +26 |
| Continuous Rectangle - | | | 10.13 | | | |

* Indicates non accredited

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 Issuing Institution.

เอกสารไม่ควบคุม

Certificate of Calibration

Customer

Name UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.
Address 81 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Prakanong, Bangkok 10260

Certificate No : 23-NDM-106
Request No : Req-2023-0952

Unit Under Calibration Details

Measurement item : Noise Dosimeter
Microphone Class : 2
Manufacturer : SVANTEK
Microphone Model : SV 27
Model : SV 104
Microphone S/N : 77362
Serial Number : 117730
Preamplifier Model : -
ID : -
Preamplifier S/N : -
Resolution : 0.1 dB
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 : 4 May 2023
Calibrated Date : 12 May 2023
Calibration Procedure : In-house method CP-NDM-01 based on IEC 61252 : 2017
Location of Calibration : Lab Acoustic


Reference Standard

| Instrument | Brand | Model | SN | Due calibration | Traceability |
|----------------------------|---------|------------|--------|-----------------|--------------|
| Multi-frequency Calibrator | Qsonit | Qsonit-cal | 188272 | 29 June 2023 | TSI |
| Standard Microphone | GRAS | 40AN | 188273 | 6 October 2023 | GRAS |
| Size Generator | Svantek | Svan401 | 131 | 12 October 2023 | WK Electric |
| Timer | EXTECH | - | 05-ACT | 20 March 2024 | TPA |

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. Noppakorn Luangrat
Calibration Officer

Approved By : 
Mr. Paitit Mathavorn
Calibration Engineer Supervisor
Issue Date : 12 May 2023

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Issuing Institution.

เอกสารไม่ควบคุม

Certificate No : 23-NDM-106
Request No : Req-2023-0952

1. Absolute acoustical sensitivity

| UUC Setting | Time | | Exposure Measurement | | | UNCERTAINTY | Tolerances Limit |
|--------------------|------|-----|----------------------|---------------------|-------|-------------|------------------|
| | Ref | UUC | Ref | UUC | Error | | |
| Calibrator Setting | (a) | (b) | (Pa ² h) | (Pa ² h) | (%) | (%) | (%) |
| 1000 Hz 114 dB | 120 | 120 | 3.19 | 3.13 | -1.88 | 3.1 | -21 ~ +26 |

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

2. Frequency weightings

| UUC Setting | Deviation from various Frequency Weighting | | UNCERTAINTY | Tolerances Limit |
|---------------|--|------|-------------|------------------|
| | A | C | | |
| FAST / 55-140 | (dB) | (dB) | (± dB) | (± dB) |
| STD Setting | | | | |
| *63 Hz | 0.3 | 0.4 | 0.40 | 2.0 |
| 125 Hz | -0.3 | 0.2 | 0.40 | 1.5 |
| 250 Hz | -0.3 | 0.2 | 0.40 | 1.5 |
| 500 Hz | -0.2 | 0.2 | 0.40 | 1.5 |
| 1000 Hz | 0.0 | 0.0 | 0.40 | - |
| 2000 Hz | -0.1 | 0.3 | 0.40 | 2.0 |
| 4000 Hz | 1.3 | 1.4 | 0.40 | 3.0 |
| 8000 Hz | -2.0 | -2.1 | 0.40 | 5.0 |

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Issuing Institution.

เอกสารไม่ควบคุม

Certificate No : 23-NDM-106
Request No : Req-2023-0952

3. Linearity of response to steady signals

a. Sound exposure meter, linearity of response for changes of input sinusoidal signal level

| UUC Setting | Ref | FAST / A / High | | | | | | | | | |
|------------------|---------|-----------------|------|------|------|-------|-------|-------|-------|-------|-------|
| | | (dB) | 55.0 | 80.0 | 90.0 | 100.0 | 110.0 | 114.8 | 120.0 | 130.0 | 140.0 |
| 1000 Hz | Level A | (dB) | 54.8 | 80.0 | 90.1 | 100.0 | 110.0 | 114.0 | 120.0 | 130.0 | 140.0 |
| | Error | (dB) | -0.2 | 0.0 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | Ref | (dB) | | 88.9 | 98.9 | 108.9 | 112.9 | 118.9 | 128.9 | 138.9 | |
| 8000 Hz | Level A | (dB) | | 88.9 | 98.9 | 108.9 | 112.9 | 118.9 | 128.8 | 138.8 | |
| | Error | (dB) | | | 0.0 | 0.0 | 0.0 | 0.0 | -0.1 | -0.1 | |
| | Ref | (dB) | | | 87.8 | 93.8 | 103.8 | 113.8 | | | |
| 63 Hz | Level A | (dB) | | | 87.8 | 93.8 | 103.8 | 113.8 | | | |
| | Error | (dB) | | | | 0.0 | 0.0 | 0.0 | 0.0 | | |
| | Ref | (dB) | | | | | | | | | |
| Tolerances Limit | | (±dB) | 1.0 | | | | | | | | |
| UNCERTAINTY | | (±dB) | 0.3 | | | | | | | | |

b. Sound exposure meter linearity of error

| UUC Setting | Time | | Exposure Measurement | | | UNCERTAINTY | Tolerance Limit |
|--------------------|------|-----|----------------------|---------------------|-------|-------------|-----------------|
| FAST / A / 55-140 | Ref | UUC | Ref | UUC | Error | | Limit |
| Calibrator Setting | (a) | (b) | (Pa ² h) | (Pa ² h) | (%) | (%) | (%) |
| 1000 Hz 110 dB | 27 | 27 | 0.30 | 0.30 | 0.00 | 5.6 | -21, +26 |
| 1000 Hz 110 dB | 45 | 45 | 0.50 | 0.51 | +2.00 | | |
| 1000 Hz 110 dB | 90 | 90 | 1.00 | 1.01 | +1.00 | | |
| 1000 Hz 110 dB | 180 | 180 | 2.00 | 2.02 | +1.00 | | |
| 1000 Hz 120 dB | 36 | 36 | 4.00 | 4.03 | +0.75 | | |
| 1000 Hz 120 dB | 72 | 72 | 8.00 | 8.05 | +0.63 | 5.6 | |
| 1000 Hz 120 dB | 90 | 90 | 10.00 | 10.13 | +1.30 | | |
| 1000 Hz 120 dB | 180 | 180 | 20.00 | 20.22 | +1.10 | | |
| 1000 Hz 120 dB | 360 | 360 | 40.00 | 40.34 | +0.85 | | |
| 1000 Hz 120 dB | 720 | 720 | 80.00 | 80.49 | +0.61 | | |

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Issuing Institution.

เอกสารไม่ควบคุม

Certificate No : 23-NDM-086
Request No : Req-2023-0952

4. Response to short duration

a. Response for sinusoidal signals - reference level

| UUC Setting | Time | | Exposure Measurement | | | UNCERTAINTY | Tolerances Limit |
|--------------------|------|------|-----------------------------|-----------------------------|-------------------------------|-------------|----------------------|
| | Ref | UUC | Ref (Pa ¹ /h) | UUC (Pa ¹ /h) | Error (Pa ¹ /h) | | |
| Calibrator Setting | (s) | (s) | (Pa ¹ /h) | (Pa ¹ /h) | (%) | (%) | (Pa ² /h) |
| 4000 Hz 95 dB | 2846 | 2846 | 1.00 | 1.00 | 0.00 | 0.052 | -0.29 ~ +0.41 |

b. Sound exposure meter response for series of toneburst impulses

| UUC Setting | Time | | Exposure Measurement | | | UNCERTAINTY | Tolerances Limit |
|--------------------|------|------|-----------------------------|-----------------------------|--------------|-------------|------------------|
| | Ref | UUC | Ref (Pa ¹ /h) | UUC (Pa ¹ /h) | Error (%) | | |
| Calibrator Setting | (s) | (s) | (Pa ¹ /h) | (Pa ¹ /h) | (%) | (%) | (%) |
| Burst 1 ms, 95 dB | 2846 | 2846 | 1.00 | 1.00 | 0.00 | 5.6 | -21 ~ +26 |
| Burst 1 ms, 100 dB | 900 | 900 | 1.00 | 1.00 | 0.00 | | -29 ~ +41 |
| Burst 1 ms, 108 dB | 143 | 143 | 1.00 | 1.01 | +1.00 | | -29 ~ +41 |

5. Response to unipolar pulse

| UUC Setting | Time | | Exposure Measurement | | | UNCERTAINTY | Tolerances Limit |
|------------------------|------|-----|-----------------------------|------------------|-----|-------------|------------------|
| | UUC | UUC | UUC (Pa ¹ /h) | Different (%) | (%) | | |
| Calibrator Setting | (s) | (s) | (Pa ¹ /h) | (%) | (%) | (%) | (%) |
| Continuous Rectangle + | 29 | | 10.37 | 0.00 | 3.7 | -21 ~ +26 | |
| Continuous Rectangle - | | | 10.37 | | | | |

* Indicates non accredited

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 Issuance Instrument Co., Ltd.

เอกสารไม่ควบคุม

Certificate of Calibration

Customer

Name : UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.
Address : 81 Soi Udomsak 41, Sukhumvit Road, Bangkok, Prakanong, Bangkok 10260

Certificate No : 23-NDM-090
Request No : Req-2023-0962

Unit Under Calibration Details

Measurement item : Noise Dosimeter
Microphone Class : 2
Manufacturer : SVANTEK
Microphone Model : SV 27S
Model : SV 104S
Microphone S/N : 133712
Serial Number : 128367
Preamplifier Model : -
ID : -
Preamplifier S/N : -
Resolution : 0.1 dB
Instrument Status : New

Calibration Environment and Details


Temperature : 23 °C ± 2 °C
Humidity : 50 %RH ± 20 %RH
Barometric Pressure : 1013 hPa ± 10 hPa
Received Date : 24 April 2023
Calibrated Date : 8 May 2023
Calibration Procedure : In-house method CP-NDM-01 based on IEC 61252 : 2017
Location of Calibration : Lab Acoustic

Reference Standard

| Instrument | Brand | Model | SN | Due calibration | Traceability |
|---------------------------|----------|----------|--------|-----------------|--------------|
| Multifrequency Calibrator | Quant | Quantcal | 188272 | 29 June 2023 | TSI |
| Standard Microphone | GRAS | 40AN | 188273 | 6 October 2023 | GRAS |
| Sine Generator | Svanteck | Svsm401 | 131 | 12 October 2023 | WK Electric |
| Timer | EXTECH | - | 05-ACT | 20 March 2024 | TPA |

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. Noppadol Luangrit
Calibration Officer

Approved By : 
Mr. Pachi Mahavorn
Calibration Engineer Supervisor
Issue Date : 8 May 2023

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

เอกสารไม่ควบคุม

Certificate No : 23-NDM-090
Request No : Req-2023-0962

1. Absolute acoustical sensitivity

| UUC Setting | Time | | Exposure Measurement | | | UNCERTAINTY | Tolerances Limit |
|--------------------|------|-----|-----------------------------|-----------------------------|--------------|-------------|------------------|
| | Ref | UUC | Ref (Pa ¹ /h) | UUC (Pa ¹ /h) | Error (%) | | |
| Calibrator Setting | (s) | (s) | (Pa ¹ /h) | (Pa ¹ /h) | (%) | (%) | (%) |
| 1000 Hz 114 dB | 120 | 120 | 3.19 | 3.20 | +0.31 | 3.1 | -21 ~ +26 |

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

2. Frequency weightings

| UUC Setting | Deviation from various Frequency Weighting | | UNCERTAINTY (± dB) | Tolerances Limit (± dB) |
|-------------------|--|------|-----------------------|----------------------------|
| | A | C | | |
| FAST / A / 60-140 | (dB) | (dB) | (± dB) | (± dB) |
| STD Setting | (dB) | (dB) | (± dB) | (± dB) |
| 90 Hz | -0.1 | 0.0 | 0.40 | 2.0 |
| 125 Hz | 0.1 | 0.5 | 0.40 | 1.5 |
| 250 Hz | -0.1 | 0.4 | 0.40 | 1.5 |
| 500 Hz | 0.0 | 0.4 | 0.40 | 1.5 |
| 1000 Hz | 0.0 | 0.0 | 0.40 | - |
| 2000 Hz | -0.4 | 0.0 | 0.40 | 2.0 |
| 4000 Hz | 0.9 | 1.1 | 0.40 | 3.0 |
| 8000 Hz | -1.9 | -2.0 | 0.40 | 5.0 |

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

เอกสารไม่ควบคุม

Certificate No : 23-NDM-090
Request No : Req-2023-0962

3. Linearity of response to steady signals

a. Sound exposure meter, linearity of response for changes of input sinusoidal signal level

| UUC Setting | Time | | FAST / A / High | | | | | | | | | |
|------------------|---------|------|-----------------|------|-------|-------|-------|-------|-------|-------|-------|--|
| | Ref | (dB) | 40.0 | 80.0 | 90.0 | 100.0 | 110.0 | 114.0 | 120.9 | 130.0 | 140.0 | |
| 1000 Hz | Level A | (dB) | 98.8 | 80.0 | 90.0 | 100.1 | 110.0 | 114.0 | 120.0 | 130.0 | 140.0 | |
| | Error | (dB) | -0.2 | 0.0 | 0.0 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| | Ref | (dB) | 98.8 | 98.9 | 108.9 | 112.9 | 118.9 | 128.9 | 138.9 | | | |
| 8000 Hz | Level A | (dB) | 88.9 | 98.9 | 108.9 | 112.9 | 118.9 | 128.9 | 138.9 | | | |
| | Error | (dB) | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | -0.1 | -0.1 | | |
| | Ref | (dB) | 87.8 | 97.8 | 107.8 | 111.8 | 117.8 | 127.8 | 137.8 | | | |
| 63 Hz | Level A | (dB) | 87.8 | 97.8 | 107.8 | 111.8 | 117.8 | 127.8 | 137.8 | | | |
| | Error | (dB) | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | |
| | Ref | (dB) | 87.8 | 97.8 | 107.8 | 111.8 | 117.8 | 127.8 | 137.8 | | | |
| Tolerances Limit | | | 1.0 | | | | | | | | | |
| UNCERTAINTY | | | 0.3 | | | | | | | | | |

b. Sound exposure meter linearity of error

| UUC Setting | Time | | Exposure Measurement | | | UNCERTAINTY | Tolerances Limit |
|--------------------|------|-----|-----------------------------|-----------------------------|--------------|-------------|------------------|
| | Ref | UUC | Ref (Pa ¹ /h) | UUC (Pa ¹ /h) | Error (%) | | |
| Calibrator Setting | (s) | (s) | (Pa ¹ /h) | (Pa ¹ /h) | (%) | (%) | (%) |
| 1000 Hz 110 dB | 27 | 27 | 0.30 | 0.30 | 0.00 | 5.6 | -21 ~ +26 |
| 1000 Hz 110 dB | 45 | 45 | 0.50 | 0.50 | 0.00 | | |
| 1000 Hz 110 dB | 90 | 90 | 1.00 | 0.99 | -1.00 | | |
| 1000 Hz 110 dB | 180 | 180 | 2.00 | 1.98 | -1.00 | | |
| 1000 Hz 120 dB | 36 | 36 | 4.00 | 4.03 | +0.75 | | |
| 1000 Hz 120 dB | 72 | 72 | 8.00 | 8.05 | +0.63 | 5.6 | -21 ~ +26 |
| 1000 Hz 120 dB | 90 | 90 | 10.00 | 10.13 | +1.30 | | |
| 1000 Hz 120 dB | 180 | 180 | 20.00 | 20.22 | +1.10 | | |
| 1000 Hz 120 dB | 360 | 360 | 40.00 | 40.34 | +0.85 | | |
| 1000 Hz 120 dB | 720 | 720 | 80.00 | 80.49 | +0.61 | | |

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

เอกสารไม่ควบคุม

Certificate No : 23-NDM-090
Request No : Req-2023-0902

4. Response to short duration

a. Response for sinusoidal signals - reference level

| UUC Setting | Time | | Exposure Measurement | | | UNCERTAINTY | Tolerances Limit |
|--------------------|------|------|----------------------|----------------------|----------------------|----------------------|----------------------|
| | Ref | UUC | Ref | UUC | Error | | |
| FAST / A / 60-140 | (s) | (s) | (Pa ¹ /h) | (Pa ¹ /h) | (Pa ¹ /h) | (Pa ¹ /h) | (Pa ² /h) |
| Calibrator Setting | (s) | (s) | (Pa ¹ /h) | (Pa ¹ /h) | (%) | (%) | (%) |
| 4000 Hz 95 dB | 2846 | 2846 | 1.00 | 0.98 | -0.02 | 0.052 | -0.29 ~ +0.41 |

b. Sound exposure meter response for series of toneburst impulses

| UUC Setting | Time | | Exposure Measurement | | | UNCERTAINTY | Tolerances |
|--------------------|------|------|----------------------|---------------------|-------|-------------|------------|
| FAST / A / 60-140 | Ref | UUC | Ref | UUC | Error | | Limit |
| Calibrator Setting | (s) | (s) | (Pa h) ¹ | (Pa h) ¹ | (%) | (%) | (%) |
| Burst 1 ms, 95 dB | 2846 | 2846 | 1.00 | 0.98 | -2.00 | 5.6 | -21 ~ +26 |
| Burst 1 ms, 100 dB | 900 | 900 | 1.00 | 0.95 | -2.00 | | -29 ~ +41 |
| Burst 1 ms, 108 dB | 143 | 143 | 1.00 | 0.99 | -1.00 | | -29 ~ +41 |

5. Response to unipolar pulse

| UUC Setting | Time | | Exposure Measurement | | | UNCERTAINTY | Tolerances Limit |
|------------------------|------|-----|----------------------|----------------------|-----------|-------------|------------------|
| | Ref | UUC | Ref | UUC | Different | | |
| FAST / A / 60-140 | (s) | (s) | (Pa ¹ /h) | (Pa ¹ /h) | (%) | (%) | (%) |
| Calibrator Setting | (s) | (s) | (Pa ¹ /h) | (Pa ¹ /h) | (%) | (%) | (%) |
| Continuous Rectangle + | 28 | | 10.13 | | 0.00 | 3.7 | -21 ~ +26 |
| Continuous Rectangle - | 28 | | 10.13 | | 0.00 | 3.7 | -21 ~ +26 |

* Indicates non accredited

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 Issuing Body.

เอกสารไม่ควรถูก

Certificate of Calibration

Customer

Name : UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.
Address : 81 Soi Udomsak 41, Sukhumvit Road, Bangkok, Prakanong, Bangkok 10260

Certificate No : 23-NDM-127
Request No : Req-2023-1046

Unit Under Calibration Details

Measurement item : Noise Dosimeter
Manufacturer : SVANTEK
Model : SV 104
Serial Number : 110830
ID : -
Resolution : 0.1 dB
Microphone Class : 2
Microphone Model : SV 27
Microphone SN : 112940
Preamplifier Model : -
Preamplifier SN : -
Instrument Status : Used

Calibration Environment and Details


Temperature : 23 °C ± 2 °C
Humidity : 50 %RH ± 20 %RH
Barometric Pressure : 1013 hPa ± 10 hPa
Received time : 12 May 2023
Calibrated Date : 25 May 2023
Calibration Procedure : In-house method CP-NDM-01 based on IEC 61252 : 2017
Location of Calibration : Lab Acoustic

Reference Standard

| Instrument | Brand | Model | SN | Due calibration | Traceability |
|---------------------------|--------|-----------|--------|-----------------|--------------|
| Multifrequency Calibrator | Quest | Quest-cal | 188272 | 29 June 2023 | TSI |
| Standard Microphone | GRAS | 40AN | 188273 | 6 October 2023 | GRAS |
| Sine Generator | Svante | Svan401 | 131 | 12 October 2023 | WK Electric |
| Timer | EXTech | - | 05-ACT | 20 March 2024 | TPA |

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 Luangrat
Calibration Officer

Approved By : 
Mr. Pachi Mahavorn
Calibration Engineer Supervisor
Issue Date : 25 May 2023

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Issuing Body.

เอกสารไม่ควรถูก

Certificate No : 23-NDM-127
Request No : Req-2023-1046

1. Absolute acoustical sensitivity

| UUC Setting | Time | | Exposure Measurement | | | UNCERTAINTY | Tolerances |
|--------------------|------|-----|----------------------|----------------------|-------|-------------|------------|
| | Ref | UUC | Ref | UUC | Error | | |
| FAST / A / 55-140 | (s) | (s) | (Pa ¹ /h) | (Pa ¹ /h) | (%) | (%) | (%) |
| Calibrator Setting | (s) | (s) | (Pa ¹ /h) | (Pa ¹ /h) | (%) | (%) | (%) |
| 1000 Hz 114 dB | 120 | 120 | 3.19 | 3.20 | +0.31 | 3.1 | -21, +26 |

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

2. Frequency weightings

| UUC Setting | Deviation from various Frequency Weighting | | UNCERTAINTY | Tolerances Limit |
|---------------|--|------|-------------|------------------|
| | A | C | | |
| FAST / 55-140 | (dB) | (dB) | (± dB) | (± dB) |
| STD Setting | (dB) | (dB) | (± dB) | (± dB) |
| *63 Hz | 0.1 | 0.2 | 0.40 | 2.0 |
| 125 Hz | -0.6 | -0.1 | 0.40 | 1.5 |
| 250 Hz | -0.5 | 0.0 | 0.40 | 1.5 |
| 500 Hz | -0.2 | 0.2 | 0.40 | 1.5 |
| 1000 Hz | 0.0 | 0.0 | 0.40 | - |
| 2000 Hz | 0.2 | 0.6 | 0.40 | 2.0 |
| 4000 Hz | 1.0 | 1.1 | 0.40 | 3.0 |
| 8000 Hz | -1.6 | -1.8 | 0.40 | 5.0 |

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Issuing Body.

เอกสารไม่ควรถูก

Certificate No : 23-NDM-127
Request No : Req-2023-1046

3. Linearity of response to steady signals

a. Sound exposure meter, linearity of response for changes of input sinusoidal signal level

| UUC Setting | FAST / A / High | | | | | | | | | | | |
|------------------|-----------------|-------|------|------|------|-------|-------|-------|-------|-------|-------|-------|
| | Ref | (dB) | 55.0 | 80.0 | 90.0 | 100.0 | 110.0 | 114.0 | 120.0 | 130.0 | 140.0 | |
| 1000 Hz | Level A | (dB) | 54.8 | 80.1 | 90.2 | 100.1 | 110.1 | 114.0 | 120.1 | 130.1 | 140.0 | |
| | Error | (dB) | -0.2 | 0.1 | 0.2 | 0.1 | 0.1 | 0.0 | 0.1 | 0.1 | 0.0 | |
| | | (dB) | | | | | | | | | | |
| 8000 Hz | Ref | (dB) | | | | | 88.9 | 98.9 | 108.9 | 118.9 | 128.9 | 138.9 |
| | Level A | (dB) | | | | | 89.0 | 98.9 | 108.9 | 118.9 | 128.9 | 138.8 |
| | Error | (dB) | | | | | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | -0.1 |
| 63 Hz | Ref | (dB) | | | | | | | 87.8 | 93.8 | 103.8 | 113.8 |
| | Level A | (dB) | | | | | | | 87.8 | 93.8 | 103.8 | 113.8 |
| | Error | (dB) | | | | | | | 0.0 | 0.0 | 0.0 | 0.0 |
| Tolerances Limit | | (±dB) | 1.0 | | | | | | | | | |
| UNCERTAINTY | | (±dB) | 0.3 | | | | | | | | | |

b. Sound exposure meter linearity of error

| UUC Setting | Time | | Exposure Measurement | | | UNCERTAINTY | Tolerances |
|--------------------|------|-----|----------------------|----------------------|-------|-------------|------------|
| FAST / A / 55-140 | Ref | UUC | Ref | UUC | Error | | Limit |
| Calibrator Setting | (s) | (s) | (Pa ¹ /h) | (Pa ¹ /h) | (%) | (%) | (%) |
| 1000 Hz 110 dB | 27 | 27 | 0.30 | 0.30 | 0.00 | 5.8 | -21, +26 |
| 1000 Hz 110 dB | 45 | 45 | 0.50 | 0.50 | 0.00 | | |
| 1000 Hz 110 dB | 90 | 90 | 1.00 | 0.99 | -1.00 | | |
| 1000 Hz 110 dB | 180 | 180 | 2.00 | 1.98 | -1.00 | | |
| 1000 Hz 120 dB | 36 | 36 | 4.00 | 3.94 | -1.50 | 5.6 | |
| 1000 Hz 120 dB | 72 | 72 | 8.00 | 7.87 | -1.63 | | |
| 1000 Hz 120 dB | 90 | 90 | 10.00 | 9.90 | -1.00 | | |
| 1000 Hz 120 dB | 180 | 180 | 20.00 | 19.76 | -1.20 | | |
| 1000 Hz 120 dB | 360 | 360 | 40.00 | 39.42 | -1.45 | | |
| 1000 Hz 120 dB | 720 | 720 | 80.00 | 78.66 | -1.68 | | |

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Issuing Body.

เอกสารไม่ควรถูก

Certificate No : 23-NDM-127
Request No : Req-2023-1046

4. Response to short duration
a. Response for sinusoidal signals - reference level

| UUC Setting | Time | | Exposure Measurement | | | UNCERTAINTY | Tolerances Limit |
|--------------------|------|------|-----------------------------|-----------------------------|-------------------------------|----------------------|----------------------|
| | Ref | UUC | Ref (Pa ² ·h) | UUC (Pa ² ·h) | Error (Pa ² ·h) | | |
| FAST / A / 55-140 | (s) | (s) | (Pa ² ·h) | (Pa ² ·h) | (Pa ² ·h) | (Pa ² ·h) | (Pa ² ·h) |
| Calibrator Setting | (s) | (s) | (Pa ² ·h) | (Pa ² ·h) | (Pa ² ·h) | (Pa ² ·h) | (Pa ² ·h) |
| 4000 Hz 95 dB | 2846 | 2846 | 1.00 | 0.98 | -0.02 | 0.052 | -0.29 ~ +0.41 |

b. Sound exposure meter response for series of toneburst impulses

| UUC Setting | Time | | Exposure Measurement | | | UNCERTAINTY | Tolerances |
|--------------------|------|------|----------------------|----------------------|-------|-------------|------------|
| FAST / A / 55-140 | Ref | UUC | Ref | UUC | Error | | Limit |
| Calibrator Setting | (s) | (s) | (Pa ² ·h) | (Pa ² ·h) | (%) | (%) | (%) |
| Burst 1 ms, 95 dB | 2846 | 2846 | 1.00 | 0.98 | -2.00 | 3.6 | -21 ~ +26 |
| Burst 1 ms, 100 dB | 900 | 900 | 1.00 | 0.98 | -2.00 | | -29 ~ +41 |
| Burst 1 ms, 108 dB | 143 | 143 | 1.00 | 0.99 | -1.00 | | -29 ~ +41 |

3. Response to unipolar pulse

| UUC Setting | Time | | Exposure Measurement | | | UNCERTAINTY | Tolerances Limit |
|------------------------|------|-----|----------------------|----------------------|-----------|-------------|------------------|
| | Ref | UUC | Ref | UUC | Different | | |
| FAST / A / 55-140 | (s) | (s) | (Pa ² ·h) | (Pa ² ·h) | (%) | (%) | (%) |
| Calibrator Setting | (s) | (s) | (Pa ² ·h) | (Pa ² ·h) | (%) | (%) | (%) |
| Continuous Rectangle + | 28 | | 10.13 | | 0.00 | 3.7 | -21 ~ +26 |
| Continuous Rectangle - | | | 10.13 | | | | |

* Indicates non accredited

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 Issuing Institution.

เอกสารไม่ควบคุม

Certificate of Calibration

Customer

Name : UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD. Certificate No : 23-NDM-010
Address : 81 Soi Udomrak 41, Sukhumvit Road, Bangchak, Prakanong, Bangkok 10260 Request No : Req-2023-0034

Unit Under Calibration Details

Measurement Item : Noise dosimeter Microphone Class : 2
Manufacturer : SVANTEK Microphone Model : SV27
Model : SV104 Microphone S/N : 96600
Serial Number : 91924 Pre-amplifier Model : -
ID : - Pre-amplifier S/N : -
Resolution : 0.1 dB 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 : 10 January 2023
Calibrated Date : 24 January 2023
Calibration Procedure : In-house method CP-NDM-01 based on IEC 61252 : 2017
Location of Calibration : Lab Acoustic

Reference Standard

| Instrument | Brand | Model | SN | Due calibration | Traceability |
|----------------------------|---------|-----------|--------|-----------------|--------------|
| Multi-frequency Calibrator | Quest | Quest-cal | 188272 | 29 June 2023 | TSH |
| Standard Microphone | GRAS | 40AN | 188273 | 6 October 2023 | GRAS |
| Sine Generator | SvanteK | Svsn401 | 131 | 12 October 2023 | WK Electric |
| Timer | EXTECH | - | 05-ACT | 24 March 2022 | TPA |

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 Luangrat
Calibration Officer

Approved By : 
Mr. Paet Mathavom
Calibration Engineer Supervisor
Issue Date : 24 January 2023

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Issuing Institution.

เอกสารไม่ควบคุม

Certificate No : 23-NDM-010
Request No : Req-2023-0034

1. Absolute acoustical sensitivity

| UUC Setting | Time | | Exposure Measurement | | | UNCERTAINTY | Tolerances Limit |
|--------------------|--------|-----|----------------------|----------------------|-------|-------------|------------------|
| | Ref | UUC | Ref | UUC | Error | | |
| FAST / A / 55-140 | (s) | (s) | (Pa ² ·h) | (Pa ² ·h) | (%) | (%) | (%) |
| Calibrator Setting | (s) | (s) | (Pa ² ·h) | (Pa ² ·h) | (%) | (%) | (%) |
| 1000 Hz 114 dB | 120.00 | 120 | 3.19 | 3.20 | +0.31 | 3.0 | -21 ~ +26 |

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

2. Frequency weightings

| UUC Setting | Deviation from various Frequency Weighting | | UNCERTAINTY | Tolerances Limit |
|---------------|--|------|-------------|------------------|
| | A | C | | |
| FAST / 55-140 | (dB) | (dB) | (± dB) | (± dB) |
| STD Setting | (dB) | (dB) | (± dB) | (± dB) |
| 763 Hz | 0.4 | 0.4 | 0.40 | 2.0 |
| 125 Hz | 0.1 | 0.1 | 0.40 | 1.5 |
| 250 Hz | -0.1 | -0.2 | 0.40 | 1.5 |
| 500 Hz | -0.1 | -0.2 | 0.40 | 1.5 |
| 1000 Hz | 0.0 | 0.0 | 0.40 | - |
| 2000 Hz | 0.1 | 0.1 | 0.40 | 2.0 |
| 4000 Hz | 0.9 | 0.7 | 0.40 | 3.0 |
| 8000 Hz | -1.8 | -1.9 | 0.40 | 5.0 |

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Issuing Institution.

เอกสารไม่ควบคุม

Certificate No : 23-NDM-010
Request No : Req-2023-0034

3. Linearity of response to steady signals

a. Sound exposure meter, linearity of response for changes of input sinusoidal signal level

| UUC Setting | | FAST / A / High | | | | | | | | | | |
|------------------|---------|-----------------|------|------|-------|-------|-------|-------|-------|-------|-------|--|
| 1000 Hz | Ref | (dB) | 55.0 | 80.0 | 90.0 | 100.0 | 110.0 | 114.0 | 120.0 | 130.0 | 140.0 | |
| | Level A | (dB) | 54.7 | 80.2 | 90.2 | 100.1 | 110.1 | 114.0 | 120.0 | 130.0 | 140.0 | |
| | Error | (dB) | -0.3 | 0.2 | 0.2 | 0.1 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | |
| 8000 Hz | Ref | (dB) | 88.9 | 88.9 | 108.9 | 112.9 | 118.9 | 128.9 | 138.9 | 148.9 | 158.9 | |
| | Level A | (dB) | 88.9 | 88.9 | 108.9 | 112.9 | 118.9 | 128.9 | 138.9 | 148.9 | 158.9 | |
| | Error | (dB) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| 63 Hz | Ref | (dB) | 87.8 | 87.8 | 107.8 | 111.8 | 117.8 | 127.8 | 137.8 | 147.8 | 157.8 | |
| | Level A | (dB) | 87.8 | 87.8 | 107.8 | 111.8 | 117.8 | 127.8 | 137.8 | 147.8 | 157.8 | |
| | Error | (dB) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| Tolerances Limit | | (dB) | 1.0 | | | | | | | | | |
| UNCERTAINTY | | (dB) | 0.27 | | | | | | | | | |

b. Sound exposure meter linearity of error

| UUC Setting | Time | | Exposure Measurement | | | UNCERTAINTY | Tolerances Limit |
|--------------------|------|-----|----------------------|----------------------|-------|-------------|------------------|
| | Ref | UUC | Ref | UUC | Error | | |
| FAST / A / 55-140 | (s) | (s) | (Pa ² ·h) | (Pa ² ·h) | (%) | (%) | (%) |
| Calibrator Setting | (s) | (s) | (Pa ² ·h) | (Pa ² ·h) | (%) | (%) | (%) |
| 1000 Hz 110 dB | 27 | 27 | 0.30 | 0.30 | 0.00 | 4.3 | -21 ~ +26 |
| 1000 Hz 110 dB | 45 | 45 | 0.50 | 0.50 | 0.00 | | |
| 1000 Hz 110 dB | 90 | 90 | 1.00 | 0.99 | -1.00 | | |
| 1000 Hz 110 dB | 180 | 180 | 2.00 | 1.98 | -1.00 | | |
| 1000 Hz 120 dB | 36 | 36 | 4.00 | 3.94 | -1.50 | | |
| 1000 Hz 120 dB | 72 | 72 | 8.00 | 7.87 | -1.63 | | |
| 1000 Hz 120 dB | 90 | 90 | 10.00 | 9.90 | -1.00 | 3.8 | -21 ~ +26 |
| 1000 Hz 120 dB | 180 | 180 | 20.00 | 19.78 | -1.20 | | |
| 1000 Hz 120 dB | 360 | 360 | 40.00 | 39.42 | -1.45 | | |
| 1000 Hz 120 dB | 720 | 720 | 80.00 | 78.66 | -1.66 | | |

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Issuing Institution.

เอกสารไม่ควบคุม

Certificate No : 23-NDM-010
Request No : Req-2023-0054

4. Response to short duration

a. Response for sinusoidal signals - reference level

| UUC Setting | Time | | Exposure Measurement | | | UNCERTAINTY | Tolerances |
|--------------------|------|------|----------------------|----------------------|----------------------|----------------------|----------------------|
| FAST / A / 55-140 | Ref | UUC | Ref | UUC | Error | | Limit |
| Calibrator Setting | (s) | (s) | (Pa ² /h) | (Pa ² /h) | (Pa ² /h) | (Pa ² /h) | (Pa ² /h) |
| 4000 Hz 95 dB | 2846 | 2846 | 1.00 | 0.98 | -0.02 | 0.01 | -0.29 ~ 0.41 |

b. Sound exposure meter response for series of toneburst impulses

| UUC Setting | Time | | Exposure Measurement | | | UNCERTAINTY | Tolerances |
|--------------------|------|------|----------------------|----------------------|-------|-------------|------------|
| FAST / A / 55-140 | Ref | UUC | Ref | UUC | Error | | Limit |
| Calibrator Setting | (s) | (s) | (Pa ² /h) | (Pa ² /h) | (%) | (%) | (%) |
| Burst 1 ms, 95 dB | 2846 | 2846 | 1.00 | 0.98 | -2.00 | | -21 ~ +26 |
| Burst 1 ms, 100 dB | 900 | 900 | 1.00 | 0.98 | -2.00 | 3.0 | -21 ~ +41 |
| Burst 1 ms, 108 dB | 143 | 143 | 1.00 | 0.99 | -1.00 | | -21 ~ +41 |

5. Response to unipolar pulse

| UUC Setting | Time | Exposure Measurement | UNCERTAINTY | Tolerances |
|------------------------|------|----------------------|---------------|------------|
| FAST / A / 55-140 | UUC | UUC | | Limit |
| Calibrator Setting | (s) | (Pa ² /h) | Different (%) | (%) |
| Continuous Rectangle + | 7 | 10.86 | 0.00 | 2.4 |
| Continuous Rectangle - | | 10.86 | | |

* Indicates non accredited

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 responsible body. (Page 4 of 4)
เอกสารไม่ควบคุม

Certificate of Calibration

Customer

Name : UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.
Address : 81 Soi Udomsak 41, Sukhumvit Road, Bangchak, Prakanong, Bangkok 10260

Certificate No : 23-NDM-009
Request No : Req-2023-0053

Unit Under Calibration Details

Measurement item : Noise dosimeter
Microphone Class : 2
Manufacturer : SVANTEK
Microphone Model : SV27
Model : SV104
Serial Number : 91928
Microphone S/N : 96601
ID : -
Preamplifier Model : -
Resolution : 0.1 dB
Preamplifier S/N : -
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 : 10 January 2023
Calibrated Date : 24 January 2023
Calibration Procedure : In-house method CP-NDM-01 based on IEC 61252 : 2017
Location of Calibration : Lab Acoustic

Reference Standard

| Instrument | Brand | Model | SN | Due calibration | Traceability |
|----------------------------|----------|-----------|--------|-----------------|--------------|
| Multi-frequency Calibrator | Quest | Quest-cal | 188272 | 29 June 2023 | TSI |
| Standard Microphone | GRAS | 40AN | 188273 | 6 October 2023 | GRAS |
| Sine Generator | Svanthor | Svan401 | 131 | 12 October 2023 | WK Electric |
| Timer | EXTECH | - | 05-ACT | 24 March 2023 | TPA |

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 : MPC
Mr. Noppadon Laungart
Calibration Officer

Approved By : Mr. P
Mr. Pait Mahavorn
Calibration Engineer Supervisor
Issue Date : 24 January 2023

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the responsible body. (Page 1 of 4)
เอกสารไม่ควบคุม

Certificate No : 23-NDM-009
Request No : Req-2023-0053

1. Absolute acoustical sensitivity

| UUC Setting | Time | | Exposure Measurement | | | UNCERTAINTY | Tolerances |
|--------------------|--------|-----|----------------------|----------------------|-------|-------------|------------|
| FAST / A / 55-140 | Ref | UUC | Ref | UUC | Error | | Limit |
| Calibrator Setting | (s) | (s) | (Pa ² /h) | (Pa ² /h) | (%) | (%) | (%) |
| 1000 Hz 114 dB | 120.00 | 120 | 3.19 | 3.20 | +0.31 | 3.0 | -21 ~ +26 |

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

2. Frequency weightings

| UUC Setting | Deviation from various Frequency Weighting | | UNCERTAINTY | Tolerances |
|-------------------|--|------|-------------|------------|
| FAST / A / 55-140 | A | C | | Limit |
| STD Setting | (dB) | (dB) | (± dB) | (± dB) |
| *63 Hz | 0.3 | 0.3 | 0.40 | 2.0 |
| 125 Hz | 0.4 | 0.4 | 0.40 | 1.5 |
| 250 Hz | 0.3 | 0.2 | 0.40 | 1.5 |
| 500 Hz | 0.2 | 0.1 | 0.40 | 1.5 |
| 1000 Hz | 0.0 | 0.0 | 0.40 | - |
| 2000 Hz | -0.8 | -0.8 | 0.40 | 2.0 |
| 4000 Hz | 0.8 | 0.6 | 0.40 | 3.0 |
| 8000 Hz | -1.4 | -1.2 | 0.40 | 5.0 |

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เอกสารไม่ควบคุม

Certificate No : 23-NDM-009
Request No : Req-2023-0053

3. Linearity of response to steady signals

a. Sound exposure meter, linearity of response for changes of input sinusoidal signal level

| UUC Setting | Ref | FAST / A / High | | | | | | | | | |
|------------------------|--------------|-----------------|------|-------|-------|-------|-------|-------|-------|-------|--|
| 1000 Hz | Ref (dB) | 55.0 | 80.0 | 90.0 | 100.0 | 110.0 | 114.0 | 120.0 | 130.0 | 140.0 | |
| | Level A (dB) | 55.0 | 80.1 | 90.1 | 100.1 | 110.0 | 114.0 | 120.0 | 130.0 | 140.0 | |
| | Error (dB) | 0.0 | 0.1 | 0.1 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| 8000 Hz | Ref (dB) | 88.8 | 98.9 | 108.9 | 112.9 | 118.9 | 128.9 | 138.9 | 148.9 | | |
| | Level A (dB) | 88.8 | 98.9 | 108.9 | 112.9 | 118.9 | 128.9 | 138.9 | 148.9 | | |
| | Error (dB) | | | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | -0.1 | |
| 63 Hz | Ref (dB) | 67.8 | 93.8 | 103.8 | 113.8 | 123.8 | 133.8 | 143.8 | | | |
| | Level A (dB) | 67.8 | 93.8 | 103.8 | 113.8 | 123.8 | 133.8 | 143.8 | | | |
| | Error (dB) | | | | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| Tolerances Limit (±dB) | | 1.0 | | | | | | | | | |
| UNCERTAINTY (±dB) | | 0.27 | | | | | | | | | |

b. Sound exposure meter linearity of error

| UUC Setting | Time | | Exposure Measurement | | | UNCERTAINTY | Tolerances |
|--------------------|------|-----|----------------------|----------------------|-------|-------------|------------|
| FAST / A / 55-140 | Ref | UUC | Ref | UUC | Error | | Limit |
| Calibrator Setting | (s) | (s) | (Pa ² /h) | (Pa ² /h) | (%) | (%) | (%) |
| 1000 Hz 110 dB | 27 | 27 | 0.30 | 0.30 | 0.00 | 4.3 | -21, +26 |
| 1000 Hz 110 dB | 45 | 45 | 0.50 | 0.50 | 0.00 | | |
| 1000 Hz 110 dB | 90 | 90 | 1.00 | 0.99 | -1.00 | | |
| 1000 Hz 110 dB | 180 | 180 | 2.00 | 1.98 | -1.00 | | |
| 1000 Hz 120 dB | 36 | 36 | 4.00 | 3.94 | -1.50 | 3.8 | |
| 1000 Hz 120 dB | 72 | 72 | 8.00 | 7.87 | -1.63 | | |
| 1000 Hz 120 dB | 90 | 90 | 16.00 | 9.90 | -1.90 | | |
| 1000 Hz 120 dB | 180 | 180 | 20.00 | 19.78 | -1.20 | | |
| 1000 Hz 120 dB | 360 | 360 | 40.00 | 39.44 | -1.40 | | |
| 1000 Hz 120 dB | 720 | 720 | 80.00 | 78.66 | -1.68 | | |

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เอกสารไม่ควบคุม

Certificate No : 23-NDM-009
Request No : Req-2023-0023

4. Response to short duration

a. Response for sinusoidal signals - reference level

| UUC Setting | Time | | Exposure Measurement | | | UNCERTAINTY | Tolerances |
|--------------------|------|------|----------------------|----------------------|----------------------|----------------------|----------------------|
| FAST / A / 55-140 | Ref | UUC | Ref | UUC | Error | | Limit |
| Calibrator Setting | (s) | (s) | (Pa ² /h) | (Pa ² /h) | (Pa ² /h) | (Pa ² /h) | (Pa ² /h) |
| 4000 Hz 95 dB | 2846 | 2846 | 1.00 | 0.98 | -0.02 | 0.01 | -0.29 ~ -0.41 |

b. Sound exposure meter response for series of toneburst impulses

| UUC Setting | Time | | Exposure Measurement | | | UNCERTAINTY | Tolerances |
|--------------------|------|------|----------------------|----------------------|-------|-------------|------------|
| FAST / A / 55-140 | Ref | UUC | Ref | UUC | Error | | Limit |
| Calibrator Setting | (s) | (s) | (Pa ² /h) | (Pa ² /h) | (%) | (%) | (%) |
| Burst 1 ms, 95 dB | 2846 | 2846 | 1.00 | 0.98 | -2.00 | | -21 ~ +26 |
| Burst 1 ms, 100 dB | 990 | 990 | 1.00 | 0.98 | -2.00 | 3.0 | -21 ~ +41 |
| Burst 1 ms, 108 dB | 143 | 143 | 1.00 | 0.99 | -1.00 | | -21 ~ +41 |

5. Response to unipolar pulse

| UUC Setting | Time | | Exposure Measurement | | | UNCERTAINTY | Tolerances |
|------------------------|------|--|----------------------|--|-----------|-------------|------------|
| FAST / A / 55-140 | UUC | | UUC | | Different | | Limit |
| Calibrator Setting | (s) | | (Pa ² /h) | | (%) | (%) | (%) |
| Continuous Rectangle + | | | 10.61 | | 0.00 | 2.4 | -21 ~ +26 |
| Continuous Rectangle - | 7 | | 10.61 | | | | |

* Indicates non accredited

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.
เอกสารไม่ควบคุม

Certificate of Calibration

Customer

Name : UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD. Certificate No : 23-NDM-108
Address : 81 Soi Udomrak 41, Sukhumvit Road, Bangchak, Prakanong, Bangkok 10260 Request No : Req-2023-0954

Unit Under Calibration Details

Measurement item : Noise Dosimeter Microphone Class : 2
Manufacturer : SVANTEK Microphone Model : SV 27
Model : SV 104 Microphone S/N : 112933
Serial Number : 117688 Pre-amplifier Model : -
ID : - Pre-amplifier S/N : -
Resolution : 0.1 dB 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 : 4 May 2023
Calibrated Date : 12 May 2023
Calibration Procedure : In-house method CP-NDM-01 based on IEC 61252 : 2017
Location of Calibration : Lab Acoustic


Reference Standard

| Instrument | Brand | Model | SN | Due calibration | Traceability |
|---------------------------|--------|-----------|--------|-----------------|--------------|
| Multifrequency Calibrator | Quest | Quest-cal | 188272 | 29 June 2023 | TSI |
| Standard Microphone | GRAS | 40AN | 188273 | 6 October 2023 | GRAS |
| Sine Generator | Svntek | Svnm401 | 131 | 12 October 2023 | WK Electric |
| Timer | EXTech | - | 05-ACT | 20 March 2024 | TPA |

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 Luangrat
Calibration Officer

Approved By : 
Mr. Pacit Mahavorn
Calibration Engineer Supervisor
Issue Date : 12 May 2023

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.
เอกสารไม่ควบคุม

Certificate No : 23-NDM-108
Request No : Req-2023-0954

1. Absolute acoustical sensitivity

| UUC Setting | Time | | Exposure Measurement | | | UNCERTAINTY | Tolerances |
|--------------------|------|-----|----------------------|----------------------|-------|-------------|------------|
| FAST / A / 55-140 | Ref | UUC | Ref | UUC | Error | | Limit |
| Calibrator Setting | (s) | (s) | (Pa ² /h) | (Pa ² /h) | (%) | (%) | (%) |
| 1000 Hz 114 dB | 120 | 120 | 3.19 | 3.20 | +0.31 | 3.1 | -21 ~ +26 |

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

2. Frequency weightings

| UUC Setting | Deviation from various Frequency Weighting | | UNCERTAINTY | Tolerances |
|---------------|--|------|-------------|------------|
| FAST / 55-140 | A | C | (± dB) | (± dB) |
| STD Setting | (dB) | (dB) | | |
| *63 Hz | 0.0 | 0.1 | 0.40 | 2.0 |
| 125 Hz | -0.4 | 0.1 | 0.40 | 1.5 |
| 250 Hz | -0.4 | 0.1 | 0.40 | 1.5 |
| 500 Hz | -0.2 | 0.2 | 0.40 | 1.5 |
| 1000 Hz | 0.0 | 0.0 | 0.40 | - |
| 2000 Hz | 0.2 | 0.6 | 0.40 | 2.0 |
| 4000 Hz | 1.8 | 1.9 | 0.40 | 3.0 |
| 8000 Hz | -3.3 | -3.4 | 0.40 | 5.0 |

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.
เอกสารไม่ควบคุม

Certificate No : 23-NDM-108
Request No : Req-2023-0954

3. Linearity of response to steady signals

a. Sound exposure meter, linearity of response for changes of input sinusoidal signal level

| UUC Setting | FAST / A / High | | | | | | | | | | | |
|------------------|-----------------|-------|------|------|------|-------|-------|-------|-------|-------|-------|--|
| 1000 Hz | Ref | (dB) | 55.0 | 80.0 | 90.0 | 100.0 | 110.0 | 114.0 | 120.0 | 130.0 | 140.0 | |
| | Level A | (dB) | 54.5 | 80.1 | 90.1 | 100.0 | 110.0 | 114.0 | 119.9 | 129.9 | 139.9 | |
| | Error | (dB) | -0.5 | 0.1 | 0.1 | 0.0 | 0.0 | 0.0 | -0.1 | -0.1 | -0.1 | |
| 8000 Hz | Ref | (dB) | | 88.9 | 98.9 | 108.9 | 112.9 | 118.9 | 128.9 | 138.9 | | |
| | Level A | (dB) | | 88.9 | 98.9 | 108.9 | 112.9 | 118.9 | 128.8 | 138.8 | | |
| | Error | (dB) | | | 0.0 | 0.0 | 0.0 | 0.0 | -0.1 | -0.1 | | |
| 63 Hz | Ref | (dB) | | 87.8 | 93.8 | 103.8 | 113.8 | | | | | |
| | Level A | (dB) | | 87.8 | 93.8 | 103.8 | 113.8 | | | | | |
| | Error | (dB) | | | | | 0.0 | 0.0 | 0.0 | 0.0 | | |
| Tolerances Limit | | (±dB) | 1.0 | | | | | | | | | |
| UNCERTAINTY | | (±dB) | 0.3 | | | | | | | | | |

b. Sound exposure meter linearity of error

| UUC Setting | Time | | Exposure Measurement | | | UNCERTAINTY | Tolerances |
|--------------------|------|-----|----------------------|----------------------|-------|-------------|------------|
| FAST / A / 55-140 | Ref | UUC | Ref | UUC | Error | | Limit |
| Calibrator Setting | (s) | (s) | (Pa ² /h) | (Pa ² /h) | (%) | (%) | (%) |
| 1000 Hz 110 dB | 27 | 27 | 0.30 | 0.30 | 0.00 | | |
| 1000 Hz 110 dB | 45 | 45 | 0.30 | 0.30 | 0.00 | | |
| 1000 Hz 110 dB | 90 | 90 | 1.00 | 0.99 | -1.00 | 5.6 | -21 ~ -26 |
| 1000 Hz 110 dB | 180 | 180 | 2.00 | 1.98 | -1.00 | | |
| 1000 Hz 120 dB | 36 | 36 | 4.00 | 4.01 | +0.75 | | |
| 1000 Hz 120 dB | 72 | 72 | 8.00 | 8.02 | +0.63 | | |
| 1000 Hz 120 dB | 90 | 90 | 10.00 | 10.13 | +1.30 | 5.6 | -21 ~ -26 |
| 1000 Hz 120 dB | 180 | 180 | 20.00 | 20.22 | +1.10 | | |
| 1000 Hz 120 dB | 360 | 360 | 40.00 | 40.34 | +0.85 | | |
| 1000 Hz 120 dB | 720 | 720 | 80.00 | 80.49 | +0.61 | | |

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.
เอกสารไม่ควบคุม

Certificate No : 23-NDM-108
Request No : Req-2023-0954

4. Response to short duration

a. Response for sinusoidal signals - reference level

| UUC Setting | Time | | Exposure Measurement | | | UNCERTAINTY | Tolerances Limit |
|--------------------|------|------|----------------------|---------------------|---------------------|-------------|------------------|
| | Ref | UUC | Ref | UUC | Error | | |
| FAST / A / 55-140 | (0) | (0) | (Pa ² h) | (Pa ² h) | (Pa ² h) | (%) | (%) |
| Calibrator Setting | (0) | (0) | (Pa ² h) | (Pa ² h) | (%) | (%) | (%) |
| 4000 Hz 95 dB | 2846 | 2846 | 1.00 | 1.00 | 0.00 | 0.052 | -0.29 ~ +0.41 |

b. Sound exposure meter response for series of toneburst impulses

| UUC Setting | Time | | Exposure Measurement | | | UNCERTAINTY | Tolerances Limit |
|--------------------|------|------|----------------------|---------------------|-------|-------------|------------------|
| | Ref | UUC | Ref | UUC | Error | | |
| FAST / A / 55-140 | (0) | (0) | (Pa ² h) | (Pa ² h) | (%) | (%) | (%) |
| Calibrator Setting | (0) | (0) | (Pa ² h) | (Pa ² h) | (%) | (%) | (%) |
| Burst 1 ms, 95 dB | 2846 | 2846 | 1.00 | 1.00 | 0.00 | 5.6 | -21 ~ +26 |
| Burst 1 ms, 100 dB | 900 | 900 | 1.00 | 1.00 | 0.00 | | -29 ~ +41 |
| Burst 1 ms, 108 dB | 143 | 143 | 1.00 | 1.01 | +1.00 | | -29 ~ +41 |

5. Response to unipolar pulse

| UUC Setting | Time | | Exposure Measurement | | | UNCERTAINTY | Tolerances Limit |
|------------------------|------|-----|----------------------|---------------------|-----------|-------------|------------------|
| | Ref | UUC | Ref | UUC | Different | | |
| FAST / A / 55-140 | (0) | (0) | (Pa ² h) | (Pa ² h) | (%) | (%) | (%) |
| Calibrator Setting | (0) | (0) | (Pa ² h) | (Pa ² h) | (%) | (%) | (%) |
| Continuous Rectangle + | 29 | | 10.37 | | 0.00 | 3.7 | -21 ~ +26 |
| Continuous Rectangle - | | | 10.37 | | | | |

* Indicates non accredited

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.
เอกสารไม่ควบคุม

Certificate of Calibration

Customer

Name : UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.
Address : 81 Soi Udomak 41, Sukhumvit Road, Bangchak, Prakanong, Bangkok 10260

Certificate No : 23-NDM-107
Request No : Req-2023-0953

Unit Under Calibration Details

Measurement item : Noise Dosimeter
Manufacturer : SVANTEK
Model : SV 104
Serial Number : 117093
ID : -
Resolution : 0.1 dB
Microphone Class : 2
Microphone Model : SV 27
Microphone S/N : 112806
Preamplifier Model : -
Preamplifier S/N : -
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 : 4 May 2023
Calibrated Date : 12 May 2023
Calibration Procedure : In-house method CP-NDM-01 based on IEC 61252 : 2017
Location of Calibration : Lab Acoustic


Reference Standard

| Instrument | Brand | Model | SN | Due calibration | Traceability |
|---------------------------|---------|-----------|--------|-----------------|--------------|
| Multifrequency Calibrator | Quest | Quest-cal | 188272 | 29 June 2023 | TSI |
| Standard Microphone | GRAS | 40AN | 188273 | 6 October 2023 | GRAS |
| Sine Generator | Svantek | Svan401 | 131 | 12 October 2023 | WK Electric |
| Timer | EXTech | - | 65-ACT | 20 March 2024 | TPA |

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. Noppon Luangrat
Calibration Officer

Approved By : 
Mr. Pachi Mathavom
Calibration Engineer Supervisor
Issue Date : 12 May 2023

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.
เอกสารไม่ควบคุม

Certificate No : 23-NDM-107
Request No : Req-2023-0953

1. Absolute acoustical sensitivity

| UUC Setting | Time | | Exposure Measurement | | | UNCERTAINTY | Tolerances Limit |
|--------------------|------|-----|----------------------|---------------------|-------|-------------|------------------|
| | Ref | UUC | Ref | UUC | Error | | |
| FAST / A / 55-140 | (0) | (0) | (Pa ² h) | (Pa ² h) | (%) | (%) | (%) |
| Calibrator Setting | (0) | (0) | (Pa ² h) | (Pa ² h) | (%) | (%) | (%) |
| 1000 Hz 114 dB | 120 | 120 | 3.19 | 3.20 | +0.31 | 3.1 | -21 ~ +26 |

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

2. Frequency weightings

| UUC Setting | Deviation from various Frequency Weighting | | UNCERTAINTY | Tolerances Limit |
|---------------|--|------|-------------|------------------|
| | A | C | | |
| FAST / 55-140 | (dB) | (dB) | (± dB) | (± dB) |
| STD Setting | (dB) | (dB) | (± dB) | (± dB) |
| *63 Hz | 0.0 | 0.1 | 0.40 | 2.0 |
| 125 Hz | -0.1 | 0.4 | 0.40 | 1.5 |
| 250 Hz | -0.1 | 0.4 | 0.40 | 1.5 |
| 500 Hz | 0.0 | 0.4 | 0.40 | 1.5 |
| 1000 Hz | 0.0 | 0.0 | 0.40 | - |
| 2000 Hz | -0.2 | 0.2 | 0.40 | 2.0 |
| 4000 Hz | 2.3 | 2.3 | 0.40 | 3.0 |
| 8000 Hz | -3.3 | -3.4 | 0.40 | 5.0 |

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.
เอกสารไม่ควบคุม

Certificate No : 23-NDM-107
Request No : Req-2023-0953

3. Linearity of response to steady signals

a. Sound exposure meter, linearity of response for changes of input sinusoidal signal level

| UUC Setting | | FAST / A / High | | | | | | | | | | |
|------------------|---------|-----------------|------|------|------|-------|-------|-------|-------|-------|-------|--|
| 1000 Hz | Ref | (dB) | 55.0 | 80.0 | 90.0 | 100.0 | 110.0 | 114.0 | 120.0 | 130.0 | 140.0 | |
| | Level A | (dB) | 54.7 | 80.3 | 90.2 | 100.1 | 110.0 | 114.0 | 120.0 | 130.0 | 140.0 | |
| | Error | (dB) | 0.3 | 0.3 | 0.2 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| 8000 Hz | Ref | (dB) | | 88.9 | 98.9 | 108.9 | 112.9 | 118.9 | 128.9 | 138.9 | | |
| | Level A | (dB) | | 88.5 | 98.9 | 108.9 | 112.5 | 118.5 | 128.5 | 138.5 | | |
| | Error | (dB) | | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| 63 Hz | Ref | (dB) | | | | | | 87.8 | 93.8 | 103.8 | 111.8 | |
| | Level A | (dB) | | | | | | 87.8 | 93.8 | 103.8 | 111.8 | |
| | Error | (dB) | | | | | | | 0.0 | 0.0 | 0.0 | |
| Tolerances Limit | | (±dB) | 1.0 | | | | | | | | | |
| UNCERTAINTY | | (±dB) | 0.3 | | | | | | | | | |

b. Sound exposure meter linearity of error

| UUC Setting | Time | | Exposure Measurement | | | UNCERTAINTY | Tolerance |
|--------------------|------|-----|----------------------|---------------------|-------|-------------|-----------|
| FAST / A / 55-140 | Ref | UUC | Ref | UUC | Error | | Limit |
| Calibrator Setting | (0) | (0) | (Pa ² h) | (Pa ² h) | (%) | (%) | (%) |
| 1000 Hz 110 dB | 27 | 27 | 0.30 | 0.30 | 0.00 | 5.6 | -21, +26 |
| 1000 Hz 110 dB | 45 | 45 | 0.50 | 0.50 | 0.00 | | |
| 1000 Hz 110 dB | 90 | 90 | 1.00 | 0.99 | -1.00 | | |
| 1000 Hz 110 dB | 180 | 180 | 2.00 | 1.98 | -1.00 | 5.6 | |
| 1000 Hz 120 dB | 36 | 36 | 4.00 | 3.94 | -1.50 | | |
| 1000 Hz 120 dB | 72 | 72 | 8.00 | 8.02 | +0.03 | | |
| 1000 Hz 120 dB | 90 | 90 | 10.00 | 9.90 | -1.00 | 5.6 | |
| 1000 Hz 120 dB | 180 | 180 | 20.00 | 19.76 | -1.20 | | |
| 1000 Hz 120 dB | 360 | 360 | 40.00 | 39.42 | -1.45 | | |
| 1000 Hz 120 dB | 720 | 720 | 80.00 | 78.66 | -1.68 | | |

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.
เอกสารไม่ควบคุม

Certificate No : 23-NDM-107
Request No : Req-2023-0953

Certificate of Calibration

Customer

Name : UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.
Address : 81 Soi Udomsak 41, Sukhumvit Road, Bangkok, Prakanong, Bangkok 10260
Certificate No : 23-NDM-105
Request No : Req-2023-0951

Unit Under Calibration Details

Measurement item : : Noise Dosimeter
Manufacturer : : SVANTEK
Model : : SV 104
Serial Number : : 117696
ID : : -
Resolution : : 0.1 dB
Microphone Class : :
Microphone Model : : SV 27
Microphone S/N : : 112864
Preamplifier Model : :
Preamplifier S/N : :
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 : : 4 May 2023
Calibrated Date : : 12 May 2023
Calibration Procedure : : In-house method CP-NDM-01 based on IEC 61252 : 2017
Location of Calibration : : Lab Acoustic

| Instrument | Brand | Model | SN | Due calibration | Traceability |
|---------------------------|---------|-----------|--------|-----------------|--------------|
| Multifrequency Calibrator | Quest | Quest-cal | 186272 | 29 June 2023 | TSI |
| Standard Microphone | GRAS | 40AN | 186273 | 6 October 2023 | GRAS |
| Sine Generator | SvanteK | Scan401 | 131 | 12 October 2023 | WK Electric |
| Timer | EXTECH | - | 95-ACT | 20 March 2024 | TPA |

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. Noppadol Luangrat
Calibration Officer

Approved By : 
Mr. Pachi Mahavorn
Calibration Engineer Supervisor
Issue Date : 12 May 2023

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Issuing Institution.

เอกสารไม่ควบคุม

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Issuing Institution.

เอกสารไม่ควบคุม

Certificate No : 23-NDM-105
Request No : Req-2023-0951

Certificate No : 23-NDM-105
Request No : Req-2023-0951

1. Absolute acoustical sensitivity

| UUC Setting | Time | | Exposure Measurement | | | UNCERTAINTY | Tolerances |
|--------------------|------|-----|----------------------|---------------------|-------|-------------|------------|
| FAST / A / 55-140 | Ref | UUC | Ref | UUC | Error | | Limit |
| Calibrator Setting | (s) | (s) | (Pa ² h) | (Pa ² h) | (%) | (%) | (%) |
| 1000 Hz 114 dB | 120 | 120 | 3.19 | 3.20 | +0.31 | 3.1 | -21, +26 |

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

2. Frequency weightings

| UUC Setting | Deviation from various Frequency Weighting | | UNCERTAINTY | Tolerances |
|---------------|--|------|-------------|------------|
| FAST / 55-140 | A | C | (± dB) | (± dB) |
| STD Setting | (dB) | (dB) | | |
| *63 Hz | 0.1 | 0.2 | 0.40 | 2.0 |
| 125 Hz | -0.8 | -0.3 | 0.40 | 1.5 |
| 250 Hz | -0.4 | 0.1 | 0.40 | 1.5 |
| 500 Hz | -0.1 | 0.3 | 0.40 | 1.5 |
| 1000 Hz | 0.0 | 0.0 | 0.40 | - |
| 2000 Hz | -0.1 | 0.3 | 0.40 | 2.0 |
| 4000 Hz | 1.7 | 1.8 | 0.40 | 3.0 |
| 8000 Hz | -2.2 | -2.3 | 0.40 | 5.0 |

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Issuing Institution.

เอกสารไม่ควบคุม

3. Linearity of response to steady signals

a. Sound exposure meter, linearity of response for changes of input sinusoidal signal level

| UUC Setting | FAST / A / High | | | | | | | | | | | |
|------------------|-----------------|-------|------|------|------|-------|-------|-------|-------|-------|-------|--|
| 1000 Hz | Ref | (dB) | 55.0 | 80.0 | 90.0 | 100.0 | 110.0 | 114.0 | 120.0 | 130.0 | 140.0 | |
| | Level A | (dB) | 54.4 | 80.1 | 90.2 | 100.0 | 110.0 | 114.0 | 120.0 | 130.0 | 140.0 | |
| | Error | (dB) | -0.6 | 0.1 | 0.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| 8000 Hz | Ref | (dB) | | 98.9 | 98.9 | 108.9 | 112.9 | 118.9 | 128.9 | 138.9 | | |
| | Level A | (dB) | | 98.9 | 98.9 | 108.9 | 112.9 | 118.9 | 128.9 | 138.9 | | |
| | Error | (dB) | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | -0.1 | -0.1 | | |
| 63 Hz | Ref | (dB) | | 87.8 | 93.8 | 103.8 | 113.8 | | | | | |
| | Level A | (dB) | | 87.8 | 93.8 | 103.8 | 113.8 | | | | | |
| | Error | (dB) | | 0.0 | 0.0 | 0.0 | 0.0 | | | | | |
| Tolerances Limit | | (±dB) | 1.0 | | | | | | | | | |
| UNCERTAINTY | | (±dB) | 0.3 | | | | | | | | | |

b. Sound exposure meter linearity of error

| UUC Setting | | Time | | Exposure Measurement | | | UNCERTAINTY | Tolerance |
|--------------------|-----|------|---------------------|----------------------|-------|-----|-------------|-----------|
| FAST / A / 55-140 | Ref | UUC | Ref | UUC | Error | | | Limit |
| Calibrator Setting | (s) | (s) | (Pa ² h) | (Pa ² h) | (%) | | (%) | (%) |
| 1000 Hz 110 dB | 27 | 27 | 0.30 | 0.30 | 0.00 | 5.6 | -21, +26 | |
| 1000 Hz 110 dB | 45 | 45 | 0.50 | 0.50 | 0.00 | | | |
| 1000 Hz 110 dB | 90 | 90 | 1.00 | 0.99 | -1.00 | | | |
| 1000 Hz 110 dB | 180 | 180 | 2.00 | 1.98 | -1.00 | | | |
| 1000 Hz 120 dB | 36 | 36 | 4.00 | 4.03 | +0.75 | | | |
| 1000 Hz 120 dB | 72 | 72 | 8.00 | 8.05 | +0.63 | 5.6 | | |
| 1000 Hz 120 dB | 90 | 90 | 10.00 | 10.13 | +1.30 | | | |
| 1000 Hz 120 dB | 180 | 180 | 20.00 | 20.22 | +1.10 | | | |
| 1000 Hz 120 dB | 360 | 360 | 40.00 | 40.34 | +0.85 | | | |
| 1000 Hz 120 dB | 720 | 720 | 80.00 | 80.49 | +0.61 | | | |

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Issuing Institution.

เอกสารไม่ควบคุม

Certificate No : 23-NDM-105
Request No : Req-2023-0953

4. Response to short duration
a. Response for sinusoidal signals - reference level

| UUC Setting | Time | | Exposure Measurement | | | UNCERTAINTY | Tolerances Limit |
|--------------------|------|------|----------------------|----------------------|----------------------|-------------|------------------|
| | Ref | UUC | Ref | UUC | Error | | |
| Calibrator Setting | (s) | (s) | (Pa ² ·h) | (Pa ² ·h) | (Pa ² ·h) | (%) | (%) |
| 4000 Hz 95 dB | 2846 | 2846 | 1.00 | 1.00 | 0.00 | 0.052 | +0.29 ~ -0.41 |

b. Sound exposure meter response for series of toneburst impulses

| UUC Setting | Time | | Exposure Measurement | | | UNCERTAINTY | Tolerances Limit |
|--------------------|------|------|----------------------|----------------------|-------|-------------|------------------|
| | Ref | UUC | Ref | UUC | Error | | |
| Calibrator Setting | (s) | (s) | (Pa ² ·h) | (Pa ² ·h) | (%) | (%) | (%) |
| Burst 1 ms, 95 dB | 2846 | 2846 | 1.00 | 1.00 | 0.00 | 5.6 | -21 ~ +26 |
| Burst 1 ms, 100 dB | 900 | 900 | 1.00 | 1.00 | 0.00 | | -29 ~ +41 |
| Burst 1 ms, 108 dB | 143 | 143 | 1.00 | 1.01 | +1.00 | | -29 ~ +41 |

9. Response to unipolar pulse

| UUC Setting | Time | | Exposure Measurement | | UNCERTAINTY | Tolerances Limit |
|------------------------|------|-----|----------------------|------|-------------|------------------|
| | Ref | UUC | Ref | UUC | | |
| Calibrator Setting | (s) | (s) | (Pa ² ·h) | (%) | (%) | (%) |
| Continuous Rectangle + | 29 | | 10.37 | 0.00 | 3.7 | -21 ~ +26 |
| Continuous Rectangle - | | | 10.37 | | | |

* Indicates non accredited

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 Issuing Authority.

เอกสารไม่ควบคุม

Certificate of Calibration

Customer

Name : UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.
Address : 81 Soi Udomak 41, Sukhumvit Road, Bangchak, Prakanong, Bangkok 10260

Certificate No : 23-NDM-013
Request No : Req-2023-0857

Unit Under Calibration Details

Measurement Item : Noise dosimeter
Microphone Class : 2
Manufacturer : SVANTEK
Microphone Model : SV27
Model : SV104
Microphone S/N : 96602
Serial Number : 91925
Preamplifier Model : -
ID : -
Preamplifier S/N : -
Resolution : 0.1 dB
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 : 10 January 2023
Calibrated Date : 23 January 2023
Calibration Procedure : In-house method CP-NDM-01 based on IEC 61252 : 2017
Location of Calibration : Lab Acoustic


Reference Standard

| Instrument | Brand | Model | SN | Due calibration | Traceability |
|----------------------------|---------|-----------|--------|-----------------|--------------|
| Multi-frequency Calibrator | Quest | Quest-cal | 188272 | 29 June 2023 | TSM |
| Standard Microphone | GRAS | 40AN | 188273 | 8 October 2023 | GRAS |
| Sine Generator | SvanteK | Svan401 | 131 | 12 October 2023 | WK Electric |
| Timer | EXTECH | - | 65-ACT | 24 March 2023 | TPA |

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. Nopadon Lattang
Calibration Officer

Approved By : 
Mr. Paht Mathavom
Calibration Engineer Supervisor
Issue Date : 25 January 2023

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Issuing Authority.

เอกสารไม่ควบคุม

Certificate No : 23-NDM-013
Request No : Req-2023-0857

1. Absolute acoustical sensitivity

| UUC Setting | Time | | Exposure Measurement | | | UNCERTAINTY | Tolerances Limit |
|--------------------|--------|-----|----------------------|----------------------|-------|-------------|------------------|
| | Ref | UUC | Ref | UUC | Error | | |
| Calibrator Setting | (s) | (s) | (Pa ² ·h) | (Pa ² ·h) | (%) | (%) | (%) |
| 1000 Hz 114 dB | 120.00 | 120 | 3.19 | 3.13 | -1.88 | 3.0 | -21 ~ +26 |

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

2. Frequency weightings

| UUC Setting | Deviation from various Frequency Weighting | | UNCERTAINTY | Tolerances Limit |
|-------------------|--|------|-------------|------------------|
| | A | C | | |
| FAST / A / 55-140 | (dB) | (dB) | (± dB) | (± dB) |
| STD Setting | (dB) | (dB) | (± dB) | (± dB) |
| 90 Hz | 0.3 | 0.3 | 0.40 | 2.0 |
| 125 Hz | -0.2 | -0.2 | 0.40 | 1.5 |
| 250 Hz | -0.3 | -0.4 | 0.40 | 1.5 |
| 500 Hz | -0.2 | -0.3 | 0.40 | 1.5 |
| 1000 Hz | 0.0 | 0.0 | 0.40 | - |
| 2000 Hz | 0.1 | 0.1 | 0.40 | 2.0 |
| 4000 Hz | 1.0 | 0.8 | 0.40 | 3.0 |
| 8000 Hz | -1.2 | -1.2 | 0.40 | 5.0 |

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Issuing Authority.

เอกสารไม่ควบคุม

Certificate No : 23-NDM-013
Request No : Req-2023-0857

3. Linearity of response to steady signals

a. Sound exposure meter, linearity of response for changes of input sinusoidal signal level

| UUC Setting | FAST / A / High | | | | | | | | | | | | | |
|------------------|-----------------|------|------|------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| | Ref | (dB) | 55.0 | 60.0 | 65.0 | 70.0 | 75.0 | 80.0 | 85.0 | 90.0 | 95.0 | 100.0 | 105.0 | 110.0 |
| 1000 Hz | Level A | (dB) | 54.4 | 60.2 | 66.2 | 72.0 | 77.8 | 83.6 | 89.4 | 95.2 | 101.0 | 106.8 | 112.6 | 118.4 |
| | Error | (dB) | -0.6 | 0.2 | 0.2 | 0.1 | 0.1 | 0.0 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.0 |
| | Ref | (dB) | 88.9 | 98.9 | 108.9 | 118.9 | 128.9 | 138.9 | 148.9 | 158.9 | 168.9 | 178.9 | 188.9 | 198.9 |
| 8000 Hz | Level A | (dB) | 88.9 | 98.9 | 108.9 | 118.9 | 128.9 | 138.9 | 148.9 | 158.9 | 168.9 | 178.9 | 188.9 | 198.9 |
| | Error | (dB) | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 0.1 |
| | Ref | (dB) | 87.8 | 93.8 | 103.8 | 113.8 | 123.8 | 133.8 | 143.8 | 153.8 | 163.8 | 173.8 | 183.8 | 193.8 |
| 63 Hz | Level A | (dB) | 87.8 | 93.8 | 103.8 | 113.8 | 123.8 | 133.8 | 143.8 | 153.8 | 163.8 | 173.8 | 183.8 | 193.8 |
| | Error | (dB) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | Ref | (dB) | 87.8 | 93.8 | 103.8 | 113.8 | 123.8 | 133.8 | 143.8 | 153.8 | 163.8 | 173.8 | 183.8 | 193.8 |
| Tolerances Limit | | (dB) | 1.0 | | | | | | | | | | | |
| UNCERTAINTY | | (dB) | 0.27 | | | | | | | | | | | |

b. Sound exposure meter linearity of error

| UUC Setting | Time | | Exposure Measurement | | | UNCERTAINTY | Tolerances Limit |
|--------------------|------|-----|----------------------|----------------------|-------|-------------|------------------|
| | Ref | UUC | Ref | UUC | Error | | |
| Calibrator Setting | (s) | (s) | (Pa ² ·h) | (Pa ² ·h) | (%) | (%) | (%) |
| 1000 Hz 110 dB | 27 | 27 | 0.30 | 0.30 | 0.00 | 4.3 | -21 ~ +26 |
| 1000 Hz 110 dB | 45 | 45 | 0.50 | 0.50 | 0.00 | | |
| 1000 Hz 110 dB | 90 | 90 | 1.00 | 1.00 | +1.00 | | |
| 1000 Hz 110 dB | 180 | 180 | 2.00 | 2.02 | +1.00 | | |
| 1000 Hz 120 dB | 36 | 36 | 4.00 | 4.03 | +0.75 | | |
| 1000 Hz 120 dB | 72 | 72 | 8.00 | 8.08 | +0.85 | | |
| 1000 Hz 120 dB | 90 | 90 | 10.00 | 9.90 | -1.00 | 3.8 | -21 ~ +26 |
| 1000 Hz 120 dB | 180 | 180 | 20.00 | 19.76 | -1.20 | | |
| 1000 Hz 120 dB | 360 | 360 | 40.00 | 40.34 | +0.85 | | |
| 1000 Hz 120 dB | 720 | 720 | 80.00 | 80.49 | +0.61 | | |

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Issuing Authority.

เอกสารไม่ควบคุม

Certificate No : 23-NDM-013
Request No : Req-2023-0957

4. Response to short duration

a. Response for sinusoidal signals - reference level

| UUC Setting | Time | | Exposure Measurement | | | UNCERTAINTY | Tolerances Limit |
|--------------------|------|------|--------------------------|--------------------------|----------------------------|-------------|------------------|
| | Ref | UUC | Ref (Pa ¹ /h) | UUC (Pa ¹ /h) | Error (Pa ¹ /h) | | |
| FAST / A / 55-140 | (s) | (s) | (Pa ¹ /h) | (Pa ¹ /h) | (%) | (%) | (%) |
| Calibrator Setting | (s) | (s) | (Pa ¹ /h) | (Pa ¹ /h) | (%) | (%) | (%) |
| 4000 Hz 95 dB | 2846 | 2846 | 1.00 | 0.98 | -0.02 | 0.01 | -0.29 ~ 0.41 |

b. Sound exposure meter response for series of toneburst impulses

| UUC Setting | Time | | Exposure Measurement | | | UNCERTAINTY | Tolerances Limit |
|--------------------|------|------|--------------------------|--------------------------|----------------------------|-------------|------------------|
| | Ref | UUC | Ref (Pa ¹ /h) | UUC (Pa ¹ /h) | Error (Pa ¹ /h) | | |
| FAST / A / 55-140 | (s) | (s) | (Pa ¹ /h) | (Pa ¹ /h) | (%) | (%) | (%) |
| Calibrator Setting | (s) | (s) | (Pa ¹ /h) | (Pa ¹ /h) | (%) | (%) | (%) |
| Burst 1 ms, 95 dB | 2846 | 2846 | 1.00 | 0.98 | -2.00 | 3.0 | -21 ~ +26 |
| Burst 1 ms, 100 dB | 900 | 900 | 1.00 | 0.98 | -2.00 | | -21 ~ +41 |
| Burst 1 ms, 105 dB | 143 | 143 | 1.00 | 0.99 | -1.00 | | -21 ~ +41 |

5. Response to unipolar pulse

| UUC Setting | Time | | Exposure Measurement | | | UNCERTAINTY | Tolerances Limit |
|------------------------|------|-----|--------------------------|--------------------------|--------------------------------|-------------|------------------|
| | Ref | UUC | Ref (Pa ¹ /h) | UUC (Pa ¹ /h) | Different (Pa ¹ /h) | | |
| FAST / A / 55-140 | (s) | (s) | (Pa ¹ /h) | (Pa ¹ /h) | (%) | (%) | (%) |
| Calibrator Setting | (s) | (s) | (Pa ¹ /h) | (Pa ¹ /h) | (%) | (%) | (%) |
| Continuous Rectangle + | 7 | 7 | 10.61 | 10.61 | -2.36 | 2.4 | -21 ~ +26 |
| Continuous Rectangle - | 7 | 7 | 10.86 | 10.86 | -2.36 | 2.4 | -21 ~ +26 |

* Indicates non accredited

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.

เอกสารไม่ควบคุม

Certificate of Calibration

Customer : UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.
Name : 81 Soi Udomsak 41, Sukhumvit Road, Bangchak, Prakanong, Bangkok 10260
Certificate No : 23-NDM-089
Request No : Req-2023-0902

Unit Under Calibration Details

Measurement item : Noise Dosimeter
Manufacturer : SVANTEK
Model : SV 104S
Serial Number : 12063
ID : -
Resolution : 0.1 dB
Microphone Class : 2
Microphone Model : SV 27IS
Microphone S/N : 133706
Preamplifier Model : -
Preamplifier S/N : -
Instrument Status : New

Calibration Environment and Details


Temperature : 23 °C ± 2 °C
Humidity : 50 %RH ± 20 %RH
Barometric Pressure : 1013 hPa ± 10 hPa
Received Date : 25 April 2023
Calibrated Date : 8 May 2023
Calibration Procedure : In-house method CP-NDM-01 based on IEC 61252 : 2017
Location of Calibration : Lab Acoustic


Reference Standard

| Instrument | Brand | Model | SN | Due calibration | Traceability |
|---------------------------|---------|-----------|--------|-----------------|--------------|
| Multifrequency Calibrator | Quest | Quest-cal | 188272 | 29 June 2023 | TSI |
| Standard Microphone | GRAS | 40AN | 188273 | 6 October 2023 | GRAS |
| Size Generator | Scantek | Scan401 | 131 | 12 October 2023 | WK Electric |
| Timer | EXTech | - | R5-ACT | 20 March 2024 | TPA |

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. Nopphon Luangrat
Calibration Officer

Approved By : 
Mr. Paitt Mahavorn
Calibration Engineer Supervisor
Issue Date : 8 May 2023

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.

เอกสารไม่ควบคุม

Certificate No : 23-NDM-089
Request No : Req-2023-0902

1. Absolute acoustical sensitivity

| UUC Setting | Time | | Exposure Measurement | | | UNCERTAINTY | Tolerances Limit |
|--------------------|------|-----|--------------------------|--------------------------|----------------------------|-------------|------------------|
| | Ref | UUC | Ref (Pa ¹ /h) | UUC (Pa ¹ /h) | Error (Pa ¹ /h) | | |
| FAST / A / 60-140 | (s) | (s) | (Pa ¹ /h) | (Pa ¹ /h) | (%) | (%) | (%) |
| Calibrator Setting | (s) | (s) | (Pa ¹ /h) | (Pa ¹ /h) | (%) | (%) | (%) |
| 1000 Hz 114 dB | 120 | 120 | 3.19 | 3.13 | -1.88 | 3.1 | -21 ~ +26 |

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

2. Frequency weightings

| UUC Setting | Deviation from various Frequency Weighting | | UNCERTAINTY (± dB) | Tolerances Limit (± dB) |
|---------------|--|--------|--------------------|-------------------------|
| | A (dB) | C (dB) | | |
| FAST / 60-140 | (dB) | (dB) | (± dB) | (± dB) |
| STD Setting | (dB) | (dB) | (± dB) | (± dB) |
| *63 Hz | 0.4 | 0.5 | 0.40 | 2.0 |
| 125 Hz | 0.3 | 0.8 | 0.40 | 1.5 |
| 250 Hz | 0.1 | 0.6 | 0.40 | 1.5 |
| 500 Hz | 0.1 | 0.5 | 0.40 | 1.5 |
| 1000 Hz | 0.0 | 0.0 | 0.40 | - |
| 2000 Hz | -0.3 | -0.1 | 0.40 | 2.0 |
| 4000 Hz | 0.8 | 1.0 | 0.40 | 3.0 |
| 8000 Hz | -1.0 | -1.0 | 0.40 | 5.0 |

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.

เอกสารไม่ควบคุม

Certificate No : 23-NDM-089
Request No : Req-2023-0902

3. Linearity of response to steady signals

a. Sound exposure meter, linearity of response for changes of input sinusoidal signal level

| UUC Setting | Ref (dB) | FAST / A / High | | | | | | | | | | | |
|-------------------------|--------------|-----------------|------|-------|-------|-------|-------|-------|-------|-------|--|--|--|
| | | 60.0 | 80.0 | 90.0 | 100.0 | 110.0 | 114.0 | 120.0 | 130.0 | 140.0 | | | |
| 1000 Hz | Level A (dB) | 80.4 | 80.4 | 90.1 | 100.0 | 110.0 | 114.0 | 120.0 | 130.0 | 139.9 | | | |
| | Error (dB) | 0.4 | 0.4 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | -0.1 | | | |
| | Ref (dB) | 88.9 | 98.9 | 108.9 | 112.9 | 118.9 | 128.9 | 138.9 | | | | | |
| 8000 Hz | Level A (dB) | 88.9 | 98.9 | 108.9 | 112.9 | 118.9 | 128.9 | 138.9 | | | | | |
| | Error (dB) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | -0.1 | -0.1 | | | | | |
| | Ref (dB) | 87.8 | 93.8 | 103.8 | 113.8 | 123.8 | | | | | | | |
| 63 Hz | Level A (dB) | 87.8 | 93.8 | 103.8 | 113.8 | 123.8 | | | | | | | |
| | Error (dB) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | | | | | | |
| | Ref (dB) | 87.8 | 93.8 | 103.8 | 113.8 | 123.8 | | | | | | | |
| Tolerances Limit (± dB) | | 1.0 | | | | | | | | | | | |
| UNCERTAINTY (± dB) | | 0.3 | | | | | | | | | | | |

b. Sound exposure meter linearity of error

| UUC Setting | Time | | Exposure Measurement | | | UNCERTAINTY | Tolerances Limit |
|--------------------|------|-----|--------------------------|--------------------------|----------------------------|-------------|------------------|
| | Ref | UUC | Ref (Pa ¹ /h) | UUC (Pa ¹ /h) | Error (Pa ¹ /h) | | |
| FAST / A / 60-140 | (s) | (s) | (Pa ¹ /h) | (Pa ¹ /h) | (%) | (%) | (%) |
| Calibrator Setting | (s) | (s) | (Pa ¹ /h) | (Pa ¹ /h) | (%) | (%) | (%) |
| 1000 Hz 110 dB | 27 | 27 | 0.30 | 0.30 | 0.00 | 5.6 | -21 ~ +26 |
| 1000 Hz 110 dB | 45 | 45 | 0.50 | 0.50 | 0.00 | | |
| 1000 Hz 110 dB | 90 | 90 | 1.00 | 0.99 | -1.00 | | |
| 1000 Hz 110 dB | 180 | 180 | 2.00 | 1.98 | -1.00 | | |
| 1000 Hz 120 dB | 36 | 36 | 4.00 | 4.03 | +0.75 | | |
| 1000 Hz 120 dB | 72 | 72 | 8.00 | 8.05 | +0.63 | | |
| 1000 Hz 120 dB | 90 | 90 | 10.00 | 10.13 | +1.30 | 5.6 | -21 ~ +26 |
| 1000 Hz 120 dB | 180 | 180 | 20.00 | 20.22 | +1.10 | | |
| 1000 Hz 120 dB | 360 | 360 | 40.00 | 40.34 | +0.85 | | |
| 1000 Hz 120 dB | 720 | 720 | 80.00 | 80.49 | +0.61 | | |

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.

เอกสารไม่ควบคุม

Certificate No : 23-NDM-089
Request No : Req-2023-0902

4. Response to short duration

a. Response for sinusoidal signals - reference level

| UUC Setting | Time | | Exposure Measurement | | | UNCERTAINTY | Tolerances Limit |
|--------------------|------|------|----------------------|---------------------|---------------------|---------------------|---------------------|
| | Ref | UUC | Ref | UUC | Error | | |
| Calibrator Setting | (s) | (s) | (Pa ² h) | (Pa ² h) | (Pa ² h) | (Pa ² h) | (Pa ² h) |
| 4000 Hz 95 dB | 2846 | 2846 | 1.00 | 0.98 | -0.02 | 0.052 | -0.29 ~ +0.41 |

b. Sound exposure meter response for series of toneburst impulses

| UUC Setting | Time | | Exposure Measurement | | | UNCERTAINTY | Tolerances Limit |
|--------------------|------|------|----------------------|---------------------|-------|-------------|------------------|
| | Ref | UUC | Ref | UUC | Error | | |
| Calibrator Setting | (s) | (s) | (Pa ² h) | (Pa ² h) | (%) | (%) | (%) |
| Burst 1 ms, 95 dB | 2846 | 2846 | 1.00 | 0.98 | -2.00 | 3.6 | -21 ~ +26 |
| Burst 1 ms, 100 dB | 900 | 900 | 1.00 | 0.96 | -2.00 | | -29 ~ +41 |
| Burst 1 ms, 106 dB | 143 | 143 | 1.00 | 0.89 | -1.00 | | -29 ~ +41 |

5. Response to unpolar pulse

| UUC Setting | Time | | Exposure Measurement | | | UNCERTAINTY | Tolerances Limit |
|------------------------|------|-----|----------------------|---------------------|-----------|-------------|------------------|
| | Ref | UUC | Ref | UUC | Different | | |
| Calibrator Setting | (s) | (s) | (Pa ² h) | (Pa ² h) | (%) | (%) | (%) |
| Continuous Rectangle + | 28 | | 10.13 | | | 3.7 | -21 ~ +26 |
| Continuous Rectangle - | | | 10.13 | | 0.00 | | |

* Indicates non accredited

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.

เอกสารไม่ควบคุม

Certificate of Calibration

Customer

Name : UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD. Certificate No : 23-NDM-222
Address : 81 Soi Uthumak 41, Sukhumvit Road, Hangechak, Prakanong, Bangkok 10260 Request No : Req-2023-1748

Unit Under Calibration Details

Measurement Item : Noise Dosimeter Microphone Class : 2
Manufacturer : SVANTEK Microphone Model : SV 27IS
Model : SV 104IS Microphone S/N : 68647
Serial Number : 67627 Preamplifier Model : -
ID : - Preamplifier S/N : -
Resolution : 0.1 dB 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 : 21 August 2023
Calibrated Date : 29 August 2023
Calibration Procedure : In-house method CP-NDM-01 based on IEC 61252 : 2017
Location of Calibration : Lab Acoustic


Reference Standard

| Instrument | Brand | Model | S/N | Due calibration | Traceability |
|---------------------------|---------|-----------|--------|-----------------|--------------|
| Multifrequency Calibrator | Quest | Quest-cal | 188272 | 25 July 2024 | TSI |
| Standard Microphone | GRAS | 40AN | 188273 | 6 October 2023 | GRAS |
| Sine Generator | Svantek | Svan401 | 131 | 12 October 2023 | WK Electric |
| Timer | EXTCH | - | 05-ACT | 20 March 2024 | TPA |

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 Luangrit
Calibration Officer

Approved By : 
Mr. Pacit Mathavorn
Calibration Engineer Supervisor
Issue Date : 29 August 2023

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.

เอกสารไม่ควบคุม

Certificate No : 23-NDM-222
Request No : Req-2023-1748

1. Absolute acoustical sensitivity

| UUC Setting | Time | | Exposure Measurement | | | UNCERTAINTY | Tolerances Limit |
|--------------------|------|-----|----------------------|---------------------|-------|-------------|------------------|
| | Ref | UUC | Ref | UUC | Error | | |
| Calibrator Setting | (s) | (s) | (Pa ² h) | (Pa ² h) | (%) | (%) | (%) |
| 1000 Hz 114 dB | 120 | 120 | 3.18 | 3.13 | -1.57 | 3.1 | -21 ~ +26 |

Note : Absolute sensitivity was established by the use of Sound Calibrator Brand SVANTEK, Model SV 35A, S/N. 59079

2. Frequency weightings

| UUC Setting | Deviation from various Frequency Weighting | | UNCERTAINTY | Tolerances Limit |
|---------------|--|------|-------------|------------------|
| | A | C | | |
| FAST / 60-140 | (dB) | (dB) | (± dB) | (± dB) |
| STD Setting | (dB) | (dB) | | |
| *63 Hz | 0.5 | 0.6 | 0.40 | 2.0 |
| 125 Hz | -0.8 | -0.5 | 0.40 | 1.5 |
| 250 Hz | -0.4 | 0.1 | 0.40 | 1.5 |
| 500 Hz | -0.1 | 0.3 | 0.40 | 1.5 |
| 1000 Hz | 0.0 | 0.0 | 0.40 | - |
| 2000 Hz | 0.4 | 0.8 | 0.40 | 2.0 |
| 4000 Hz | 1.5 | 1.3 | 0.40 | 3.0 |
| 8000 Hz | -2.0 | -1.9 | 0.40 | 5.0 |

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.

เอกสารไม่ควบคุม

Certificate No : 23-NDM-222
Request No : Req-2023-1748

3. Linearity of response to steady signals

a. Sound exposure meter, linearity of response for changes of input sinusoidal signal level

| UUC Setting | Ref | FAST / A / High | | | | | | | | | |
|------------------|---------|-----------------|------|------|-------|-------|-------|-------|-------|-------|-------|
| | | (dB) | 80.0 | 80.0 | 90.0 | 100.0 | 110.0 | 114.0 | 120.0 | 130.0 | 140.0 |
| 1000 Hz | Level A | (dB) | 60.4 | 80.8 | 90.2 | 100.1 | 110.0 | 114.0 | 120.0 | 130.0 | 140.0 |
| | Error | (dB) | 0.4 | 0.4 | 0.2 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | Ref | (dB) | 88.9 | 98.9 | 108.9 | 112.9 | 118.9 | 128.9 | 138.9 | | |
| 8000 Hz | Level A | (dB) | 88.9 | 98.9 | 108.9 | 112.9 | 118.9 | 128.9 | 138.9 | | |
| | Error | (dB) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | -0.1 | -0.1 | | |
| | Ref | (dB) | 87.8 | 93.8 | 103.8 | 113.8 | | | | | |
| 63 Hz | Level A | (dB) | 87.8 | 93.8 | 103.8 | 113.8 | | | | | |
| | Error | (dB) | | | | 0.0 | 0.0 | 0.0 | 0.0 | | |
| | Ref | (dB) | | | | | | | | | |
| Tolerances Limit | | (±dB) | 1.0 | | | | | | | | |
| UNCERTAINTY | | (±dB) | 0.3 | | | | | | | | |

b. Sound exposure meter linearity of error

| UUC Setting | Time | | Exposure Measurement | | | UNCERTAINTY | Tolerance |
|--------------------|------|-----|----------------------|---------------------|-------|-------------|-----------|
| FAST / A / 60-140 | Ref | UUC | Ref | UUC | Error | | Limit |
| Calibrator Setting | (s) | (s) | (Pa ² h) | (Pa ² h) | (%) | (%) | (%) |
| 1000 Hz 110 dB | 27 | 27 | 0.30 | 0.30 | 0.00 | 5.6 | -21, +26 |
| 1000 Hz 110 dB | 45 | 45 | 0.50 | 0.50 | 0.00 | | |
| 1000 Hz 110 dB | 90 | 90 | 1.00 | 0.99 | -1.00 | | |
| 1000 Hz 110 dB | 180 | 180 | 2.00 | 1.99 | -1.00 | | |
| 1000 Hz 120 dB | 36 | 36 | 4.00 | 3.94 | -1.50 | | |
| 1000 Hz 120 dB | 72 | 72 | 8.00 | 7.87 | -1.63 | 5.6 | |
| 1000 Hz 120 dB | 90 | 90 | 10.00 | 9.90 | -1.00 | | |
| 1000 Hz 120 dB | 180 | 180 | 20.00 | 19.78 | -1.10 | | |
| 1000 Hz 120 dB | 360 | 360 | 40.00 | 39.42 | -1.45 | | |
| 1000 Hz 120 dB | 720 | 720 | 80.00 | 79.18 | -1.02 | | |

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.

เอกสารไม่ควบคุม

Certificate No : 23-NDM-222
Request No : Req-2023-1748

4. Response to short duration

a. Response for sinusoidal signals - reference level

| UUC Setting | Time | | Exposure Measurement | | | UNCERTAINTY | Tolerances |
|--------------------|------|------|----------------------|----------------------|----------------------|----------------------|----------------------|
| FAST / A / 60-140 | Ref | UUC | Ref | UUC | Error | Limit | |
| Calibrator Setting | (s) | (s) | (Pa ² /h) | (Pa ² /h) | (Pa ² /h) | (Pa ² /h) | (Pa ² /h) |
| 4000 Hz 95 dB | 2846 | 2846 | 1.00 | 0.98 | -0.02 | 0.052 | -0.29 ~ +0.41 |

b. Sound exposure meter response for series of toneburst impulses

| UUC Setting | Time | | Exposure Measurement | | | UNCERTAINTY | Tolerances |
|--------------------|------|------|----------------------|----------------------|-------|-------------|------------|
| FAST / A / 60-140 | Ref | UUC | Ref | UUC | Error | Limit | |
| Calibrator Setting | (s) | (s) | (Pa ² /h) | (Pa ² /h) | (%) | (%) | (%) |
| Burst 1 ms, 95 dB | 2846 | 2846 | 1.00 | 0.98 | -2.00 | 5.6 | -21 ~ +26 |
| Burst 1 ms, 100 dB | 999 | 900 | 1.00 | 0.98 | -2.00 | | -29 ~ +41 |
| Burst 1 ms, 105 dB | 143 | 143 | 1.00 | 0.99 | -1.00 | | -29 ~ +41 |

5. Response to unipolar pulse

| UUC Setting | Time | | Exposure Measurement | | | UNCERTAINTY | Tolerances |
|------------------------|------|-----|----------------------|----------------------|-----------|-------------|------------|
| FAST / A / 60-140 | Ref | UUC | Ref | UUC | Different | Limit | |
| Calibrator Setting | (s) | (s) | (Pa ² /h) | (Pa ² /h) | (%) | (%) | (%) |
| Continuous Rectangle + | | | 10.13 | | 0.00 | 3.7 | -21 ~ +26 |
| Continuous Rectangle - | 29 | | 10.13 | | | | |

* Indicates non accredited

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.

เอกสารไม่ควรถูก

Certificate of Calibration

Customer

Name : UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.
Address : 81 Soi Udomsak 41, Sukhumvit Road, Bangchak, Prakanong, Bangkok 10260

Certificate No : 23-NDM-062

Request No : Req-2023-0663

Unit Under Calibration Details

Measurement Item : Noise dosimeter
Microphone Class : 2
Manufacturer : SVANTEK
Microphone Model : SV 27S
Model : SV 104IS
Microphone S/N : 106782
Serial Number : 106003
Preamplifier Model : -
ID : UAE.EFM.168/2564
Preamplifier S/N : -
Resolution : 0.1 dB
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 : 22 March 2023
Calibrated Date : 23 March 2023
Calibration Procedure : In-house method CP-NDM-01 based on IEC 61252:2017
Location of Calibration : Lab Acoustic

Reference Standard

| Instrument | Brand | Model | S/N | Date calibration | Traceability |
|---------------------------|---------|-----------|--------|------------------|--------------|
| Multifrequency Calibrator | Quest | Quest-cal | 188272 | 29 June 2023 | TSL |
| Standard Microphone | GRAS | 40AN | 188273 | 6 October 2023 | GRAS |
| Sine Generator | Svantek | Svsn401 | 131 | 12 October 2023 | WK Electric |
| Timer | EXTech | - | 05-ACT | 24 March 2023 | TPA |

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. Nopadon Luangrat
Calibration Officer

Approved By :

Mr. Pait Mathavorn
Calibration Engineer Supervisor

Issue Date : 23 March 2023

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.

เอกสารไม่ควรถูก

Certificate No : 23-NDM-062
Request No : Req-2023-0663

1. Absolute acoustical sensitivity

| UUC Setting | Time | | Exposure Measurement | | | UNCERTAINTY | Tolerances |
|--------------------|--------|-----|----------------------|----------------------|-------|-------------|------------|
| FAST / A / 60-140 | Ref | UUC | Ref | UUC | Error | Limit | |
| Calibrator Setting | (s) | (s) | (Pa ² /h) | (Pa ² /h) | (%) | (%) | (%) |
| 1000 Hz 114 dB | 120.00 | 120 | 3.19 | 3.13 | -1.88 | 3.0 | -21 ~ +26 |

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

2. Frequency weightings

| UUC Setting | Deviation from various Frequency Weighting | | UNCERTAINTY | Tolerances |
|-------------------|--|------|-------------|------------|
| FAST / A / 60-140 | A | C | (± dB) | (± dB) |
| STD Setting | (dB) | (dB) | | |
| *63 Hz | 0.2 | 0.2 | 0.40 | 2.0 |
| 125 Hz | 0.2 | 0.1 | 0.40 | 1.5 |
| 250 Hz | 0.2 | 0.2 | 0.40 | 1.5 |
| 500 Hz | 0.1 | 0.1 | 0.40 | 1.5 |
| 1000 Hz | 0.0 | 0.0 | 0.40 | - |
| 2000 Hz | -0.9 | -0.9 | 0.40 | 2.0 |
| 4000 Hz | -0.7 | -0.7 | 0.40 | 3.0 |
| 8000 Hz | -1.6 | -1.7 | 0.40 | 3.0 |

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.

เอกสารไม่ควรถูก

Certificate No : 23-NDM-062
Request No : Req-2023-0663

3. Linearity of response to steady signals

a. Sound exposure meter, linearity of response for changes of input sinusoidal signal level

| UUC Setting | Ref | UUC | Ref | UUC | Error | Limit |
|------------------|------|------|------|------|-------|-------|
| FAST / A / High | (dB) | (dB) | (dB) | (dB) | (%) | (%) |
| 1000 Hz | 60.0 | 60.0 | 60.0 | 60.0 | 0.0 | 0.0 |
| Level A | 60.1 | 60.2 | 60.3 | 60.4 | 0.1 | 0.1 |
| Error | 0.1 | 0.2 | 0.3 | 0.4 | 0.1 | 0.1 |
| 8000 Hz | 88.9 | 88.9 | 88.9 | 88.9 | 0.0 | 0.0 |
| Level A | 88.9 | 88.9 | 88.9 | 88.9 | 0.0 | 0.0 |
| Error | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 63 Hz | 87.8 | 87.8 | 87.8 | 87.8 | 0.0 | 0.0 |
| Level A | 87.8 | 87.8 | 87.8 | 87.8 | 0.0 | 0.0 |
| Error | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Tolerances Limit | ±0.0 | ±0.0 | ±0.0 | ±0.0 | ±0.0 | ±0.0 |
| UNCERTAINTY | ±0.0 | ±0.0 | ±0.0 | ±0.0 | ±0.0 | ±0.0 |

b. Sound exposure meter linearity of error

| UUC Setting | Time | | Exposure Measurement | | | UNCERTAINTY | Tolerances |
|--------------------|------|-----|----------------------|----------------------|-------|-------------|------------|
| FAST / A / 60-140 | Ref | UUC | Ref | UUC | Error | Limit | |
| Calibrator Setting | (s) | (s) | (Pa ² /h) | (Pa ² /h) | (%) | (%) | (%) |
| 1000 Hz 110 dB | 27 | 27 | 0.30 | 0.30 | 0.00 | 4.3 | -21 ~ +26 |
| 1000 Hz 110 dB | 45 | 45 | 0.30 | 0.30 | 0.00 | | |
| 1000 Hz 110 dB | 90 | 90 | 1.00 | 1.00 | -1.00 | | |
| 1000 Hz 110 dB | 180 | 180 | 2.00 | 1.98 | -1.00 | | |
| 1000 Hz 120 dB | 56 | 56 | 4.00 | 3.94 | -1.50 | | |
| 1000 Hz 120 dB | 72 | 72 | 8.00 | 8.05 | +0.63 | | |
| 1000 Hz 120 dB | 90 | 90 | 10.00 | 9.90 | -1.00 | | |
| 1000 Hz 120 dB | 180 | 180 | 20.00 | 19.76 | -1.20 | | |
| 1000 Hz 120 dB | 360 | 360 | 40.00 | 39.42 | -1.45 | | |
| 1000 Hz 120 dB | 720 | 720 | 80.00 | 80.49 | +0.61 | | |

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.

เอกสารไม่ควรถูก

Certificate No : 23-NDM-062
Request No : Req-2023-0963

4. Response to short duration
a. Response for sinusoidal signals - reference level

| UUC Setting | Time | | Exposure Measurement | | | UNCERTAINTY (%) | Tolerances Limit (%) |
|--------------------|------|------|-----------------------------|-----------------------------|-------------------------------|--------------------|----------------------------|
| | Ref | UUC | Ref (Pa ² ·h) | UUC (Pa ² ·h) | Error (Pa ² ·h) | | |
| Calibrator Setting | (s) | (s) | (Pa ² ·h) | (Pa ² ·h) | (Pa ² ·h) | (%) | (%) |
| 4000 Hz 95 dB | 2846 | 2846 | 1.00 | 1.00 | 0.00 | 0.01 | -0.29 ~ +0.41 |

b. Sound exposure meter response for series of toneburst impulses

| UUC Setting | Time | | Exposure Measurement | | | UNCERTAINTY (%) | Tolerances Limit (%) |
|--------------------|------|------|-----------------------------|-----------------------------|--------------|--------------------|----------------------------|
| | Ref | UUC | Ref (Pa ² ·h) | UUC (Pa ² ·h) | Error (%) | | |
| Calibrator Setting | (s) | (s) | (Pa ² ·h) | (Pa ² ·h) | (%) | (%) | (%) |
| Burst 1 ms, 95 dB | 2846 | 2846 | 1.00 | 1.00 | 0.00 | | -21 ~ +26 |
| Burst 1 ms, 100 dB | 900 | 900 | 1.00 | 1.00 | 0.00 | 3.0 | -21 ~ +41 |
| Burst 1 ms, 105 dB | 143 | 143 | 1.00 | 1.01 | +1.00 | | -21 ~ +41 |

5. Response to unipolar pulse

| UUC Setting | Time | | Exposure Measurement | | | UNCERTAINTY (%) | Tolerances Limit (%) |
|------------------------|------|-----|-----------------------------|-----------------------------|------------------|--------------------|----------------------------|
| | Ref | UUC | Ref (Pa ² ·h) | UUC (Pa ² ·h) | Different (%) | | |
| Calibrator Setting | (s) | (s) | (Pa ² ·h) | (Pa ² ·h) | (%) | (%) | (%) |
| Continuous Rectangle + | 29 | | 10.13 | | +2.37 | 2.4 | -21 ~ +26 |
| Continuous Rectangle - | | | 10.37 | | | | |

* Indicates non accredited

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.

เอกสารไม่ควบคุม

Certificate of Calibration

Customer

Name : UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.
Address : 81 Soi Udomnuik 41, Sukhumvit Road, Bangchak, Prakanong, Bangkok 10260

Certificate No : 23-NDM-097
Request No : Req-2023-0902

Unit Under Calibration Details

Measurement item : Microphone Cable : 2
Manufacturer : SVANTEK Microphone Model : SV 27IS
Model : SV 104IS Microphone S/N : 85456
Serial Number : 128477 Preamplifier Model : -
ID : - Preamplifier S/N : -
Resolution : 0.1 dB Instrument Status : New

Calibration Environment and Details


Temperature : 23 °C ± 2 °C
Humidity : 50 %RH ± 20 %RH
Barometric Pressure : 1013 hPa ± 10 hPa
Received Date : 26 April 2023
Calibrated Date : 9 May 2023
Calibration Procedure : In-house method CP-NDM-01 based on IEC 61252 : 2017
Location of Calibration : Lab Acoustic


Reference Standard

| Instrument | Brand | Model | SN | Due calibration | Traceability |
|---------------------------|---------|-----------|--------|-----------------|--------------|
| Multifrequency Calibrator | Quest | Quest-cal | 188272 | 29 June 2023 | TSI |
| Standard Microphone | GRAS | 40AN | 188273 | 6 October 2023 | GRAS |
| Size Generator | SvanteK | Svante401 | 131 | 12 October 2023 | WK Electric |
| Timer | EXTech | - | 05-ACT | 20 March 2024 | TPA |

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. Noppadol Luangrat
Calibration Officer

Approved By : 
Mr. Pacit Mulayom
Calibration Engineer Supervisor
Issue Date : 9 May 2023

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.

เอกสารไม่ควบคุม

Certificate No : 23-NDM-097
Request No : Req-2023-0902

1. Absolute acoustical sensitivity

| UUC Setting | Time | | Exposure Measurement | | | UNCERTAINTY (%) | Tolerances Limit (%) |
|--------------------|------|-----|-----------------------------|-----------------------------|--------------|--------------------|----------------------------|
| | Ref | UUC | Ref (Pa ² ·h) | UUC (Pa ² ·h) | Error (%) | | |
| Calibrator Setting | (s) | (s) | (Pa ² ·h) | (Pa ² ·h) | (%) | (%) | (%) |
| 1000 Hz 114 dB | 120 | 120 | 3.19 | 3.13 | -1.88 | 3.1 | -21 ~ +26 |

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

2. Frequency weightings

| UUC Setting | Deviation from various Frequency Weighting | | UNCERTAINTY (± dB) | Tolerances Limit (± dB) |
|------------------------------|---|-----------|-----------------------|-------------------------------|
| | A (dB) | C (dB) | | |
| FAST / 60-140 STD Setting | (dB) | (dB) | (± dB) | (± dB) |
| 763 Hz | 0.4 | 0.5 | 0.40 | 2.0 |
| 125 Hz | -0.4 | 0.0 | 0.40 | 1.5 |
| 250 Hz | -0.5 | 0.0 | 0.40 | 1.5 |
| 500 Hz | -0.4 | 0.0 | 0.40 | 1.5 |
| 1000 Hz | 0.0 | 0.0 | 0.40 | - |
| 2000 Hz | 0.4 | 0.8 | 0.40 | 2.0 |
| 4000 Hz | 1.4 | 1.2 | 0.40 | 3.0 |
| 8000 Hz | -1.9 | -1.9 | 0.40 | 3.0 |

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.

เอกสารไม่ควบคุม

Certificate No : 23-NDM-097
Request No : Req-2023-0902

3. Linearity of response to steady signals

a. Sound exposure meter, linearity of response for changes of input sinusoidal signal level

| UUC Setting | Ref (dB) | FAST / A / High | | | | | | | |
|------------------|-------------|-----------------|------|------|-------|-------|-------|-------|-------|
| | | 60.0 | 80.0 | 90.0 | 100.0 | 110.0 | 120.0 | 130.0 | 140.0 |
| 3000 Hz | Level A | 99.9 | 80.1 | 90.1 | 100.0 | 110.0 | 114.0 | 120.0 | 130.0 |
| | Error | -0.1 | 0.1 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | -0.1 |
| | (dB) | | | | | | | | |
| 8000 Hz | Ref | | | 88.9 | 98.9 | 108.9 | 112.9 | 118.9 | 128.9 |
| | Level A | | | 88.9 | 98.9 | 108.9 | 112.9 | 118.9 | 128.9 |
| | Error | | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | -0.1 |
| 63 Hz | Ref | | | | | | 87.8 | 93.8 | 103.8 |
| | Level A | | | | | | 87.8 | 93.8 | 103.8 |
| | Error | | | | | | 0.0 | 0.0 | 0.0 |
| Tolerances Limit | | 1.0 | | | | | | | |
| UNCERTAINTY | | 0.3 | | | | | | | |

b. Sound exposure meter linearity of error

| UUC Setting | Time | | Exposure Measurement | | | UNCERTAINTY | Tolerance |
|--------------------|------|-----|----------------------|----------------------|-------|-------------|-----------|
| FAST A / 60-140 | Ref | UUC | Ref | UUC | Error | | Limit |
| Calibrator Setting | (s) | (s) | (Pa ² ·h) | (Pa ² ·h) | (%) | (%) | (%) |
| 1000 Hz 110 dB | 27 | 27 | 0.30 | 0.30 | 0.00 | 5.6 | -21, +26 |
| 1000 Hz 110 dB | 45 | 45 | 0.50 | 0.50 | 0.00 | | |
| 1000 Hz 110 dB | 90 | 90 | 1.00 | 1.01 | +1.00 | | |
| 1000 Hz 110 dB | 180 | 180 | 2.00 | 2.02 | +1.00 | | |
| 1000 Hz 120 dB | 36 | 36 | 4.00 | 4.03 | +0.75 | | |
| 1000 Hz 120 dB | 72 | 72 | 8.00 | 8.05 | +0.63 | 5.6 | |
| 1000 Hz 120 dB | 90 | 90 | 10.00 | 9.99 | -1.00 | | |
| 1000 Hz 120 dB | 180 | 180 | 20.00 | 19.76 | -1.20 | | |
| 1000 Hz 120 dB | 360 | 360 | 40.00 | 40.34 | +0.85 | | |
| 1000 Hz 120 dB | 720 | 720 | 80.00 | 80.49 | +0.61 | | |

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เอกสารไม่ควบคุม

Certificate No : 23-NDM-097
Request No : Req-2023-0902

4. Response to short duration

a. Response for sinusoidal signals - reference level

| UUC Setting | Time | | Exposure Measurement | | | UNCERTAINTY | Tolerances Limit |
|--------------------|------|------|----------------------|----------------------|----------------------|-------------|----------------------|
| | Ref | UUC | Ref | UUC | Error | | |
| FAST / A / 60-140 | (s) | (s) | (Pa ² ·h) | (Pa ² ·h) | (Pa ² ·h) | (%) | (Pa ² ·h) |
| Calibrator Setting | 2846 | 2846 | 1.00 | 1.00 | 0.00 | 0.032 | -0.25 ~ +0.41 |
| 4000 Hz 95 dB | | | | | | | |

b. Sound exposure meter response for series of toneburst impulses

| UUC Setting | Time | | Exposure Measurement | | | UNCERTAINTY | Tolerances Limit |
|--------------------|------|------|----------------------|----------------------|-------|-------------|------------------|
| | Ref | UUC | Ref | UUC | Error | | |
| FAST / A / 60-140 | (s) | (s) | (Pa ² ·h) | (Pa ² ·h) | (%) | (%) | (%) |
| Calibrator Setting | 2846 | 2846 | 1.00 | 1.00 | 0.00 | 3.6 | -21 ~ +26 |
| Burst 1 ms, 95 dB | 900 | 900 | 1.00 | 1.00 | 0.00 | | -29 ~ +41 |
| Burst 1 ms, 100 dB | 143 | 143 | 1.00 | 1.01 | +1.00 | | -29 ~ +41 |

5. Response to unipolar pulse

| UUC Setting | Time | | Exposure Measurement | | | UNCERTAINTY | Tolerances Limit |
|------------------------|------|-----|----------------------|----------------------|-----------|-------------|------------------|
| | Ref | UUC | Ref | UUC | Different | | |
| FAST / A / 60-140 | (s) | (s) | (Pa ² ·h) | (Pa ² ·h) | (%) | (%) | (%) |
| Calibrator Setting | 29 | 29 | 10.37 | 10.37 | 0.00 | 3.7 | -21 ~ +26 |
| Continuous Rectangle + | | | | | | | |
| Continuous Rectangle - | | | | | | | |

* Indicates non accredited

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.

เอกสารไม่ควบคุม

Certificate of Calibration

Customer

Name : UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.
Address : 81 Soi Udomsak 41, Sukhumvit Road, Bangchak, Prakanong, Bangkok 10260

Certificate No : 23-NDM-096
Request No : Req-2023-0902

Unit Under Calibration Details

Measurement item : Noise Dosimeter
Manufacturer : SVANTEK
Model : SV 1045
Serial Number : 128475
ID : -
Resolution : 0.1 dB
Microphone Class : 2
Microphone Model : SV 2715
Microphone S/N : 68312
Preamplifier Model : -
Preamplifier S/N : -
Instrument Status : New

Calibration Environment and Details


Temperature : 23 °C ± 2 °C
Humidity : 50 %RH ± 20 %RH
Barometric Pressure : 1013 hPa ± 10 hPa
Received Date : 25 April 2023
Calibrated Date : 9 May 2023
Calibration Procedure : In-house method CP-NDM-01 based on IEC 61252 : 2017
Location of Calibration : Lab Acoustic


Reference Standard

| Instrument | Brand | Model | SN | Due calibration | Traceability |
|---------------------------|---------|-----------|--------|-----------------|--------------|
| Multifrequency Calibrator | Quint | Quint-cal | 188272 | 29 June 2023 | TSI |
| Standard Microphone | GRAS | 40AN | 188273 | 6 October 2023 | GRAS |
| Sine Generator | Scantek | Scan401 | 131 | 12 October 2023 | WK Electric |
| Timer | EXTECH | - | 05-ACT | 20 March 2024 | TPA |

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
Calibration Officer

Approved By : 
Mr. Pachi Mahavorn
Calibration Engineer Supervisor
Issue Date : 9 May 2023

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.

เอกสารไม่ควบคุม

Certificate No : 23-NDM-096
Request No : Req-2023-0902

1. Absolute acoustical sensitivity

| UUC Setting | Time | | Exposure Measurement | | | UNCERTAINTY | Tolerances Limit |
|--------------------|------|-----|----------------------|----------------------|-------|-------------|------------------|
| | Ref | UUC | Ref | UUC | Error | | |
| FAST / A / 60-140 | (s) | (s) | (Pa ² ·h) | (Pa ² ·h) | (%) | (%) | (%) |
| Calibrator Setting | 120 | 120 | 3.19 | 3.13 | -1.88 | 3.1 | -21 ~ +26 |
| 1000 Hz 114 dB | | | | | | | |

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

2. Frequency weightings

| UUC Setting | Deviation from various Frequency Weighting | | UNCERTAINTY (± dB) | Tolerances Limit (± dB) |
|---------------|--|------|-----------------------|----------------------------|
| | A | C | | |
| FAST / 60-140 | (dB) | (dB) | | |
| STD Setting | 0.1 | 0.2 | 0.40 | 2.0 |
| *63 Hz | -0.7 | -0.3 | 0.40 | 1.5 |
| 125 Hz | -0.6 | -0.1 | 0.40 | 1.5 |
| 250 Hz | -0.4 | 0.0 | 0.40 | 1.5 |
| 500 Hz | 0.0 | 0.0 | 0.40 | - |
| 1000 Hz | 0.5 | 0.9 | 0.40 | 2.0 |
| 2000 Hz | 1.8 | 1.6 | 0.40 | 3.0 |
| 8000 Hz | -2.2 | -2.2 | 0.40 | 5.0 |

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.

เอกสารไม่ควบคุม

Certificate No : 23-NDM-096
Request No : Req-2023-0902

3. Linearity of response to steady signals

a. Sound exposure meter, linearity of response for changes of input sinusoidal signal level

| UUC Setting | | FAST / A / High | | | | | | | | | | | | |
|------------------|---------|-----------------|------|------|------|-------|-------|-------|-------|-------|-------|-------|-------|--|
| 1000 Hz | Ref | (dB) | 60.0 | 80.0 | 90.0 | 100.0 | 110.0 | 114.0 | 120.0 | 130.0 | 140.0 | | | |
| | Level A | (dB) | 59.9 | 80.2 | 90.2 | 100.2 | 110.1 | 114.0 | 120.1 | 130.0 | 140.0 | | | |
| | Error | (dB) | -0.1 | 0.2 | 0.2 | 0.2 | 0.1 | 0.0 | 0.1 | 0.0 | 0.0 | | | |
| 8000 Hz | Ref | (dB) | | | | 88.9 | 96.9 | 108.9 | 112.9 | 118.9 | 128.9 | 138.9 | | |
| | Level A | (dB) | | | | | | | | | | | | |
| | Error | (dB) | | | | | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | -0.1 | |
| 63 Hz | Ref | (dB) | | | | | | | | 87.8 | 93.8 | 103.8 | 113.8 | |
| | Level A | (dB) | | | | | | | | 87.8 | 93.8 | 103.8 | 113.8 | |
| | Error | (dB) | | | | | | | | 0.0 | 0.0 | 0.0 | 0.0 | |
| Tolerances Limit | | (±dB) | 1.0 | | | | | | | | | | | |
| UNCERTAINTY | | (±dB) | 0.3 | | | | | | | | | | | |

b. Sound exposure meter linearity of error

| UUC Setting | Time | | Exposure Measurement | | | UNCERTAINTY | Tolerances Limit |
|--------------------|------|-----|----------------------|----------------------|-------|-------------|------------------|
| | Ref | UUC | Ref | UUC | Error | | |
| FAST / A / 60-140 | (s) | (s) | (Pa ² ·h) | (Pa ² ·h) | (%) | (%) | (%) |
| Calibrator Setting | 27 | 27 | 0.30 | 0.30 | 0.00 | 5.6 | -21 ~ +26 |
| 1000 Hz 119 dB | 45 | 45 | 0.30 | 0.30 | 0.00 | | |
| 1000 Hz 110 dB | 90 | 90 | 1.00 | 0.99 | -1.00 | | |
| 1000 Hz 110 dB | 180 | 180 | 2.00 | 1.98 | -1.00 | | |
| 1000 Hz 120 dB | 36 | 36 | 4.00 | 3.94 | -1.50 | | |
| 1000 Hz 120 dB | 72 | 72 | 8.00 | 7.87 | -1.63 | | |
| 1000 Hz 120 dB | 90 | 90 | 10.00 | 9.90 | -1.00 | | |
| 1000 Hz 120 dB | 180 | 180 | 20.00 | 19.76 | -1.20 | 5.6 | -21 ~ +26 |
| 1000 Hz 120 dB | 360 | 360 | 40.00 | 39.42 | -1.45 | | |
| 1000 Hz 120 dB | 720 | 720 | 80.00 | 78.66 | -1.68 | | |

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.

เอกสารไม่ควบคุม

Certificate No : 23-NDM-096
Request No : Req-2023-0902

4. Response to short duration
a. Response for sinusoidal signals - reference level

| UUC Setting | Time | | Exposure Measurement | | | UNCERTAINTY | Tolerances Limit |
|--------------------|------|------|----------------------|----------------------|----------------------|-------------|----------------------|
| | Ref | UUC | Ref | UUC | Error | | |
| FAST / A / 60-140 | (s) | (s) | (Pa ² /h) | (Pa ² /h) | (Pa ² /h) | (%) | (Pa ² /h) |
| Calibrator Setting | 60 | 60 | 1.00 | 1.00 | 0.00 | 0.052 | -0.29 ~ +0.41 |
| 4000 Hz 95 dB | 2846 | 2846 | 1.00 | 1.00 | 0.00 | 0.052 | -0.29 ~ +0.41 |

b. Sound exposure meter response for series of toneburst impulses

| UUC Setting | Time | | Exposure Measurement | | | UNCERTAINTY | Tolerances Limit |
|--------------------|------|------|----------------------|----------------------|-------|-------------|------------------|
| | Ref | UUC | Ref | UUC | Error | | |
| FAST / A / 60-140 | (s) | (s) | (Pa ² /h) | (Pa ² /h) | (%) | (%) | (%) |
| Calibrator Setting | 60 | 60 | 1.00 | 1.00 | 0.00 | 5.6 | -21 ~ +26 |
| Burst 1 ms, 95 dB | 2846 | 2846 | 1.00 | 1.00 | 0.00 | 5.6 | -21 ~ +26 |
| Burst 1 ms, 100 dB | 900 | 900 | 1.00 | 1.00 | 0.00 | 5.6 | -21 ~ +26 |
| Burst 1 ms, 106 dB | 143 | 143 | 1.00 | 1.01 | +1.00 | 5.6 | -21 ~ +26 |

5. Response to unipolar pulse

| UUC Setting | Time | | Exposure Measurement | | | UNCERTAINTY | Tolerances Limit |
|------------------------|------|-----|----------------------|----------------------|-----------|-------------|------------------|
| | Ref | UUC | Ref | UUC | Different | | |
| FAST / A / 60-140 | (s) | (s) | (Pa ² /h) | (Pa ² /h) | (%) | (%) | (%) |
| Calibrator Setting | 60 | 60 | 1.00 | 1.00 | 0.00 | 3.7 | -21 ~ +26 |
| Continuous Rectangle + | 29 | 29 | 10.13 | 10.13 | 0.00 | 3.7 | -21 ~ +26 |
| Continuous Rectangle - | 29 | 29 | 10.13 | 10.13 | 0.00 | 3.7 | -21 ~ +26 |

* Indicates non accredited

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.

เอกสารไม่ควบคุม

Certificate of Calibration

Customer

Name : UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.
Address : 81 Soi Udomsak 41, Sukhumvit Road, Bangchak, Prakanong, Bangkok 10260

Certificate No : 23-NDM-189
Request No : Req-2023-1549

Unit Under Calibration Details

Measurement item : Noise Dosimeter
Manufacturer : SVANTEK
Model : SV 104S
Serial Number : 67628
ID : UAEFPM1072561
Resolution : 0.1 dB
Calibration Environment and Details
Temperature : 23 °C ± 2 °C
Humidity : 50 %RH ± 20 %RH
Barometric Pressure : 1013 kPa ± 10 kPa
Received Date : 21 July 2023
Calibrated Date : 11 August 2023
Calibration Procedure : In-house method CP-NDM-01 based on IEC 61252:2017
Location of Calibration : Lab Acoustic


Calibration Environment and Details


Microphone Class : 2
Microphone Model : SV 2T05
Microphone S/N : 68622
Preamplifier Model : -
Preamplifier S/N : -
Instrument Status : Used

| Instrument | Brand | Model | SN | Due calibration | Traceability |
|---------------------------|--------|-----------|--------|-----------------|--------------|
| Multifrequency Calibrator | Quest | Quest-val | 188272 | 25 July 2024 | TSI |
| Standard Microphone | GRAS | 40AN | 188273 | 6 October 2023 | GRAS |
| Sine Generator | Svante | Svante401 | 131 | 12 October 2023 | WK Electric |
| Timer | EXTech | - | 05-ACT | 20 March 2024 | TPA |

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 Laungart
Calibration Officer

Approved By : 
Mr. Pacit Mathavorn
Calibration Engineer Supervisor
Issue Date : 11 August 2023

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.

เอกสารไม่ควบคุม

Certificate No : 23-NDM-189
Request No : Req-2023-1549

1. Absolute acoustical sensitivity

| UUC Setting | Time | | Exposure Measurement | | | UNCERTAINTY | Tolerances Limit |
|--------------------|------|-----|----------------------|----------------------|-------|-------------|------------------|
| | Ref | UUC | Ref | UUC | Error | | |
| FAST / A / 60-140 | (s) | (s) | (Pa ² /h) | (Pa ² /h) | (%) | (%) | (%) |
| Calibrator Setting | 120 | 120 | 3.18 | 3.13 | -1.57 | 3.1 | -21 ~ +26 |
| 1000 Hz 114 dB | 120 | 120 | 3.18 | 3.13 | -1.57 | 3.1 | -21 ~ +26 |

Note : Absolute sensitivity was established by the use of Sound Calibrator Brand SVANTEK, Model SV 35A, SN: 38079

2. Frequency weightings

| UUC Setting | Deviation from various Frequency Weighting | | UNCERTAINTY | Tolerances Limit |
|---------------|--|------|-------------|------------------|
| | A | C | | |
| FAST / 60-140 | (dB) | (dB) | (± dB) | (± dB) |
| STD Setting | 0.3 | 0.3 | 0.40 | 2.0 |
| 63 Hz | -0.4 | -0.1 | 0.40 | 1.5 |
| 125 Hz | -0.4 | 0.3 | 0.40 | 1.5 |
| 250 Hz | 0.0 | 0.4 | 0.40 | 1.5 |
| 500 Hz | 0.0 | 0.4 | 0.40 | 1.5 |
| 1000 Hz | 0.0 | 0.0 | 0.40 | 1.5 |
| 2000 Hz | 0.2 | 0.6 | 0.40 | 2.0 |
| 4000 Hz | 1.4 | 1.2 | 0.40 | 3.0 |
| 8000 Hz | -1.9 | -1.8 | 0.40 | 5.0 |

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.

เอกสารไม่ควบคุม

Certificate No : 23-NDM-189
Request No : Req-2023-1549

3. Linearity of response to steady signals

a. Sound exposure meter, linearity of response for changes of input sinusoidal signal level

| UUC Setting | FAST / A / High | | | | | | | | | | | | | |
|------------------|-----------------|------|------|------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| | Ref | (dB) | 60.0 | 80.0 | 90.0 | 100.0 | 110.0 | 114.0 | 120.0 | 130.0 | 140.0 | 150.0 | 160.0 | 170.0 |
| 1000 Hz | Level A | (dB) | 60.3 | 80.3 | 90.1 | 100.0 | 110.0 | 114.0 | 120.0 | 130.0 | 140.0 | 150.0 | 160.0 | 170.0 |
| | Error | (dB) | 0.3 | 0.3 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 8000 Hz | Ref | (dB) | 88.9 | 98.9 | 108.9 | 118.9 | 128.9 | 138.9 | 148.9 | 158.9 | 168.9 | 178.9 | 188.9 | 198.9 |
| | Level A | (dB) | 88.9 | 98.9 | 108.9 | 118.9 | 128.9 | 138.9 | 148.9 | 158.9 | 168.9 | 178.9 | 188.9 | 198.9 |
| | Error | (dB) | 0.1 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 63 Hz | Ref | (dB) | 87.8 | 93.8 | 103.8 | 113.8 | 123.8 | 133.8 | 143.8 | 153.8 | 163.8 | 173.8 | 183.8 | 193.8 |
| | Level A | (dB) | 87.8 | 93.8 | 103.8 | 113.8 | 123.8 | 133.8 | 143.8 | 153.8 | 163.8 | 173.8 | 183.8 | 193.8 |
| | Error | (dB) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Tolerances Limit | (±dB) | | 1.0 | | | | | | | | | | | |
| UNCERTAINTY | (±dB) | | 0.3 | | | | | | | | | | | |

b. Sound exposure meter linearity of error

| UUC Setting | Time | | Exposure Measurement | | | UNCERTAINTY | Tolerances Limit |
|--------------------|------|-----|----------------------|----------------------|-------|-------------|------------------|
| | Ref | UUC | Ref | UUC | Error | | |
| FAST / A / 60-140 | (s) | (s) | (Pa ² /h) | (Pa ² /h) | (%) | (%) | (%) |
| Calibrator Setting | 60 | 60 | 1.00 | 1.00 | 0.00 | 5.6 | -21 ~ +26 |
| 1000 Hz 110 dB | 27 | 27 | 0.30 | 0.30 | 0.00 | 5.6 | -21 ~ +26 |
| 1000 Hz 110 dB | 45 | 45 | 0.50 | 0.50 | 0.00 | 5.6 | -21 ~ +26 |
| 1000 Hz 110 dB | 90 | 90 | 1.00 | 1.01 | +1.00 | 5.6 | -21 ~ +26 |
| 1000 Hz 110 dB | 180 | 180 | 2.00 | 2.02 | +1.00 | 5.6 | -21 ~ +26 |
| 1000 Hz 120 dB | 36 | 36 | 4.00 | 4.03 | +0.75 | 5.6 | -21 ~ +26 |
| 1000 Hz 120 dB | 72 | 72 | 8.00 | 8.05 | +0.63 | 5.6 | -21 ~ +26 |
| 1000 Hz 120 dB | 90 | 90 | 10.00 | 10.13 | +1.30 | 5.6 | -21 ~ +26 |
| 1000 Hz 120 dB | 180 | 180 | 20.00 | 20.22 | +1.10 | 5.6 | -21 ~ +26 |
| 1000 Hz 120 dB | 360 | 360 | 40.00 | 40.34 | +0.85 | 5.6 | -21 ~ +26 |
| 1000 Hz 120 dB | 720 | 720 | 80.00 | 80.49 | +0.61 | 5.6 | -21 ~ +26 |

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.

เอกสารไม่ควบคุม

Certificate No : 23-NDM-189
Request No : Req-2023-1549

4. Response to short duration
a. Response for sinusoidal signals - reference level

| UUC Setting | Time | | Exposure Measurement | | | UNCERTAINTY | Tolerances |
|--------------------|------|------|----------------------|----------------------|-------|----------------------|---------------|
| FAST / A / 60-140 | Ref | UUC | Ref | UUC | Error | (Pa ² /h) | Limit |
| Calibrator Setting | (s) | (s) | (Pa ² /h) | (Pa ² /h) | (%) | (%) | (%) |
| 4000 Hz 95 dB | 2846 | 2846 | 1.00 | 0.98 | -0.02 | 0.052 | +0.29 - +0.41 |

b. Sound exposure meter response for series of toneburst impulses

| UUC Setting | Time | | Exposure Measurement | | | UNCERTAINTY | Tolerances |
|--------------------|------|------|----------------------|----------------------|-------|-------------|------------|
| FAST / A / 60-140 | Ref | UUC | Ref | UUC | Error | (%) | Limit |
| Calibrator Setting | (s) | (s) | (Pa ² /h) | (Pa ² /h) | (%) | (%) | (%) |
| Burst 1 ms, 95 dB | 2846 | 2846 | 1.00 | 0.98 | -2.00 | 3.6 | -21 - +26 |
| Burst 1 ms, 100 dB | 900 | 900 | 1.00 | 0.98 | -2.00 | | -29 - +41 |
| Burst 1 ms, 108 dB | 143 | 143 | 1.00 | 0.99 | -1.00 | | -29 - +41 |

5. Response to unipolar pulse

| UUC Setting | Time | | Exposure Measurement | | | UNCERTAINTY | Tolerances |
|------------------------|------|-----|----------------------|----------------------|-----------|-------------|------------|
| FAST / A / 60-140 | Ref | UUC | Ref | UUC | Different | (%) | Limit |
| Calibrator Setting | (s) | (s) | (Pa ² /h) | (Pa ² /h) | (%) | (%) | (%) |
| Continuous Rectangle + | 30 | | 10.13 | 10.13 | 0.00 | 3.7 | -21 - +26 |
| Continuous Rectangle - | | | 10.13 | | | | |

* Indicates non accredited

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.

เอกสารไม่ควบคุม

Certificate of Calibration

Customer
Name : UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.
Address : 81 Sor Udomsak 41, Sukhumvit Road, Bangkok, Prakanong, Bangkok 10260
Certificate No : 23-NDM-109
Request No : Req-2023-0966

Unit Under Calibration Details

Measurement item : Noise Dosimeter
Manufacturer : SVANTEK
Model : SV 104
Serial Number : 117721
ID : -
Resolution : 0.1 dB
Microphone Class : 2
Microphone Model : SV 27
Microphone S/N : 73969
Preamplifier Model : -
Preamplifier S/N : -
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 : 4 May 2023
Calibrated Date : 15 May 2023
Calibration Procedure : In-house method CP-NDM-01 based on IEC 61252 : 2017
Location of Calibration : Lab Acoustic

| Instrument | Brand | Model | SN. | Due calibration | Traceability |
|---------------------------|----------|-----------|--------|-----------------|--------------|
| Multifrequency Calibrator | Quest | Quest-cal | 18K272 | 29 June 2023 | TSI |
| Standard Microphone | GRAS | 40AN | 18K273 | 6 October 2023 | GRAS |
| Sine Generator | Svanteck | Svan401 | 131 | 12 October 2023 | WK Electric |
| Timer | EXTech | - | 05-ACT | 20 March 2024 | TPA |

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. Noppadol Luangrat
Calibration Officer

Approved By : 
Mr. Pacit Muthavorn
Calibration Engineer Supervisor
Issue Date : 15 May 2023

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.

เอกสารไม่ควบคุม

Certificate No : 23-NDM-109
Request No : Req-2023-0966

1. Absolute acoustical sensitivity

| UUC Setting | Time | | Exposure Measurement | | | UNCERTAINTY | Tolerances |
|--------------------|------|-----|----------------------|----------------------|-------|-------------|------------|
| FAST / A / 55-140 | Ref | UUC | Ref | UUC | Error | (%) | Limit |
| Calibrator Setting | (s) | (s) | (Pa ² /h) | (Pa ² /h) | (%) | (%) | (%) |
| 1000 Hz 114 dB | 120 | 120 | 3.19 | 3.20 | +0.31 | 3.1 | -21 - +26 |

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

2. Frequency weightings

| UUC Setting | Deviation from various Frequency Weighting | | UNCERTAINTY | Tolerances |
|---------------|--|------|-------------|------------|
| FAST / 55-140 | A | C | (± dB) | Limit |
| STD Setting | (dB) | (dB) | (± dB) | (± dB) |
| 763 Hz | -0.2 | -0.1 | 0.40 | 2.0 |
| 125 Hz | -0.1 | 0.4 | 0.40 | 1.5 |
| 250 Hz | -0.2 | 0.3 | 0.40 | 1.5 |
| 500 Hz | -0.1 | 0.3 | 0.40 | 1.5 |
| 1000 Hz | 0.0 | 0.0 | 0.40 | - |
| 2000 Hz | 0.3 | 0.7 | 0.40 | 2.0 |
| 4000 Hz | 2.5 | 2.6 | 0.40 | 3.0 |
| 8000 Hz | -3.5 | -3.6 | 0.40 | 5.0 |

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.

เอกสารไม่ควบคุม

Certificate No : 23-NDM-109
Request No : Req-2023-0966

3. Linearity of response to steady signals
a. Sound exposure meter, linearity of response for changes of input sinusoidal signal level

| UUC Setting | FAST / A / High | | | | | | | | | | | |
|------------------------|-----------------|------|------|------|-------|-------|-------|-------|-------|-------|-------|-------|
| Ref | (dB) | 55.0 | 80.0 | 90.0 | 100.0 | 110.0 | 114.0 | 120.0 | 130.0 | 140.0 | | |
| 1000 Hz | Level A | (dB) | 54.6 | 79.9 | 89.9 | 100.0 | 110.0 | 114.0 | 120.0 | 129.9 | 139.9 | |
| | Error | (dB) | -0.4 | -0.1 | -0.1 | 0.0 | 0.0 | 0.0 | 0.0 | -0.1 | -0.1 | |
| | Ref | (dB) | 88.9 | 98.9 | 108.9 | 112.9 | 118.9 | 128.9 | 138.9 | | | |
| 8000 Hz | Level A | (dB) | | | | 89.0 | 98.9 | 108.9 | 112.9 | 118.9 | 128.9 | 138.9 |
| | Error | (dB) | | | | -0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | -0.1 |
| | Ref | (dB) | | | | 87.8 | 93.8 | 103.8 | 113.8 | | | |
| 63 Hz | Level A | (dB) | | | | | | | | 87.8 | 93.8 | 103.8 |
| | Error | (dB) | | | | | | | | 0.0 | 0.1 | 0.1 |
| Tolerances Limit (±dB) | | | | | | | | | | | | 1.0 |
| UNCERTAINTY (±dB) | | | | | | | | | | | | 0.3 |

b. Sound exposure meter linearity of error

| UUC Setting | | Time | | Exposure Measurement | | | UNCERTAINTY | Tolerances |
|--------------------|-----|------|----------------------|----------------------|-------|-----|-------------|------------|
| FAST / A / 55-140 | Ref | UUC | Ref | UUC | Error | | | |
| Calibrator Setting | (s) | (s) | (Pa ² /h) | (Pa ² /h) | (%) | (%) | (%) | |
| 1000 Hz 110 dB | 27 | 27 | 0.30 | 0.30 | 0.00 | 5.8 | -21, +26 | |
| 1000 Hz 110 dB | 45 | 45 | 0.50 | 0.50 | 0.00 | | | |
| 1000 Hz 110 dB | 90 | 90 | 1.00 | 0.99 | -1.00 | | | |
| 1000 Hz 110 dB | 180 | 180 | 2.00 | 1.98 | -1.00 | | | |
| 1000 Hz 120 dB | 36 | 36 | 4.00 | 4.03 | +0.75 | | | |
| 1000 Hz 120 dB | 72 | 72 | 8.00 | 8.08 | +0.63 | 5.6 | | |
| 1000 Hz 120 dB | 90 | 90 | 10.00 | 10.13 | +1.30 | | | |
| 1000 Hz 120 dB | 180 | 180 | 20.00 | 20.22 | +1.10 | | | |
| 1000 Hz 120 dB | 360 | 360 | 40.00 | 40.34 | +0.85 | | | |
| 1000 Hz 120 dB | 720 | 720 | 80.00 | 80.49 | +0.61 | | | |

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.

เอกสารไม่ควบคุม

Certificate No : 23-NDM-109
Request No : Req-2023-0966

4. Response to short duration

a. Response for sinusoidal signals - reference level

| UUC Setting | Time | | Exposure Measurement | | | UNCERTAINTY (%) | Tolerances Limit (%) |
|--------------------|------|------|----------------------------|----------------------------|------------------------------|--------------------|----------------------------|
| | Ref | UUC | Ref (Pa ² h) | UUC (Pa ² h) | Error (Pa ² h) | | |
| Calibrator Setting | (s) | (s) | (Pa ² h) | (Pa ² h) | (Pa ² h) | (%) | (%) |
| 4000 Hz 95 dB | 2846 | 2846 | 1.00 | 1.00 | 0.00 | 0.052 | -0.29 ~ +0.41 |

b. Sound exposure meter response for series of toneburst impulses

| UUC Setting | Time | | Exposure Measurement | | | UNCERTAINTY (%) | Tolerances Limit (%) |
|--------------------|------|------|----------------------------|----------------------------|--------------|--------------------|----------------------------|
| | Ref | UUC | Ref (Pa ² h) | UUC (Pa ² h) | Error (%) | | |
| Calibrator Setting | (s) | (s) | (Pa ² h) | (Pa ² h) | (%) | (%) | (%) |
| Burst 1 ms, 95 dB | 2846 | 2846 | 1.00 | 1.00 | 0.00 | 5.6 | -21 ~ +26 |
| Burst 1 ms, 100 dB | 900 | 900 | 1.00 | 1.00 | 0.00 | | -29 ~ +41 |
| Burst 1 ms, 108 dB | 143 | 143 | 1.00 | 1.01 | +1.00 | | -29 ~ +41 |

5. Response to unipolar pulse

| UUC Setting | Time | | Exposure Measurement | | UNCERTAINTY (%) | Tolerances Limit (%) |
|------------------------|------|-----|----------------------------|------------------|--------------------|----------------------------|
| | Ref | UUC | Ref (Pa ² h) | Different (%) | | |
| Calibrator Setting | (s) | (s) | (Pa ² h) | (%) | (%) | (%) |
| Continuous Rectangle + | 29 | | 10.13 | +2.37 | 3.7 | -21 ~ +26 |
| Continuous Rectangle - | | | 10.37 | | | |

* Indicates not accredited

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 Issuance Institution.

เอกสารไม่ควรถูก

Certificate of Calibration

Customer

Name : UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.
Address : 81 Soi Udomsak 41, Sukhumvit Road, Bangkok, Prakanong, Bangkok 10260

Certificate No : 23-NDM-095
Request No : Req-2023-0902

Unit Under Calibration Details

Measurement item : Noise Dosimeter
Microphone Class : 2
Manufacturer : SVANTEK
Microphone Model : SV 2705
Model : SV 104S
Microphone S/N : 133728
Serial Number : 128474
Preamplifier S/N : -
ID : -
Preamplifier S/N : -
Resolution : 0.1 dB
Instrument Status : New

Calibration Environment and Details


Temperature : 23 °C ± 2 °C
Humidity : 50 %RH ± 20 %RH
Barometric Pressure : 1013 hPa ± 10 hPa
Received Date : 23 April 2023
Calibrated Date : 9 May 2023
Calibration Procedure : In-house method CP-NDM-01 based on IEC 61252 : 2017


Location of Calibration : Lab Acoustic

| Reference Standard | Instrument | Brand | Model | SN | Our calibration | Traceability |
|---------------------------|---------------------|---------|-----------|--------|-----------------|--------------|
| Multifrequency Calibrator | Quant | Quant | Quant-cal | 188272 | 29 June 2023 | TSI |
| | Standard Microphone | GRAS | 40AN | 188273 | 6 October 2023 | GRAS |
| Signal Generator | SvanteK | SvanteK | Svan401 | 131 | 12 October 2023 | WK Electric |
| | Timer | EXTech | - | 05-ACT | 20 March 2024 | TPA |

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 Luangrat
Calibration Officer

Approved By : 
Mr. Pachi Muthavorn
Calibration Engineer Supervisor
Issue Date : 9 May 2023

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Issuance Institution.

เอกสารไม่ควรถูก

Certificate No : 23-NDM-095
Request No : Req-2023-0902

1. Absolute acoustical sensitivity

| UUC Setting | Time | | Exposure Measurement | | | UNCERTAINTY (%) | Tolerances Limit (%) |
|--------------------|------|-----|----------------------------|----------------------------|--------------|--------------------|----------------------------|
| | Ref | UUC | Ref (Pa ² h) | UUC (Pa ² h) | Error (%) | | |
| Calibrator Setting | (s) | (s) | (Pa ² h) | (Pa ² h) | (%) | (%) | (%) |
| 1000 Hz 114 dB | 120 | 120 | 3.19 | 3.20 | +0.31 | 3.1 | -21 ~ +26 |

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

2. Frequency weightings

| UUC Setting | Deviation from various Frequency Weighting | | UNCERTAINTY (± dB) | Tolerances Limit (± dB) |
|---------------|---|------|-----------------------|-------------------------------|
| | A | C | | |
| FAST / 60-140 | (dB) | (dB) | (± dB) | (± dB) |
| STD Setting | (dB) | (dB) | (± dB) | (± dB) |
| *63 Hz | 0.1 | 0.2 | 0.40 | 2.0 |
| 125 Hz | -0.2 | 0.2 | 0.40 | 1.5 |
| 250 Hz | -0.2 | 0.3 | 0.40 | 1.5 |
| 500 Hz | -0.1 | 0.3 | 0.40 | 1.5 |
| 1000 Hz | 0.0 | 0.0 | 0.40 | - |
| 2000 Hz | -0.1 | 0.3 | 0.40 | 2.0 |
| 4000 Hz | 0.0 | -0.2 | 0.40 | 3.0 |
| 8000 Hz | -0.7 | -0.8 | 0.40 | 5.0 |

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Issuance Institution.

เอกสารไม่ควรถูก

Certificate No : 23-NDM-095
Request No : Req-2023-0902

3. Linearity of response to steady signals

a. Sound exposure meter, linearity of response for changes of input sinusoidal signal level

| a. Sound exposure measure, linearity of response for changes of input sinusoidal signal level | | | | | | | | | | | | | |
|---|---------|-------|-----------------|------|-------|-------|-------|-------|-------|-------|-------|--|--|
| EUC Setting | | | FAST / A / High | | | | | | | | | | |
| 1000 Hz | Ref | (dB) | 60.0 | 80.8 | 90.0 | 100.0 | 110.0 | 114.0 | 120.0 | 130.0 | 140.0 | | |
| | Level A | (dB) | 59.9 | 80.2 | 90.1 | 100.0 | 110.0 | 114.0 | 120.0 | 130.0 | 140.0 | | |
| | Error | (dB) | -0.1 | 0.2 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | |
| | | (dB) | 88.9 | 98.9 | 108.9 | 112.9 | 118.9 | 128.9 | 138.9 | 148.9 | 158.9 | | |
| 8000 Hz | Ref | (dB) | | | 89.0 | 98.9 | 108.9 | 112.9 | 118.9 | 128.9 | 138.9 | | |
| | Level A | (dB) | | | 89.0 | 98.9 | 108.9 | 112.9 | 118.9 | 128.9 | 138.9 | | |
| | Error | (dB) | | | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | |
| | | (dB) | | | 87.8 | 93.8 | 103.8 | 113.8 | 123.8 | 133.8 | 143.8 | | |
| 63 Hz | Ref | (dB) | | | | | | 87.8 | 93.8 | 103.8 | 113.8 | | |
| | Level A | (dB) | | | | | | 87.8 | 93.8 | 103.8 | 113.8 | | |
| | Error | (dB) | | | | | | 0.0 | 0.0 | 0.0 | 0.0 | | |
| | | (dB) | | | | | | 0.0 | 0.0 | 0.0 | 0.0 | | |
| Tolerances Limit | | (±dB) | 1.0 | | | | | | | | | | |
| UNCERTAINTY | | (±dB) | 0.3 | | | | | | | | | | |

b. Sound exposure meter linearity of error

| UUC Setting | Time | | Exposure Measurement | | | UNCERTAINTY (%) | Tolerances Limit (%) |
|--------------------|------|-----|----------------------------|----------------------------|--------------|--------------------|----------------------------|
| | Ref | UUC | Ref (Pa ² h) | UUC (Pa ² h) | Error (%) | | |
| Calibrator Setting | (s) | (s) | (Pa ² h) | (Pa ² h) | (%) | (%) | (%) |
| 1000 Hz 110 dB | 27 | 27 | 0.30 | 0.30 | 0.00 | 5.6 | -21 ~ +26 |
| 1000 Hz 110 dB | 45 | 45 | 0.50 | 0.50 | 0.00 | | |
| 1000 Hz 110 dB | 90 | 90 | 1.00 | 0.99 | -1.00 | | |
| 1000 Hz 110 dB | 180 | 180 | 2.00 | 1.98 | -1.00 | | |
| 1000 Hz 120 dB | 36 | 36 | 4.00 | 4.03 | +0.75 | | |
| 1000 Hz 120 dB | 72 | 72 | 8.00 | 8.05 | +0.63 | 5.6 | -21 ~ +26 |
| 1000 Hz 120 dB | 90 | 90 | 10.00 | 10.13 | +1.30 | | |
| 1000 Hz 120 dB | 180 | 180 | 20.00 | 20.22 | +1.10 | | |
| 1000 Hz 120 dB | 360 | 360 | 40.00 | 40.34 | +0.85 | | |
| 1000 Hz 120 dB | 720 | 720 | 80.00 | 80.49 | +0.61 | | |

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Issuance Institution.

เอกสารไม่ควรถูก

Certificate No : 23-NDM-095
Request No : Req-2023-0902

4. Response to short duration

a. Response for sinusoidal signals - reference level

| UUC Setting | Time | | Exposure Measurement | | | UNCERTAINTY | Tolerances Limit |
|--------------------|------|------|----------------------|----------------------|----------------------|-------------|----------------------|
| | Ref | UUC | Ref | UUC | Error | | |
| FAST / A / 60-140 | (s) | (s) | (Pa ² ·h) | (Pa ² ·h) | (Pa ² ·h) | (%) | (Pa ² ·h) |
| Calibrator Setting | | | | | | | |
| 4000 Hz 95 dB | 2846 | 2846 | 1.00 | 0.98 | -0.02 | 0.052 | -0.20 ~ +0.41 |

b. Sound exposure meter response for series of toneburst impulses

| UUC Setting | Time | | Exposure Measurement | | | UNCERTAINTY | Tolerances Limit |
|--------------------|------|------|----------------------|----------------------|-------|-------------|------------------|
| | Ref | UUC | Ref | UUC | Error | | |
| FAST / A / 60-140 | (s) | (s) | (Pa ² ·h) | (Pa ² ·h) | (%) | (%) | (%) |
| Calibrator Setting | | | | | | | |
| Burst 1 ms, 95 dB | 2846 | 2846 | 1.00 | 0.98 | -2.00 | 3.6 | -21 ~ +26 |
| Burst 1 ms, 100 dB | 900 | 900 | 1.00 | 0.98 | -2.00 | | -29 ~ +41 |
| Burst 1 ms, 108 dB | 143 | 143 | 1.00 | 0.99 | -1.00 | | -29 ~ +41 |

5. Response to unipolar pulse

| UUC Setting | Time | | Exposure Measurement | | | UNCERTAINTY | Tolerances Limit |
|------------------------|------|-----|----------------------|----------------------|-----------|-------------|------------------|
| | Ref | UUC | Ref | UUC | Different | | |
| FAST / A / 60-140 | (s) | (s) | (Pa ² ·h) | (Pa ² ·h) | (%) | (%) | (%) |
| Calibrator Setting | | | | | | | |
| Continuous Rectangle + | 28 | | 10.33 | | 0.00 | 3.7 | -21 ~ +26 |
| Continuous Rectangle - | | | 10.33 | | | | |

* Indicates non accredited

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.

เอกสารไม่ควรถูก

Certificate of Calibration

Customer

Name : UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.
Address : 81 Soi Udomsak 41, Sukhumvit Road, Bangkok, Prakanong, Bangkok 10240

Certificate No : 23-NDM-093
Request No : Req-2023-0902

Unit Under Calibration Details

Measurement item : Noise Dosimeter
Microphone Class : 2
Manufacturer : SVANTER
Microphone Model : SV 27S
Model : SV 104S
Microphone S/N : 68643
Serial Number : 128472
Preamplifier Model : -
ID : -
Preamplifier S/N : -
Resolution : 0.1 dB
Instrument Status : New

Calibration Environment and Details


Temperature : 23 °C ± 2 °C
Humidity : 50 %RH ± 20 %RH
Barometric Pressure : 1013 hPa ± 10 hPa
Received Date : 23 April 2023
Calibrated Date : 9 May 2023
Calibration Procedure : In-house method CP-NDM-01 based on IEC 61252 : 2017
Location of Calibration : Lab Acoustic


Reference Standard

| Instrument | Brand | Model | SN | Due calibration | Traceability |
|---------------------------|---------|----------|--------|-----------------|--------------|
| Multifrequency Calibrator | Qunt | Qunt-cal | 188272 | 29 June 2023 | TSI |
| Standard Microphone | GRAS | 40AN | 188273 | 6 October 2023 | GRAS |
| Size Generator | Scantek | Scan401 | 131 | 12 October 2023 | WK Electric |
| Timer | EXTECH | - | 05-ACT | 20 March 2024 | TPA |

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
Calibration Officer

Approved By : 
Mr. Pait Mathavorn
Calibration Engineer Supervisor
Issue Date : 9 May 2023

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.

เอกสารไม่ควรถูก

Certificate No : 23-NDM-093
Request No : Req-2023-0902

1. Absolute acoustical sensitivity

| UUC Setting | Time | | Exposure Measurement | | | UNCERTAINTY | Tolerances Limit |
|--------------------|------|-----|----------------------|----------------------|-------|-------------|------------------|
| | Ref | UUC | Ref | UUC | Error | | |
| FAST / A / 60-140 | (s) | (s) | (Pa ² ·h) | (Pa ² ·h) | (%) | (%) | (%) |
| Calibrator Setting | | | | | | | |
| 1000 Hz 114 dB | 120 | 120 | 3.19 | 3.13 | -1.88 | 3.1 | -21 ~ +26 |

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

2. Frequency weightings

| UUC Setting | Deviation from various Frequency Weighting | | UNCERTAINTY | Tolerances Limit |
|---------------|--|------|-------------|------------------|
| | A | C | | |
| FAST / 60-140 | (dB) | (dB) | (± dB) | (± dB) |
| STD Setting | | | | |
| *63 Hz | 0.4 | 0.5 | 0.40 | 2.0 |
| 125 Hz | -0.2 | 0.2 | 0.40 | 1.5 |
| 250 Hz | -0.2 | 0.3 | 0.40 | 1.5 |
| 500 Hz | -0.1 | 0.3 | 0.40 | 1.5 |
| 1000 Hz | 0.0 | 0.0 | 0.40 | - |
| 2000 Hz | 0.1 | 0.5 | 0.40 | 2.0 |
| 4000 Hz | 0.6 | 0.4 | 0.40 | 3.0 |
| 8000 Hz | -0.8 | -0.7 | 0.40 | 3.0 |

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.

เอกสารไม่ควรถูก

Certificate No : 23-NDM-093
Request No : Req-2023-0902

3. Linearity of response to steady signals

a. Sound exposure meter, linearity of response for changes of input sinusoidal signal level

| UUC Setting | FAST / A / High | | | | | | | | | | | |
|------------------|-----------------|-------|------|------|-------|-------|-------|-------|-------|-------|-------|-------|
| | Ref | (dB) | 90.0 | 80.0 | 90.0 | 100.0 | 110.0 | 110.0 | 120.0 | 130.0 | 140.0 | 140.0 |
| 1000 Hz | Level A | (dB) | 60.4 | 80.4 | 90.2 | 100.1 | 110.3 | 114.9 | 120.0 | 130.0 | 140.0 | 140.0 |
| | Error | (dB) | 0.4 | 0.4 | 0.2 | 0.1 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | Error | (dB) | 0.4 | 0.4 | 0.2 | 0.1 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 8000 Hz | Ref | (dB) | 88.9 | 98.9 | 108.9 | 112.9 | 118.9 | 128.9 | 138.9 | 148.9 | 148.9 | 148.9 |
| | Level A | (dB) | 88.9 | 98.9 | 108.9 | 112.9 | 118.9 | 128.9 | 138.9 | 148.9 | 148.9 | 148.9 |
| | Error | (dB) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 63 Hz | Ref | (dB) | 87.8 | 93.8 | 103.8 | 113.8 | 123.8 | 133.8 | 143.8 | 153.8 | 153.8 | 153.8 |
| | Level A | (dB) | 87.8 | 93.8 | 103.8 | 113.8 | 123.8 | 133.8 | 143.8 | 153.8 | 153.8 | 153.8 |
| | Error | (dB) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Tolerances Limit | | (±dB) | 1.0 | | | | | | | | | |
| UNCERTAINTY | | (±dB) | 0.3 | | | | | | | | | |

b. Sound exposure meter linearity of error

| UUC Setting | Time | | Exposure Measurement | | | UNCERTAINTY | Tolerances Limit |
|--------------------|------|-----|----------------------|----------------------|-------|-------------|------------------|
| | Ref | UUC | Ref | UUC | Error | | |
| FAST / A / 60-140 | (s) | (s) | (Pa ² ·h) | (Pa ² ·h) | (%) | (%) | (%) |
| Calibrator Setting | | | | | | | |
| 1000 Hz 110 dB | 27 | 27 | 0.30 | 0.30 | 0.00 | 3.6 | -21 ~ +26 |
| 1000 Hz 110 dB | 45 | 45 | 0.50 | 0.50 | 0.00 | | |
| 1000 Hz 110 dB | 90 | 90 | 1.00 | 0.99 | -1.00 | | |
| 1000 Hz 110 dB | 180 | 180 | 2.00 | 1.98 | -1.00 | | |
| 1000 Hz 120 dB | 36 | 36 | 4.00 | 4.03 | +0.75 | | |
| 1000 Hz 120 dB | 72 | 72 | 8.00 | 8.05 | +0.63 | 3.6 | -21 ~ +26 |
| 1000 Hz 120 dB | 90 | 90 | 10.00 | 10.13 | +1.30 | | |
| 1000 Hz 120 dB | 180 | 180 | 20.00 | 20.22 | +1.10 | | |
| 1000 Hz 120 dB | 360 | 360 | 40.00 | 40.34 | +0.85 | | |
| 1000 Hz 120 dB | 720 | 720 | 80.00 | 80.49 | +0.61 | | |

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เอกสารไม่ควรถูก

Certificate No : 23-NDM-090
Request No : Req-2023-0902

4. Response to short duration

a. Response for sinusoidal signals - reference level

| UUC Setting | Time | | Exposure Measurement | | | UNCERTAINTY | Tolerances Limit |
|--------------------|------|------|----------------------|----------------------|----------------------|----------------------|----------------------|
| | Ref | UUC | Ref | UUC | Error | | |
| Calibrator Setting | (s) | (s) | (Pa ² /h) | (Pa ² /h) | (Pa ² /h) | (Pa ² /h) | (Pa ² /h) |
| 4000 Hz 95 dB | 2846 | 2846 | 1.00 | 1.00 | 0.00 | 0.032 | -0.28 ~ +0.41 |

b. Sound exposure meter response for series of toneburst impulses

| UUC Setting | Time | | Exposure Measurement | | | UNCERTAINTY | Tolerances Limit |
|--------------------|------|------|----------------------|----------------------|-------|-------------|------------------|
| | Ref | UUC | Ref | UUC | Error | | |
| Calibrator Setting | (s) | (s) | (Pa ² /h) | (Pa ² /h) | (%) | (%) | (%) |
| Burst 1 ms, 95 dB | 2846 | 2846 | 1.00 | 1.00 | 0.00 | 3.6 | -21 ~ +26 |
| Burst 1 ms, 100 dB | 900 | 900 | 1.00 | 1.00 | 0.00 | | -29 ~ +41 |
| Burst 1 ms, 105 dB | 143 | 143 | 1.00 | 1.01 | +1.00 | | -29 ~ +41 |

2. Response to unipolar pulse

| UUC Setting | Time | | Exposure Measurement | | | UNCERTAINTY | Tolerances Limit |
|------------------------|------|-----|----------------------|----------------------|-----------|-------------|------------------|
| | Ref | UUC | Ref | UUC | Different | | |
| Calibrator Setting | (s) | (s) | (Pa ² /h) | (Pa ² /h) | (%) | (%) | (%) |
| Continuous Rectangle + | 29 | | 10.33 | | 0.00 | 3.7 | -21 ~ +26 |
| Continuous Rectangle - | | | 10.13 | | | | |

* Indicates non accredited

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.

เอกสารไม่ควรถูก

Certificate of Calibration

Customer

Name : UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.
Address : 81 Soi Udomsak 41, Sukhumvit Road, Bangkok, Prakanong, Bangkok 10260

Certificate No : 23-NDM-061
Request No : Req-2023-0604

Unit Under Calibration Details

Measurement Item : Noise dosimeter
Microphone Class : 2
Manufacturer : SVANTEK
Microphone Model : SV 2705
Model : SV 1045
Microphone S/N : 106322
Serial Number : 106134
Preamplifier Model : -
ID : -
Preamplifier S/N : -
Resolution : 0.1 dB
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 : 16 March 2023
Calibrated Date : 22 March 2023
Calibration Procedure : In-house method CP-NDM-01 based on IEC 61252 : 2017
Location of Calibration : Lab Acoustic

| Instrument | Brand | Model | S/N | Due calibration | Traceability |
|----------------------------|----------|-----------|--------|-----------------|--------------|
| Multi-frequency Calibrator | Quest | Quest-cal | 188272 | 29 June 2023 | TSI |
| Standard Microphone | GRAS | 40AN | 188273 | 8 October 2023 | GRAS |
| Size Generator | Svantech | Svan401 | 131 | 12 October 2023 | WK Electric |
| Timer | EXTECH | - | 05-ACT | 24 March 2023 | TPA |

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. Nopadol Luangrat
Calibration Officer

Approved By : 
Mr. Pait Mahavorn
Calibration Engineer Supervisor
Issue Date : 22 March 2023

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.

เอกสารไม่ควรถูก

Certificate No : 23-NDM-061
Request No : Req-2023-0604

1. Absolute acoustical sensitivity

| UUC Setting | Time | | Exposure Measurement | | | UNCERTAINTY | Tolerances Limit |
|--------------------|--------|-----|----------------------|----------------------|-------|-------------|------------------|
| | Ref | UUC | Ref | UUC | Error | | |
| Calibrator Setting | (s) | (s) | (Pa ² /h) | (Pa ² /h) | (%) | (%) | (%) |
| 1000 Hz 114 dB | 120.00 | 120 | 3.19 | 3.20 | +0.31 | 3.0 | -21 ~ +26 |

Note : Absolute sensitivity was established by the use of Sound Calibrator Brand SVANTEK, Model SV 35A, S/N. 38079

2. Frequency weightings

| UUC Setting | Deviation from various Frequency Weighting | | UNCERTAINTY | Tolerances Limit |
|-------------|--|------|-------------|------------------|
| | A | C | | |
| STD Setting | (dB) | (dB) | (± dB) | (± dB) |
| *63 Hz | 0.0 | 0.0 | 0.40 | 2.0 |
| 125 Hz | 0.2 | 0.1 | 0.40 | 1.5 |
| 250 Hz | 0.1 | 0.1 | 0.40 | 1.5 |
| 500 Hz | 0.0 | 0.0 | 0.40 | 1.5 |
| 1000 Hz | 0.0 | 0.0 | 0.40 | - |
| 2000 Hz | -0.6 | -0.6 | 0.40 | 2.0 |
| 4000 Hz | 0.6 | 0.6 | 0.40 | 3.0 |
| 8000 Hz | -1.1 | -1.1 | 0.40 | 5.0 |

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.

เอกสารไม่ควรถูก

Certificate No : 23-NDM-061
Request No : Req-2023-0604

3. Linearity of response to steady signals

a. Sound exposure meter, linearity of response for changes of input sinusoidal signal level

| UUC Setting | Ref | FAST / A / High | | | | | | | | | | | |
|------------------|---------|-----------------|------|------|-------|-------|-------|-------|-------|-------|-------|--|--|
| | | (dB) | 60.0 | 80.0 | 90.0 | 100.0 | 110.0 | 114.0 | 120.0 | 130.0 | 140.0 | | |
| 1000 Hz | Level A | (dB) | 59.9 | 80.2 | 90.3 | 100.1 | 110.1 | 114.0 | 120.0 | 130.0 | 140.0 | | |
| | Error | (dB) | -0.1 | 0.2 | 0.2 | 0.1 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | | |
| | Ref | (dB) | 88.9 | 98.9 | 108.9 | 112.9 | 118.9 | 128.9 | 138.9 | | | | |
| 8000 Hz | Level A | (dB) | 88.9 | 98.9 | 108.9 | 112.9 | 118.9 | 128.9 | 138.9 | | | | |
| | Error | (dB) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | -0.1 | | | |
| | Ref | (dB) | 87.8 | 97.8 | 107.8 | 111.8 | 117.8 | 127.8 | 137.8 | | | | |
| 63 Hz | Level A | (dB) | 87.8 | 97.8 | 107.8 | 111.8 | 117.8 | 127.8 | 137.8 | | | | |
| | Error | (dB) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | | |
| | Ref | (dB) | 87.8 | 97.8 | 107.8 | 111.8 | 117.8 | 127.8 | 137.8 | | | | |
| Tolerances Limit | | (±dB) | 3.0 | | | | | | | | | | |
| UNCERTAINTY | | (±dB) | 0.27 | | | | | | | | | | |

b. Sound exposure meter linearity of error

| UUC Setting | Time | | Exposure Measurement | | | UNCERTAINTY | Tolerances Limit |
|--------------------|------|-----|----------------------|----------------------|-------|-------------|------------------|
| | Ref | UUC | Ref | UUC | Error | | |
| Calibrator Setting | (s) | (s) | (Pa ² /h) | (Pa ² /h) | (%) | (%) | (%) |
| 1000 Hz 110 dB | 27 | 27 | 0.30 | 0.30 | 0.00 | 4.3 | -21 ~ +26 |
| 1000 Hz 110 dB | 45 | 45 | 0.30 | 0.51 | +2.00 | | |
| 1000 Hz 110 dB | 90 | 90 | 1.00 | 1.01 | +1.00 | | |
| 1000 Hz 110 dB | 180 | 180 | 2.00 | 2.02 | +1.00 | | |
| 1000 Hz 120 dB | 36 | 36 | 4.00 | 4.03 | +0.75 | | |
| 1000 Hz 120 dB | 72 | 72 | 8.00 | 8.05 | +0.63 | 3.8 | -21 ~ +26 |
| 1000 Hz 120 dB | 90 | 90 | 10.00 | 9.90 | -1.00 | | |
| 1000 Hz 120 dB | 180 | 180 | 20.00 | 20.22 | +1.10 | | |
| 1000 Hz 120 dB | 360 | 360 | 40.00 | 40.34 | +0.85 | | |
| 1000 Hz 120 dB | 720 | 720 | 80.00 | 80.49 | +0.61 | | |

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.

เอกสารไม่ควรถูก

Certificate No : ZI-NDM-061
Request No : Req-2023-0904

4. Response to short duration
a. Response for sinusoidal signals - reference level

| UUC Setting | Time | | Exposure Measurement | | | UNCERTAINTY | Tolerances Limit |
|--------------------|------|------|----------------------|----------------------|----------------------|-------------|----------------------|
| | Ref | UUC | Ref | UUC | Error | | |
| Calibrator Setting | (s) | (s) | (Pa ² /h) | (Pa ² /h) | (Pa ² /h) | (%) | (Pa ² /h) |
| 4000 Hz 95 dB | 2846 | 2846 | 1.00 | 1.00 | 0.00 | 0.01 | -0.29 ~ 0.41 |

b. Sound exposure meter response for series of toneburst impulses

| UUC Setting | Time | | Exposure Measurement | | | UNCERTAINTY | Tolerances Limit |
|--------------------|------|------|----------------------|----------------------|-------|-------------|------------------|
| | Ref | UUC | Ref | UUC | Error | | |
| Calibrator Setting | (s) | (s) | (Pa ² /h) | (Pa ² /h) | (%) | (%) | (%) |
| Burst 1 ms, 95 dB | 2846 | 2846 | 1.00 | 1.00 | 0.00 | | -21 ~ +26 |
| Burst 1 ms, 100 dB | 900 | 900 | 1.00 | 1.00 | 0.00 | 3.0 | -21 ~ +41 |
| Burst 1 ms, 108 dB | 143 | 143 | 1.00 | 1.01 | +1.00 | | -21 ~ +41 |

5. Response to unipolar pulse

| UUC Setting | Time | | Exposure Measurement | | | UNCERTAINTY | Tolerances Limit |
|------------------------|------|-----|----------------------|----------------------|-----------|-------------|------------------|
| | Ref | UUC | Ref | UUC | Different | | |
| Calibrator Setting | (s) | (s) | (Pa ² /h) | (Pa ² /h) | (%) | (%) | (%) |
| Continuous Rectangle + | 29 | | 10.37 | 0.00 | 0.00 | 2.4 | -21 ~ +26 |
| Continuous Rectangle - | | | 10.37 | | | | |

* Indicates not accredited

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.

เอกสารไม่ควรถูก

Certificate of Calibration

Customer

Name : UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.
Address : 81 Soi Udimuk 41, Sukhumvit Road, Bangkok, Prakanong, Bangkok 10260

Certificate No : ZI-NDM-068
Request No : Req-2023-0902

Unit Under Calibration Details

Measurement item : Noise Dosimeter
Manufacturer : SVANTEK
Model : SV 104S
Serial Number : 128560
ID : -
Resolution : 0.1 dB
Microphone Class : 2
Microphone Model : SV 27IS
Microphone S/N : 133702
Preamplifier Model : -
Preamplifier S/N : -
Instrument Status : New

Calibration Environment and Details


Temperature : 23 °C ± 2 °C
Humidity : 50 %RH ± 20 %RH
Barometric Pressure : 1013 hPa ± 10 hPa
Received Date : 25 April 2023
Calibrated Date : 8 May 2023
Calibration Procedure : In-house method CP-NDM-01 based on IEC 61252 : 2017
Location of Calibration : Lab Acoustic


Reference Standard

| Instrument | Brand | Model | SN | Due calibration | Traceability |
|----------------------------|---------|-----------|--------|-----------------|--------------|
| Multi-frequency Calibrator | Quest | Quest-cal | 188272 | 29 June 2023 | TSI |
| Standard Microphone | GRAS | 40AN | 188273 | 6 October 2023 | GRAS |
| Size Generator | SvanteK | Svan401 | 131 | 12 October 2023 | WK Electric |
| Timer | EXTech | - | 05-ACT | 20 March 2024 | TPA |

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 Luangrat
Calibration Officer

Approved By : 
Mr. Pait Mahavorn
Calibration Engineer Supervisor
Issue Date : 8 May 2023

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.

เอกสารไม่ควรถูก

Certificate No : ZI-NDM-068
Request No : Req-2023-0902

1. Absolute acoustical sensitivity

| UUC Setting | Time | | Exposure Measurement | | | UNCERTAINTY | Tolerances Limit |
|--------------------|------|-----|----------------------|----------------------|-------|-------------|------------------|
| | Ref | UUC | Ref | UUC | Error | | |
| Calibrator Setting | (s) | (s) | (Pa ² /h) | (Pa ² /h) | (%) | (%) | (%) |
| 1000 Hz 114 dB | 120 | 120 | 3.19 | 3.20 | +0.31 | 3.1 | -21 ~ +26 |

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

2. Frequency weightings

| UUC Setting | Deviation from various Frequency Weighting | | UNCERTAINTY | Tolerances Limit |
|-------------------|--|------|-------------|------------------|
| | A | C | | |
| FAST / A / 60-140 | (dB) | (dB) | (± dB) | (± dB) |
| STD Setting | | | | |
| *63 Hz | 0.2 | 0.3 | 0.40 | 2.0 |
| 125 Hz | -0.1 | 0.4 | 0.40 | 1.5 |
| 250 Hz | -0.3 | 0.2 | 0.40 | 1.5 |
| 500 Hz | -0.2 | 0.2 | 0.40 | 1.5 |
| 1000 Hz | 0.0 | 0.0 | 0.40 | - |
| 2000 Hz | 0.4 | 0.8 | 0.40 | 2.0 |
| 4000 Hz | 1.7 | 1.9 | 0.40 | 3.0 |
| 8000 Hz | -2.0 | -2.2 | 0.40 | 5.0 |

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.

เอกสารไม่ควรถูก

Certificate No : ZI-NDM-068
Request No : Req-2023-0902

3. Linearity of response to steady signals

a. Sound exposure meter, linearity of response for changes of input sinusoidal signal level

| UUC Setting | Ref | FAST / A / High | | | | | | | | | |
|------------------|---------|-----------------|------|------|-------|-------|-------|-------|-------|-------|-------|
| | | (dB) | 60.0 | 80.0 | 100.0 | 120.0 | 114.0 | 126.0 | 130.0 | 140.0 | |
| 1000 Hz | Level A | (dB) | 95.9 | 80.0 | 90.0 | 100.0 | 110.0 | 114.0 | 120.0 | 129.9 | 139.9 |
| | Error | (dB) | -0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | -0.1 | -0.1 | |
| | Error | (dB) | 88.9 | 98.9 | 108.9 | 112.9 | 118.9 | 128.9 | 138.9 | | |
| 8000 Hz | Level A | (dB) | | | | 88.9 | 98.9 | 108.9 | 112.9 | 118.9 | 128.9 |
| | Error | (dB) | | | | 0.0 | 0.0 | 0.0 | 0.0 | -0.1 | -0.1 |
| | Error | (dB) | | | | 87.8 | 93.8 | 103.8 | 113.8 | | |
| 63 Hz | Level A | (dB) | | | | | | | 87.8 | 93.8 | 103.8 |
| | Error | (dB) | | | | | | | 0.0 | 0.0 | 0.0 |
| | Error | (dB) | | | | | | | 87.8 | 93.8 | 103.8 |
| Tolerances Limit | | (±dB) | 1.0 | | | | | | | | |
| UNCERTAINTY | | (±dB) | 0.3 | | | | | | | | |

b. Sound exposure meter linearity of error

| UUC Setting | Time | | Exposure Measurement | | | UNCERTAINTY | Tolerances Limit |
|--------------------|------|-----|----------------------|----------------------|-------|-------------|------------------|
| | Ref | UUC | Ref | UUC | Error | | |
| Calibrator Setting | (s) | (s) | (Pa ² /h) | (Pa ² /h) | (%) | (%) | (%) |
| 1000 Hz 110 dB | 27 | 27 | 0.30 | 0.30 | 0.00 | 3.6 | -21 ~ +26 |
| 1000 Hz 110 dB | 45 | 45 | 0.50 | 0.50 | 0.00 | | |
| 1000 Hz 110 dB | 90 | 90 | 1.00 | 1.01 | +1.00 | | |
| 1000 Hz 110 dB | 180 | 180 | 2.00 | 2.02 | +1.00 | | |
| 1000 Hz 120 dB | 36 | 36 | 4.00 | 3.94 | -1.50 | | |
| 1000 Hz 120 dB | 72 | 72 | 8.00 | 7.87 | -1.63 | 3.6 | -21 ~ +26 |
| 1000 Hz 120 dB | 90 | 90 | 10.00 | 9.90 | -1.00 | | |
| 1000 Hz 120 dB | 180 | 180 | 20.00 | 19.78 | -1.20 | | |
| 1000 Hz 120 dB | 360 | 360 | 40.00 | 39.42 | -1.43 | | |
| 1000 Hz 120 dB | 720 | 720 | 80.00 | 78.66 | -1.68 | | |

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.

เอกสารไม่ควรถูก

Certificate No : 23-NDM-008
Request No : Req-2023-0902

4. Response to short duration

a. Response for sinusoidal signals - reference level

| UUC Setting | Time | | Exposure Measurement | | | UNCERTAINTY | Tolerances Limit |
|--------------------|------|------|----------------------|---------------------|---------------------|---------------------|---------------------|
| | Ref | UUC | Ref | UUC | Error | | |
| Calibrator Setting | (s) | (s) | (Pa ² h) | (Pa ² h) | (Pa ² h) | (Pa ² h) | (Pa ² h) |
| 4000 Hz 95 dB | 2846 | 2846 | 1.00 | 0.99 | -0.01 | 0.052 | -0.29 ~ -0.41 |

b. Sound exposure meter response for series of toneburst impulses

| UUC Setting | Time | | Exposure Measurement | | | UNCERTAINTY | Tolerances Limit |
|--------------------|------|------|----------------------|---------------------|-------|-------------|------------------|
| | Ref | UUC | Ref | UUC | Error | | |
| Calibrator Setting | (s) | (s) | (Pa ² h) | (Pa ² h) | (%) | (%) | (%) |
| Burst 1 ms, 93 dB | 2846 | 2846 | 1.00 | 0.99 | -1.00 | 3.6 | -21 ~ -26 |
| Burst 1 ms, 100 dB | 900 | 900 | 1.00 | 0.99 | -1.00 | | -29 ~ -41 |
| Burst 1 ms, 108 dB | 143 | 143 | 1.00 | 1.00 | 0.00 | | -29 ~ -41 |

5. Response to bipolar pulse

| UUC Setting | Time | | Exposure Measurement | | | UNCERTAINTY | Tolerances Limit |
|------------------------|------|-----|----------------------|---------------------|-----------|-------------|------------------|
| | Ref | UUC | Ref | UUC | Different | | |
| Calibrator Setting | (s) | (s) | (Pa ² h) | (Pa ² h) | (%) | (%) | (%) |
| Continuous Rectangle + | 29 | 29 | 10.37 | 10.37 | 0.00 | 3.7 | -21 ~ -26 |
| Continuous Rectangle - | | | 10.37 | | | | |

* Indicates non accredited

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.

เอกสารไม่ควบคุม

Certificate of Calibration

Customer
Name : UNITED ANALYST AND ENGINEERING CONSULTANT
CO.,LTD.
Address : 81 Soi Udomsak 41, Sukhumvit Road, Bangchak, Prakanong,
Bangkok 10260

Certificate No : 23-LXM-053
Request No : Req-2023-0121
Page : 1/2

Unit Under Calibration Details

Instrument Name : Digital Lux Meter
Manufacturer : EXTECH
Model : 407026
Serial Number : A052267
Resolution : 1 lx
ID Number : UAE.EFM.175/2564

Range Calibration : 2000 , 20000 lx
Instrument Status : Used

Calibration Environment and Details


Temperature : 25 °C ± 2 °C
Humidity : 60 %RH ± 20 %RH
Received Date : 17 January 2023
Calibrated Date : 14 February 2023
Calibration Procedure : The measurement was done in accordance with CP-LXM-01

Reference Standard : Photometer and Illuminance Sensor, Serial No.: 30662/2, 30592/2, which was calibrated on 11 November 2022,
Certificate No.: TP-1027-22

Traceability : This Certificate is traceable to International System of Unit (SI) Unit through National Institute of
Metrology (Thailand)

Note

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

Approved By : 
Mr. Pacit Mathavorn
Calibration Engineer Supervisor
Issue Date : 14 February 2023

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.

เอกสารไม่ควบคุม

Calibration Note
UUC Adjustment : Zero adjustment before use

Certificate No : 23-LXM-053
Request No : Req-2023-0121
Page : 2/2

Result of Calibration :

| UUC Range (lx) | Standard (lx) | UUC Reading (lx) | Correction (lx) | Uncertainty (± lx) |
|----------------|---------------|------------------|-----------------|--------------------|
| 2000 | 0 | 0 | 0 | 0.58 |
| | 30 | 30 | 0 | 2.3 % of Reading |
| | 100 | 100 | -1 | |
| | 200 | 202 | -2 | |
| | 300 | 301 | -1 | |
| | 400 | 403 | -3 | |
| | 600 | 603 | -3 | |
| | 800 | 801 | -1 | |
| | 1000 | 1007 | -7 | |
| | 1200 | 1209 | -9 | |
| | 1400 | 1406 | -6 | |
| | 1600 | 1608 | -8 | |
| | 1800 | 1802 | -2 | |
| | 2000 | 1999 | 11 | |
| 20000 | 2000 | 2000 | 20 | 2.3 % of Reading |
| | 4000 | 3990 | 20 | |
| | 5000 | 4960 | 40 | |

End of Certificate

Calibrated By : 
Mr. Nopphon Luangrue

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.

เอกสารไม่ควบคุม

Certificate of Calibration

Customer
Name : UNITED ANALYST AND ENGINEERING CONSULTANT
CO.,LTD.
Address : 81 Soi Udomsak 41, Sukhumvit Road, Bangchak, Prakanong,
Bangkok 10260

Certificate No : 23-LXM-313
Request No : Req-2023-2173
Page : 1/2

Unit Under Calibration Details

Instrument Name : Digital Lux Meter
Manufacturer : EXTECH
Model : 407026
Serial Number : A016905
Resolution : 1 lx
ID Number : UAE.EFM.018/2559

Range Calibration : 2000 , 20000 lx
Instrument Status : Used

Calibration Environment and Details


Temperature : 25 °C ± 2 °C
Humidity : 60 %RH ± 20 %RH
Received Date : 11 October 2023
Calibrated Date : 26 October 2023
Calibration Procedure : The measurement was done in accordance with CP-LXM-01

Reference Standard : Photometer and Illuminance Sensor, Serial No.: 30662/2, 30592/2, which was calibrated on 11 November 2022,
Certificate No.: TP-1027-22

Traceability : This Certificate is traceable to International System of Unit (SI) Unit through National Institute of
Metrology (Thailand)

Note

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

Approved By : 
Mr. Pacit Mathavorn
Calibration Engineer Supervisor
Issue Date : 26 October 2023

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.

เอกสารไม่ควบคุม

Calibration Note

UUC Adjustment : Zero adjustment before use

Certificate No : ZH-LXM-313

Request No : Req-2023-2173

Page : 2/2

Result of Calibration :

| UUC Range (ts) | Standard (ts) | UUC Reading (ts) | Correction (ts) | Uncertainty (ts) |
|----------------|---------------|------------------|-----------------|------------------|
| 3000 | 70 | 0 | 0 | 0.0058 |
| | 50 | 0 | 0 | 2.2 % of Reading |
| | 100 | 0 | 0 | 2.2 % of Reading |
| | 200 | 199 | 1 | 2.2 % of Reading |
| | 300 | 299 | 1 | 2.2 % of Reading |
| | 400 | 402 | -2 | 2.2 % of Reading |
| | 600 | 604 | -4 | 2.2 % of Reading |
| | 800 | 801 | -1 | 2.2 % of Reading |
| | 1000 | 1003 | -3 | 2.2 % of Reading |
| | 1200 | 1206 | -6 | 2.2 % of Reading |
| | 1400 | 1405 | -5 | 2.2 % of Reading |
| | 1600 | 1609 | -9 | 2.2 % of Reading |
| | 1800 | 1811 | -11 | 2.2 % of Reading |
| | 2000 | 1991 | 9 | 2.2 % of Reading |
| 20000 | 3000 | 2990 | 10 | 2.2 % of Reading |
| | 4000 | 3970 | 30 | 2.2 % of Reading |
| | 5000 | 4970 | 30 | 2.2 % of Reading |

* Indicates non accredited

End of Certificate

Calibrated By :

Mr. Noppadon Luangart

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.
FM-708-AFM-01 Rev.03 Issue date 01/07/23

เอกสารไม่ควบคุม

Certificate of Calibration

Certificate No : 23-AFM-080

Request No : Req-2022-0620

Customer

Name : UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.
Address : 81 Soi Udomsak 41, Sukhumvit Road, Bangchak, Prakanong, Bangkok 10260

Unit Under Calibration Details

Measurement Item : Primary Flow Calibrator
Sensor Model : -
Manufacturer : TSI
Model : 4146
Serial Number : 41461708009
ID : UAE.EFM.103/2561
Location of Calibration : LAB 4 AIR VELOCITY METER

Calibration Environment and Details

Temperature : 23 °C ± 3 °C
Humidity : 55 %RH ± 20 %RH
Barometric Pressure : 1013 hPa ± 10 hPa
Received Date : 14 March 2023
Calibration Date : 23 March 2023
Calibration Procedure : In-house method CP-AFM-01 by Comparison technique with Standard Primary Flow Calibrator

| Reference Standard | Model | Serial Number | Traceable | Due Calibration |
|--------------------|----------------------------|---------------|-----------|-----------------|
| Air Flow Meter | Gilibrator 3 Low flow | 18501010006 | Sensidyne | 16 June 2023 |
| Air Flow Meter | Gilibrator 3 Standard flow | 19031011903 | Sensidyne | 15 June 2023 |

Traceability :

This certificate provides traceability of measurement to recognized national standard, and to the realization of the international System of Units (SI)

Note :

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

Calibration By :

Mr. Noppadon Luangart
Service Calibration Engineer

Approved By :

Mr. Paeti Mathavorn
Calibration Engineer Supervisor

Issue Date : 23 March 2023

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.
FM-708-AFM-01 Rev.03 Issue date 01/07/23

เอกสารไม่ควบคุม

Certificate No : 23-AFM-080

Request No : Req-2022-0620

Result of Calibration :

| Flow Setting | STD Flow Reading | UUC Flow Reading | Correction Flow | Uncertainty |
|--------------|------------------|------------------|-----------------|-------------|
| (LPM) | (LPM) | (LPM) | (LPM) | (LPM) |
| 0.02 | 0.022 | 0.021 | 0.001 | 0.004 |
| 0.05 | 0.051 | 0.049 | 0.002 | 0.005 |
| 0.1 | 0.100 | 0.099 | 0.001 | 0.007 |
| 0.2 | 0.200 | 0.198 | 0.002 | 0.003 |
| 0.5 | 0.501 | 0.511 | -0.010 | 0.007 |
| 1.0 | 1.009 | 1.024 | -0.015 | 0.014 |
| 1.7 | 1.704 | 1.731 | -0.027 | 0.024 |
| 2.0 | 2.005 | 2.033 | -0.028 | 0.028 |
| 3.0 | 3.000 | 3.034 | -0.034 | 0.043 |
| 4.0 | 4.007 | 4.056 | -0.049 | 0.057 |
| 8.0 | 8.007 | 8.049 | -0.042 | 0.071 |

Note

STD : Standard

UUC : Unit Under Calibration

Calibration media : Air

* Indicates non accredited

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.
FM-708-AFM-01 Rev.03 Issue date 01/07/23

เอกสารไม่ควบคุม



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES & EQUIPMENT CALIBRATION AND TESTING SERVICES
534/4 BANTANAKARN ROAD SOI 18, SUANLIANG, SUANLIANG, BANGKOK 10258
TEL. 0-2717-3080-24 FAX. 0-2719-9484



Certificate of Calibration

Certificate No. : 23P1658
Page : 1 of 2

Equipment : Aneroid Barometer

Manufacturer : Barigo

Model : -

Serial No. : -

ID No. : UAE.ANV.124/2550

Condition As-Received: Used Item

Received Date : 26 May 2023

Calibration Date : 02 June 2023

Reference : 2305-0919W5G

Ambient Temperature : (23 ± 2) °C

Relative Humidity : (50 ± 15) %

Atmospheric Pressure : 1007 mbar

Submitted by : United Analyst and Engineering Consultant Co., Ltd.

81 Soi Udomsak 41, Sukhumvit Road,
Bangchak, Phrakhanong, Bangkok 10260

Procedure used: The calibration was conducted by direct comparison method against Pressure Measuring Instruments Standard according to in-house calibration procedure CP-P10, using "DKD-R 6-1" Calibration of Pressure Gauges, Edition 03/2014 " as a guidelines.

Condition of this result of calibration

1. Reference standards instruments :

| Instrument | Model | Serial No. | Certificate No. | Due Date |
|---|--------|------------|-----------------|-------------|
| 1) Standard Barometer | DP1142 | 1422505046 | MP-0094-23 | 03 May 2024 |
| 2. This instrument was installed in vertical orientation and center of the dial was used as the reference level. | | | | |
| 3. This result of calibration was made on requested at the point specified by customer. | | | | |
| 4. This result of calibration instrument was in absolute pressure. | | | | |
| 5. This instrument was used clean air as pressure media. | | | | |
| 6. The certificate is valid only to the item calibrated on date and place of calibration. | | | | |
| 7. This Certification is traceable to the International System of Unit maintained through:- -National Institute of Metrology Thailand (NIMT) | | | | |

Calibrated by : Sukson Khankaew
Issue Date : 08 June 2023

Approved Signatory : Attapol P.
[] Phalinee Phatpaipal
[] Sura Suwanasri
[x] Attapol Panurach

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0316958



Cert.No.: 23P1858
Page: 2 of 2

Result of calibration:- Without adjustment
Function:- Absolute Pressure Measurement

Range: 960 hPa to 1030 hPa
Scale Interval: 1 hPa (The Fifth Estimate)

| Increasing Pressure | | | | | | | | |
|------------------------|--------|--------|--------|--------|---------|---------|---------|---------|
| Applied Pressure (hPa) | 959.93 | 970.47 | 981.93 | 991.32 | 1002.29 | 1011.04 | 1021.14 | 1032.30 |
| UUC* Indication (hPa) | 960.0 | 970.0 | 980.0 | 990.0 | 1000.0 | 1010.0 | 1020.0 | 1030.0 |
| Error (hPa) | 0.07 | -0.47 | -1.93 | -1.32 | -2.29 | -1.84 | -1.14 | -2.30 |

| Decreasing Pressure | | | | | | | | |
|------------------------|---------|---------|---------|---------|--------|--------|--------|--------|
| Applied Pressure (hPa) | 1032.30 | 1021.44 | 1011.67 | 1002.36 | 992.35 | 981.94 | 970.49 | 959.94 |
| UUC* Indication (hPa) | 1030.0 | 1020.0 | 1010.0 | 1000.0 | 990.0 | 980.0 | 970.0 | 960.0 |
| Error (hPa) | -2.30 | -1.44 | -1.67 | -2.36 | -2.35 | -1.94 | -0.49 | 0.06 |

The uncertainty of measurement was ± 0.30 hPa

* UUC = Unit Under Calibration

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

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Athapol P.

เอกสารไม่ควบคุม
a 1165506



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
5344 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG, BANGKOK, 10250
TEL. 0-2717-3000-24 FAX. 0-2719-9484



Certificate of Calibration

Certificate No.: 23H1101
Page: 1 of 2

Equipment: Digital Thermo-Hygrometer

Manufacturer: Digicon

Model: TH-02

Serial No.: 395034175

ID No.: UAE.EFM.184/2565

Condition As-Received: Used Item

Received Date: 18 May 2023

Calibration Date: 22 May 2023

Reference: 10 24 May 2023

Ambient Temperature: (25 \pm 3) °C

Relative Humidity: (50 \pm 20) %

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: United Analyst and Engineering Consultant Co., Ltd.

81 Soi Udomauk 41, Sukhumvit Road, Bangkok,
Phrakhanong, Bangkok 10260

Procedure used: Calibration was conducted using in-house calibration procedure CP-H03 according to comparison
with secondary certified minor sensor for humidity measurement function and comparison with standard
temperature probe for temperature measurement function into humidity / temperature chamber.

Condition of this result of calibration

1. Reference standards instruments:

| Instrument | Model | Serial No. | Certificate No. | Due Date |
|-------------------------------------|------------|------------|-----------------|-------------|
| 1) Chilled Mirror Hygrometer | Dew Master | 44730 | 20563A | 14 Jun 2023 |
| 2) Handheld Thermometer With Sensor | 1521 | ASA339 | 2211251 | 12 Oct 2023 |

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

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

-National Institute of Standards and Technology (NIST), The United States of America

-National Institute of Metrology Thailand (NIMT)

Calibrated by: Kraipon Onrat

Issue Date: 25 May 2023

Approved Signatory:

[✓] Chakrit Waewwanjua

[] Parthippa Tameyakul

[] Viporn Tantiyawuthi

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a 0314979



Cert. No.: 23H1101
Page: 2 of 2

Result of Calibration:- Without Adjustment
Function: Humidity Measurement

| Reference Temperature (°C) | Standard Humidity (%R.H.) | UUC* Reading (%R.H.) | Error (%R.H.) | Uncertainty of Measurement (\pm %R.H.) |
|-------------------------------|------------------------------|----------------------------|------------------|---|
| 25.0 | 40.1 | 41 | 0.9 | 1.3 |
| 25.0 | 50.1 | 51 | 0.9 | 1.6 |
| 25.0 | 60.0 | 60 | 0.0 | 1.6 |
| 25.0 | 70.2 | 67 | -3.2 | 1.6 |

Result of Calibration:- Without Adjustment
Function: Temperature Measurement

| Standard Temperature (°C) | UUC* Reading (°C) | Error (°C) | Uncertainty of Measurement (\pm °C) |
|------------------------------|-------------------------|---------------|--|
| 20.014 | 20.4 | 0.386 | 0.42 |
| 25.022 | 25.6 | 0.578 | 0.42 |
| 30.033 | 30.3 | 0.267 | 0.42 |
| 40.000 | 40.1 | 0.100 | 0.42 |

UUC* : Unit Under Calibration

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

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Athapol P.

เอกสารไม่ควบคุม
a 1162980

ภาคผนวก ค-2
เอกสารสอบเทียบเครื่องมือวิเคราะห์

List of Instrument Certificates for Environmental Quality Analysis

| No. | Instrument/Equipment | Parameter | Manufacturer | Model/Serial No. | Calibrator | Certification No. | Date of Calibration | Due date of Calibration* |
|-----|-----------------------------|---|----------------|---------------------------|--|-------------------|---------------------|--------------------------|
| 1 | Analytical Balance | FAT OIL AND GREASE | Mettler Toledo | AB204-S/FACT / 1129361010 | National Food Institute,Ministry of Industry, Thailand | 2303074-001-01 | 27 May 23 | 25 May 24 |
| 2 | Analytical Balance | TOTAL DISSOLVED SOLIDS TOTAL SOLIDS | Mettler Toledo | XSR205DU / C210685394 | Technology Promotion Association (Thailand-Japan) | 23MM113 | 26 Apr 23 | 25 Apr 24 |
| 3 | Analytical Balance | TOTAL SUSPENDED SOLIDS | Mettler Toledo | XSR205DU / C009071872 | Technology Promotion Association (Thailand-Japan) | 23MM112 | 26 Apr 23 | 25 Apr 24 |
| 4 | DO Meter | BIOCHEMICAL OXYGEN DEMAND | YSI | 5100 / 11B 101863 | Harikul Science | HSU012C | 1 Mar 23 | 29 Feb 24 |
| 5 | Hot Air Oven | TOTAL DISSOLVED SOLIDS TOTAL SUSPENDED SOLIDS | Memmert | UF55 / B212.0411 | Technology Promotion Association (Thailand-Japan) | 23TM373 | 11 Apr 23 | 10 Apr 24 |
| 6 | pH Meter | pH | Horiba | LAQUA-PH210 / HA9M0047 | technology promotion association (thailand-japan) | 23CH523 | 27 Apr 23 | 26 Apr 24 |
| 7 | UV-VIS Spectrophotometer | CHEMICAL OXYGEN DEMAND | Hitachi | U-1900 / 2021-064 | DQE Services Co.,Ltd. | SP23-007 | 6 Jan 23 | 5 Jan 24 |

Due Date of Calibration* : Based on the annual calibration plan. At least 1 time per year.

List of Instrument Certificates for Environmental Quality Analysis

| No. | Instrument/Equipment | Parameter | Manufacturer | Model/Serial No. | Calibrator | Certification No. | Date of Calibration | Due date of Calibration* |
|-----|----------------------|------------------------------|--------------|-----------------------|---|--|---------------------|--------------------------|
| 1 | Gas Chromatography | TPH (C5-C8) TPH (C17-C35) | Agilent | GC 7890A / CN11021007 | Agilent Technologies (Thailand) Co.,Ltd. | Certificate of System Qualification GC-OQ | 23 Feb 23 | 22 Feb 24 |

Due Date of Calibration* : Based on the annual calibration plan. At least 1 time per year.

DQE Services Co.,Ltd.
32 Soi Ladprao-Wanghin 55, Ladprao-Wanghin Rd., Ladprao, Bangkok 10230
Phone : +66 (0)2 538 2054, Email : dqeservicesinfo@gmail.com

CERTIFICATE OF CALIBRATION

Certificate No. : SP23-007 Page 1 of 5

Customer : United Analyst and Engineering Consultant Co.,Ltd. (Head Office)

Address : 3 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Phrakhanong, Bangkok 10260

Location of calibration : Laboratory 315

Equipment : UV-Vis Spectrophotometer

Manufacturer : Hitachi

Model : U-1900

Serial No. : 2021-064



ID No. : UAE.WAS.006/2552

Received Date : 6 January 2023

Calibration Date : 6 January 2023

Issue Date : 10 January 2023

Condition Instrument : Used

Calibrated by :  Approved by : 
(Mr. Tanawut Rittidach) (Ms. Chonthicha Sangngern)
Technical Manager Quality Manager

The calibration result is applied only to the above calibrated item and was found accurate as shown on date and place of calibration only.

The measurement capability of the laboratory and its traceability to recognized national standards and to the unit of measurement realized at the corresponding national standards laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the DQE Services Co., Ltd.

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FM-708-02 R01 1/11/2021

DQE Services Co.,Ltd.
32 Soi Ladprao-Wanghin 55, Ladprao-Wanghin Rd., Ladprao, Bangkok 10230
Phone : +66 (0)2 538 2054, Email : dqeservicesinfo@gmail.com

REPORT OF CALIBRATION

Certificate No. : SP23-007 Page 2 of 5

Environment Condition : Ambient Temperature 25 ± 5 °C

Relative humidity 55 ± 20 %RH

Calibration method : In-house method CP-01 Based on ASTM E275-08

Certified Reference Materials :

| Material | Serial No. | Certificate No. | Due date |
|-------------------------|------------|-----------------|-----------------|
| Absorbance Standard set | 25760 | 95935 | 22 October 2023 |
| Absorbance Standard set | 25757 | 95929 | 22 October 2023 |
| Wavelength Standard set | 25806 | 95916 | 22 October 2023 |
| Wavelength Standard set | 25758 | 95915 | 22 October 2023 |

Traceability This certification is traceable to the International System of Unit maintained at National Institute of Standards and Technology (NIST) through Sarna Scientific Limited

Spectral Band Width of UUC : 4.0 nm.

Scan Speed of UUC : 200 nm/min

Scan Interval of UUC : 0.1 nm.

Resolution of UUC : Photometric 0.001 Abs.

Wavelength 0.1 nm.

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FM-708-02 R01 1/11/2021

DQE Services Co.,Ltd.
32 Soi Ladprao-Wanghin 55, Ladprao-Wanghin Rd., Ladprao, Bangkok 10230
Phone : +66 (0)2 538 2054, Email : dqeservicesinfo@gmail.com

REPORT OF CALIBRATION

Certificate No. : SP23-007 Page 3 of 5

Calibration Results : Without adjustment

Photometric Accuracy :

| Wavelength (nm.) | CRMs Values (Abs) | UUC Reading (Abs) | Correction (Abs) | Uncertainty (Abs) | Coverage factor k |
|------------------|-------------------|-------------------|------------------|-------------------|-------------------|
| 420 | 0.0000 | 0.000 | 0.0000 | 0.0028 | 2.00 |
| | 0.5787 | 0.575 | 0.0037 | 0.0031 | 2.00 |
| | 1.0490 | 1.044 | 0.0050 | 0.0029 | 2.00 |
| | 2.1900 | 2.181 | 0.0090 | 0.0080 | 2.00 |
| 440 | 0.0000 | 0.000 | 0.0000 | 0.0028 | 2.00 |
| | 0.5607 | 0.558 | 0.0027 | 0.0034 | 2.00 |
| | 1.0247 | 1.021 | 0.0037 | 0.0035 | 2.00 |
| | 2.1229 | 2.115 | 0.0079 | 0.0081 | 2.00 |
| 465 | 0.0000 | 0.000 | 0.0000 | 0.0028 | 2.00 |
| | 0.5236 | 0.520 | 0.0036 | 0.0030 | 2.00 |
| | 0.9634 | 0.961 | 0.0024 | 0.0029 | 2.00 |
| | 1.9763 | 1.968 | 0.0083 | 0.0070 | 2.00 |
| 546.1 | 0.0000 | 0.000 | 0.0000 | 0.0028 | 2.00 |
| | 0.5191 | 0.518 | 0.0011 | 0.0031 | 2.00 |
| | 1.0003 | 1.000 | 0.0003 | 0.0033 | 2.00 |
| | 1.9987 | 1.993 | 0.0057 | 0.0084 | 2.00 |
| 590 | 0.0000 | 0.000 | 0.0000 | 0.0028 | 2.00 |
| | 0.5523 | 0.552 | 0.0003 | 0.0030 | 2.00 |
| | 1.0809 | 1.082 | -0.0011 | 0.0030 | 2.00 |
| | 2.0391 | 2.031 | 0.0081 | 0.0080 | 2.00 |
| 635 | 0.0000 | 0.000 | 0.0000 | 0.0028 | 2.00 |
| | 0.5601 | 0.562 | -0.0019 | 0.0032 | 2.00 |
| | 1.0512 | 1.052 | -0.0008 | 0.0030 | 2.00 |
| | 1.9294 | 1.923 | 0.0064 | 0.0079 | 2.00 |

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FM-708-02 R01 1/11/2021

DQE Services Co.,Ltd.
32 Soi Ladprao-Wanghin 55, Ladprao-Wanghin Rd., Ladprao, Bangkok 10230
Phone : +66 (0)2 538 2054, Email : dqeservicesinfo@gmail.com

REPORT OF CALIBRATION

Certificate No. : SP23-007 Page 4 of 5

Photometric Accuracy :

| Wavelength (nm.) | CRMs Values (Abs) | UUC Reading (Abs) | Correction (Abs) | Uncertainty (Abs) | Coverage factor k |
|------------------|-------------------|-------------------|------------------|-------------------|-------------------|
| 235 | 0.0000 | 0.000 | 0.0000 | 0.0050 | 2.00 |
| | 0.7478 | 0.743 | 0.0048 | 0.0057 | 2.00 |
| 257 | 0.0000 | 0.000 | 0.0000 | 0.0050 | 2.00 |
| | 0.8686 | 0.861 | 0.0076 | 0.0059 | 2.00 |
| 313 | 0.0000 | 0.000 | 0.0000 | 0.0050 | 2.00 |
| | 0.2912 | 0.291 | 0.0002 | 0.0051 | 2.00 |
| 350 | 0.0000 | 0.000 | 0.0000 | 0.0050 | 2.00 |
| | 0.6448 | 0.639 | 0.0058 | 0.0055 | 2.00 |

เอกสารไม่ควบคุม

FM-708-02 R01 1/11/2021

DQE Services Co., Ltd.
32 Soi Ladprao-Wanghin 55, Ladprao-Wanghin Rd., Ladprao, Bangkok 10230
Phone : +66 (0)2 538 2054, Email : dqeservicesinfo@gmail.com

REPORT OF CALIBRATION

Certificate No. : SP23-007 Page 5 of 5

Wavelength Accuracy :

| CRM Values (nm.) | UUC Reading (nm.) | Correction (nm.) | Uncertainty (nm.) | Coverage factor k |
|------------------|-------------------|------------------|-------------------|-------------------|
| 241.54 | 240.8 | 0.74 | 0.18 | 2.00 |
| 279.40 | 278.5 | 0.90 | 0.18 | 2.00 |
| 288.70 | 288.0 | 0.70 | 0.18 | 2.00 |
| 334.22 | 333.5 | 0.72 | 0.18 | 2.00 |
| 361.26 | 360.5 | 0.76 | 0.18 | 2.00 |
| 418.48 | 417.8 | 0.68 | 0.21 | 2.00 |
| 446.70 | 445.9 | 0.80 | 0.18 | 2.00 |
| 453.20 | 452.5 | 0.70 | 0.18 | 2.00 |
| 460.06 | 459.5 | 0.56 | 0.18 | 2.00 |
| 536.90 | 536.0 | 0.90 | 0.18 | 2.00 |
| 637.94 | 637.1 | 0.84 | 0.18 | 2.00 |
| 440.74 | 440.0 | 0.74 | 0.18 | 2.00 |
| 472.22 | 471.5 | 0.72 | 0.18 | 2.00 |
| 513.70 | 513.0 | 0.70 | 0.18 | 2.00 |
| 528.72 | 528.0 | 0.72 | 0.18 | 2.00 |
| 574.60 | 574.0 | 0.60 | 0.18 | 2.00 |
| 585.48 | 584.6 | 0.88 | 0.20 | 2.00 |
| 684.63 | 684.0 | 0.63 | 0.18 | 2.00 |
| 740.27 | 740.0 | 0.27 | 0.20 | 2.00 |
| 748.28 | 747.5 | 0.78 | 0.18 | 2.00 |
| 807.16 | 806.5 | 0.66 | 0.18 | 2.00 |
| 879.70 | 879.0 | 0.70 | 0.18 | 2.00 |

Remark : - UUC = Unit Under Calibration
- N/A = Not Available
- The result expanded uncertainty of measurement U is stated as the standard uncertainty of measurement multiplied by the coverage factor k, which for a normal distribution corresponds to a coverage probability of approximately 95%.
- * Indicates non TISI accredited

- End of Certificate -

เอกสารไม่ควบคุม

PM-708-02 R01 1/11/2021



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES & EQUIPMENT CALIBRATION AND TESTING SERVICES
134/4 PATANAKARN ROAD SU 18, SUANLUANG, SUANLUANG BANGKOK 10230
TEL. 0-2717-9000-25 FAX. 0-2719-9484



Cert.No.: 23CH523
Page.: 1 of 3

Certificate of Calibration

Equipment : pH Meter
Manufacturer : Horiba
Model : LAQUA-PH210
Serial No. : HA9M0047
ID No. : UAE EFM 005/2563(EFM.pH.05/63)
Condition As-Received : Used Item
Received Date : 26 April 2023
Calibration Date : 27 April 2023
Reference : 2304-0707WSC-1
Submitted by : United Analyst and Engineering Consultant Co., Ltd.
3 Soi Udomsak 41 Sukhumvit Road,
Bangkok, Phraknanong, Bangkok 10260
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 Lemgagrakul
Approved by :
(/) Malee Bulkruea
() Saithip Meangmai
() Warakorn Lemgagrakul
Issue Date : 9 May 2023

The Uncertainties are for a confidence probability of approximately 95%

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Cert.No.: 23CH523
Page.: 2 of 3

Condition of this calibration result

- Reference Standard instrument

| Instrument | Serial No. | ID No. | Cert. No. | Due Date |
|--------------------------------|------------|----------|-----------|-------------|
| 1) Document Process Calibrator | 54030049 | 130RC116 | 22E2769 | 24 Aug 2023 |
| 2) Ref. Standard Thermometer | 4982054 | 110RC044 | 22I1306 | 27 Oct 2023 |

This certification is traceable to the International System of Unit maintained at: Traceable to National Institute of Metrology (Thailand), NIMT
- Certified Reference Materials : The measurement results are traceable to SI through CPA chem Ltd. ANSI-ASQ National Accreditation Board, Accredited No. AR-1835

| Buffer Solution | Manufacturer | Lot No. | Exp date |
|-----------------|--------------|---------|--------------|
| pH 4.008 | CPA chem | 863632 | 28 Dec 2024 |
| pH 6.987 | CPA chem | 826589 | 09 July 2023 |
| pH 10.010 | CPA chem | 863835 | 28 Dec 2023 |

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 Fluor at pH (4.7)(7.10)

| Unit Under Calibration | Nominal Value | Standard Voltage Input | Actual Reading | | Uncertainty of Measurement (±mV) | Coverage factor k |
|----------------------------|---------------|------------------------|----------------|-------|----------------------------------|-------------------|
| | pH | mV | mV | pH | | |
| pH Meter S/N : HA9M0047 | 4.00 | -177.48 | -177.2 | 4.01 | 0.058 | 2.00 |
| | 7.00 | 0.00 | 0.0 | 7.01 | 0.058 | 2.00 |
| | 7.00 | 0.00 | 0.0 | 7.01 | 0.058 | 2.00 |
| | 10.00 | -177.48 | -177.3 | 10.01 | 0.058 | 2.00 |



Cert.No.: 23CH523
Page.: 3 of 3

Calibration Results

Function : pH Measurement

Performing three buffers standard curve by using buffer nominal pH (4.7)(7.10)

| Unit Under Calibration | Standard pH Buffer Solution | Actual pH Reading | Actual mV Reading (mV) | Uncertainty of pH measurement (±) | Coverage factor k |
|--------------------------------|-----------------------------|-------------------|------------------------|-----------------------------------|-------------------|
| pH Electrode S/N : Q92M0181 | 4.008 | 4.01 | 180.7 | 0.0079 | 2.00 |
| | 6.987 | 6.99 | 6.3 | 0.011 | 2.00 |
| | 6.987 | 7.00 | 6.0 | 0.011 | 2.00 |
| | 10.010 | 10.01 | -169.7 | 0.0096 | 2.00 |

Function : Temperature Measurement

(*) Without adjustment

This equipment was connected with Temperature Probe:

Model : 9652-10D
Serial No. : Q92M0181
Dimension of probe :
Length : 103 mm
Diameter : 16 mm
Immersion Depth : 90 mm

| Calibration Point (°C) | Standard Temperature (°C) | UUC Reading (°C) | Error (°C) | Uncertainty of measurement (± °C) | Coverage factor k |
|------------------------|---------------------------|------------------|------------|-----------------------------------|-------------------|
| 25.0 | 25.002 | 25.0 | -0.002 | 0.13 | 2.00 |
| 30.0 | 30.002 | 30.0 | -0.002 | 0.13 | 2.00 |
| 35.0 | 35.003 | 35.0 | -0.003 | 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 %

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เอกสารไม่ควบคุม



Cert.No.: 23MM112
Page.: 1 of 3

Certificate of Calibration

Equipment : Electronic Balance
Manufacturer : Mettler Toledo
Model : XSR205
Serial No. : C09071872
ID No. : UAE.WAO.012/2563
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phakhanong,
Bangkok 10260
Location : Balance Room
Received order : 26 April 2023
Calibration Date : 26 April 2023
Ambient Temperature : 15 °C to 40 °C
Relative Humidity : 30 % to 90 %

Calibrated by : Man Pattanapongpaiboon

Approved by :

- () Pornthippa Tameyakul
() Malee Butkruea
(x) Suwit Imjai

Issue Date : 2 May 2023

The Uncertainties are for a confidence probability of approximately 95%

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Approval of the head of Corporate Services 3 : Equipment Calibration and Testing Services.

เอกสารไม่ควบคุม



Equipment : Electronic Balance
Condition As-Received : Used Item
Reference : 2304-0459OC-1

Cert.No.: 23MM112
Page: 2 of 3

Procedure used :-

Calibration were conducted using in-house calibration procedure CP-OB01 according to direct measurement method against standard weight.

Condition of this result of calibration

1. Reference standard instruments:-

| Instruments | Model | Serial No. | ID No. | Test report No. | Due date |
|-----------------------------|-------|------------|---------|-----------------|-------------|
| 1) Standard Weight Set (E2) | 15884 | 24053 | 70RC007 | MM-0010-22 | 20 Jan 2024 |

2. This certificate is valid only to the item calibrated on date and place of calibration.
3. This result of calibration was made on requested at the point specified by customer.
4. This certificate is not certified for any commercial transaction.
5. This certification is traceable to the International System of Unit.

Result of calibration () Without Adjustment (*) After Adjustment by Internal Calibration

Range capacity : 0 g to 81 g Resolution 0.00001 g
81 g to 220 g Resolution 0.0001 g

Before Adjustment :

| Applied Weight | Balance Reading | Correction | Measurement Uncertainty | Coverage Factor |
|----------------|-----------------|------------|-------------------------|-----------------|
| (g) | (g) | (g) | (± mg) | (k) |
| 80 | 80.00005 | -0.00005 | 0.15 | 2.00 |
| 200 | 199.9999 | +0.0001 | 0.29 | 2.00 |

After Adjustment :

1. Determination of the standard deviation of weighing machine (n = 10)

| Applied Weight | Standard Deviation of Reading (g) |
|----------------|-----------------------------------|
| (g) | |
| 80 | 0.000007 |
| 200 | 0.00000 |

เอกสารไม่ควบคุม



Equipment : Electronic Balance
Condition As-Received : Used Item
Reference : 2304-0459OC-1

Cert.No.: 23MM112
Page: 3 of 3

Result of calibration

2. Effect of off center loading

A mass of 100 g was placed to various position on the pan.
The weighing machine reading error obtained is given in the table

| Position 1 | Position 2 | Position 3 | Position 4 | Position 5 |
|------------|------------|------------|------------|------------|
| (g) | (g) | (g) | (g) | (g) |
| -0.0001 | -0.0001 | 0.0000 | -0.0001 | -0.0001 |

3. Departure from nominal value

| Applied Weight | Balance Reading | Correction | Measurement Uncertainty | Coverage Factor |
|----------------|-----------------|------------|-------------------------|-----------------|
| (g) | (g) | (g) | (± mg) | (k) |
| Unload | 0.00000 | 0.00000 | 0.014 | 2.13 |
| 0.05 | 0.05001 | -0.00001 | 0.015 | 2.09 |
| 0.1 | 0.10001 | -0.00001 | 0.015 | 2.09 |
| 1 | 1.00001 | -0.00001 | 0.018 | 2.04 |
| 5 | 5.00003 | -0.00003 | 0.026 | 2.00 |
| 20 | 20.00006 | -0.00006 | 0.045 | 2.00 |
| 50 | 50.00006 | -0.00006 | 0.080 | 2.00 |
| 80 | 80.00004 | -0.00004 | 0.15 | 2.00 |
| 100 | 100.0000 | 0.0000 | 0.16 | 2.00 |
| 150 | 150.0000 | 0.0000 | 0.29 | 2.00 |
| 200 | 200.0000 | 0.0000 | 0.29 | 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%.

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เอกสารไม่ควบคุม



Cert.No.: 23MM113
Page.: 1 of 3

Certificate of Calibration

Equipment : Electronic Balance
Manufacturer : Mettler Toledo
Model : XSR205
Serial No. : C210685394
ID No. : UAE.WAO.010/2565
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phakhanong,
Bangkok 10260
Location : Balance Room
Received order : 28 April 2023
Calibration Date : 28 April 2023
Ambient Temperature : 15 °C to 40 °C
Relative Humidity : 30 % to 90 %

Calibrated by : Man Pattanapongpaiboon

Approved by :

- () Pornthippa Tameyakul
() Malee Butkruea
(x) Suwit Imjai

Issue Date : 2 May 2023

The Uncertainties are for a confidence probability of approximately 95%

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Approval of the head of Corporate Services 3 : Equipment Calibration and Testing Services.

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Equipment : Electronic Balance
Condition As-Received : Used Item
Reference : 2304-0459OC-2
Procedure used :-

Cert.No.: 23MM113
Page: 2 of 3

Calibration were conducted using in-house calibration procedure CP-OB01 according to direct measurement method against standard weight.

Condition of this result of calibration

1. Reference standard instruments:-

| Instruments | Model | Serial No. | ID No. | Test report No. | Due date |
|-----------------------------|-------|------------|---------|-----------------|-------------|
| 1) Standard Weight Set (E2) | 15884 | 24053 | 70RC007 | MM-0010-22 | 20 Jan 2024 |

- This certificate is valid only to the item calibrated on date and place of calibration.
- This result of calibration was made on requested at the point specified by customer.
- This certificate is not certified for any commercial transaction.
- This certification is traceable to the International System of Unit.

Result of calibration () Without Adjustment (*) After Adjustment by Internal Calibration

Range capacity : 0 g to 81 g **Resolution** 0.00001 g
81 g to 220 g **Resolution** 0.0001 g

Before Adjustment :

| Applied Weight | Balance Reading | Correction | Measurement Uncertainty | Coverage Factor |
|----------------|-----------------|------------|-------------------------|-----------------|
| (g) | (g) | (g) | (± mg) | (k) |
| 80 | 79.99992 | +0.00008 | 0.15 | 2.00 |
| 200 | 199.9995 | +0.0005 | 0.29 | 2.00 |

After Adjustment :

1. Determination of the standard deviation of weighing machine (n = 10)

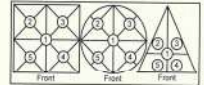
| Applied Weight | Standard Deviation of Reading (g) |
|----------------|-----------------------------------|
| (g) | |
| 80 | 0.000007 |
| 200 | 0.00004 |

เอกสารไม่ควบคุม



Equipment : Electronic Balance
Condition As-Received : Used Item
Reference : 2304-0459OC-2
Result of calibration

Cert.No.: 23MM113
Page: 3 of 3



2. Effect of off center loading

A mass of 100 g was placed to various position on the pan.
The weighing machine reading error obtained is given in the table

| Position 1 | Position 2 | Position 3 | Position 4 | Position 5 | Maximum difference between off-center and central loading |
|------------|------------|------------|------------|------------|---|
| (g) | (g) | (g) | (g) | (g) | (g) |
| -0.0001 | -0.0001 | 0.0000 | -0.0001 | -0.0001 | 0.0001 |

3. Departure from nominal value

| Applied Weight | Balance Reading | Correction | Measurement Uncertainty | Coverage Factor |
|----------------|-----------------|------------|-------------------------|-----------------|
| (g) | (g) | (g) | (± mg) | (k) |
| Unload | 0.00000 | 0.00000 | 0.014 | 2.11 |
| 0.05 | 0.04999 | +0.00001 | 0.015 | 2.09 |
| 0.1 | 0.09999 | +0.00001 | 0.015 | 2.07 |
| 1 | 1.00000 | 0.00000 | 0.018 | 2.04 |
| 5 | 5.00000 | 0.00000 | 0.026 | 2.00 |
| 20 | 20.00002 | -0.00002 | 0.045 | 2.00 |
| 50 | 50.00002 | -0.00002 | 0.080 | 2.00 |
| 80 | 80.00002 | -0.00002 | 0.15 | 2.00 |
| 100 | 100.00000 | 0.00000 | 0.17 | 2.00 |
| 150 | 150.00000 | 0.00000 | 0.29 | 2.00 |
| 200 | 199.99999 | +0.00001 | 0.29 | 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 %.

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เอกสารไม่ควบคุม



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES & EQUIPMENT CALIBRATION AND TESTING SERVICES
5344 PATTANAKAR ROAD SOI 18, SUANLIANG, SUANLIANG BANGKOK 10250
TEL. 0-2717-3000-29 FAX. 0-2719-9454



Cert. No.: 23TM373
Page : 1 of 3

Certificate of Calibration

Equipment : Hot Air Oven
Manufacturer : Memmert
Model : UF 55
Serial No. : B212.0411
ID No. : UAE.WAO.005/2556
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phraekhanong,
Bangkok 10260
Location : Lab Floor 2
Received Order : 11 April 2023
Calibration Date : 11 - 12 April 2023
Ambient Temperature : (26 ± 10) °C
Relative Humidity : (50 ± 30) %
Calibrated by : Krisda Malee
Approved by :
() Porrtippa Tameyakul
(x) Malee Butkruea
() Suwit Imjai
Issue Date : 24 April 2023

The Uncertainties are for a confidence probability of approximately 95%

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เอกสารไม่ควบคุม

A 0053359



Equipment : Hot Air Oven
Condition As-Received : Used Item
Reference : 2304-0156OC-1
Procedure Used :-

Cert. No.: 23TM373
Page : 2 of 3

Calibration were conducted using calibration procedure CP-OT02 according to direct measurement method with Data Acquisition which connected with Resistance Temperature Detector (RTD) and Thermocouple Type T.

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

| Instrument | Model | Serial No. | Cert. No. | Due Date |
|---------------------|--------|------------|-----------|-------------|
| 1) Data Acquisition | 34972A | MY59003411 | 22LM165 | 26 Nov 2023 |

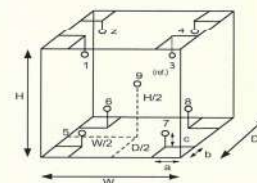
2. This certificate is valid only to the item calibrated on date and place of calibration.

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

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Fresh air setting : Close



| Probe Installation Details : | Dimension of Chamber : |
|------------------------------|--------------------------------|
| a = 5.0 cm | D = 0.50 m |
| b = 5.0 cm | W = 0.80 m |
| c = 5.0 cm | H = 0.76 m |
| | Capacity = 0.30 m ³ |

| Environment during calibration | | |
|--------------------------------|-----------|----------|
| | Beginning | Finished |
| Temp. (°C) | 27 | 28 |
| REL Humid. (%) | 45 | 44 |
| AC Supply (Volt) | 221 | 220 |

| Ref. Std. ID No.: @ Calibration Point | | |
|---------------------------------------|-------------------|------------|
| Position : | (120 to 180) °C | (104) °C |
| 1 | 18-20TC-01 | 20RTD-2/1 |
| 2 | 18-20TC-02 | 20RTD-2/2 |
| 3 | 18-20TC-03 | 20RTD-2/3 |
| 4 | 18-20TC-04 | 20RTD-2/4 |
| 5 | 18-20TC-05 | 20RTD-2/5 |
| 6 | 18-20TC-06 | 20RTD-2/6 |
| 7 | 18-20TC-07 | 20RTD-2/7 |
| 8 | 18-20TC-08 | 20RTD-2/8 |
| 9 (ref.) | 18-20TC-09 | 20RTD-2/9 |

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a 1158261

Calibration Certificate

Equipment: Hot Air Oven
Condition As-Received: Used Item
Reference: 2304-0156OC-1
Result of Calibration: () Without Adjustment
Function of UUC: Temperature Source
Fresh air setting: Close

Cert. No.: 23TM373
Page: 3 of 3

| Calibration Point (°C) | UUC Setting (°C) | UUC Reading (°C) | Temperature stability (± °C) | Temperature uniformity (°C) | Overall Variation (°C) | Coverage Factor |
|------------------------|------------------|------------------|------------------------------|-----------------------------|------------------------|-----------------|
| 104.0 | 104.0 | 104.0 | 0.054 | 0.59 | 0.95 | 2 |
| 120.0 | 120.0 | 120.0 | 0.12 | 0.89 | 1.5 | 2 |
| 180.0 | 180.0 | 180.0 | 0.12 | 1.5 | 2.5 | 2 |

Average: The average of 30 values in each position.
Temperature stability: One-half of the greatest maximum difference of measured temperature at any one sensor.
Temperature uniformity: The maximum difference of measured temperatures at any sensors and the measured temperature at the reference location which are observed at the same time or at as close an observation time as possible to determine the temperature pattern or homogeneity within the chamber under steady-state conditions.
Overall Variation: The Difference of the maximum and minimum measured temperatures throughout observation.
UUC: Unit Under Calibration
Note: The reported uncertainty of measurement was included stability and excluded uniformity.
The reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor k, providing a level of confidence of approximately 95 %.

-000-

เอกสารไม่ควบคุม
a 1158260

Calibration Certificate

Certificate No.: 2303074-001-01
Client name: UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.
Address: 3 Soi Udomsuk 41, Sukhumvit Road, Bangchack, Prakhonong, Bangkok 10260

Equipment: Electronic Balance
Manufacturer: METTLER TOLEDO
Model: AB204-S/FACT
Serial No.: 1129361010
ID No.: UAE.WAS.002/2552
Order No.: 2303074
Operation No.: 2303074-001
Date of Receipt: 26 May 2023
Date of Calibration: 26 May 2023

Calibrated by: Mr.Pheraphat Tuanjit Scientist
Approved by: P. Jengharnit (Miss Preeyaporn Jengharnit) Vice President, Department of Laboratory Services Responsible for the Technical Management Team
Date of Issue: 29 May 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 standards laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the National Food Institute.

FCS-009 Revision: 01 Date: 20-04-65

Calibration Report

Certificate No.: 2303074-001-01
Equipment: Electronic Balance
Manufacturer: METTLER TOLEDO
Model: AB204-S/FACT
Serial No.: 1129361010
Capacity: 220 g
Resolution: 0.0001 g
ID No.: UAE.WAS.002/2552

Date of Calibration: 26 May 2023
Page 2 of 3

Environment Condition: Ambient Temperature: 23.7 ± 0.1 °C Relative Humidity: 61 ± 2.2 %
Place of Calibration: Room 108 Balance Room, UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.
Condition of Equipment: Good Condition
Condition of This Results of Calibration:
1. Calibration Method: NFI Method W-M-001 In-House Method based on UKAS Lab 14 : 2019
2. Reference Standards:
Reference Standard Model Serial No. Calibrated By Certificate No. Due Date
Standard Weight Class E2 1mg to 200g 8505567572 TCS M23040535 8 April 2024
Instrument Model Serial No. Calibrated By Certificate No. Due Date
Thermo Hygro Meter 608-HI NFI.BTH 0118/23 Quality Reborn GK23-0491 21 February 2024
3. This certification is traceable to SI UNIT
4. This certificate was certified only for the instrument we calibrated.
5. This result of calibration was found accurate as shown on date and place of calibration only.

Calibration Results:
1. Repeatability of Reading:
Nominal Value (g) Standard Deviation of Reading (g)
100 0.000048
200 0.000048

2. Off-Center Error:
A mass of 100 g was placed and moved to various position on pan.
The balance reading obtained is given in the table.

| 1 (g) | 2 (g) | 3 (g) | 4 (g) | 5 (g) | 6 (g) | (Maximum Difference) (g) |
|---------|---------|---------|---------|---------|---------|----------------------------|
| 99.9996 | 99.9995 | 99.9995 | 99.9999 | 99.9999 | 99.9997 | 0.0003 |

เอกสารไม่ควบคุม
a 1158260

Calibration Report

Certificate No.: 2303074-001-01
Equipment: Electronic Balance
Manufacturer: METTLER TOLEDO
Model: AB204-S/FACT
Serial No.: 1129361010
Capacity: 220 g
Resolution: 0.0001 g
ID No.: UAE.WAS.002/2552

Date of Calibration: 26 May 2023
Page 3 of 3

Calibration Results: (Continued)
Calibration Range: 0-200 g
Calibration Adjustment: Internal Calibration
3. Departure from Nominal Value:

| Nominal Value (g) | Standard Value (g) | Average Reading (g) | Correction (g) | Uncertainty (± g) | Coverage Factor k |
|---------------------|----------------------|-----------------------|------------------|---------------------|-------------------|
| Unloaded | 0.00000 | 0.0000 | 0.0000 | 0.000088 | 2.00 |
| 0.01 | 0.01000 | 0.0100 | 0.0000 | 0.000088 | 2.00 |
| 0.05 | 0.05000 | 0.0500 | 0.0000 | 0.000088 | 2.00 |
| 0.1 | 0.10001 | 0.0999 | 0.0001 | 0.000088 | 2.00 |
| 0.2 | 0.20001 | 0.1999 | 0.0001 | 0.000088 | 2.00 |
| 0.5 | 0.50002 | 0.5000 | 0.0000 | 0.000088 | 2.00 |
| 1 | 1.00000 | 1.0000 | 0.0000 | 0.000089 | 2.00 |
| 2 | 2.00002 | 2.0000 | 0.0000 | 0.000089 | 2.00 |
| 5 | 5.00002 | 5.0000 | 0.0000 | 0.000090 | 2.00 |
| 10 | 10.00001 | 9.9999 | 0.0001 | 0.000091 | 2.00 |
| 20 | 20.00003 | 20.0000 | 0.0000 | 0.000095 | 2.00 |
| 50 | 50.00003 | 49.9999 | 0.0001 | 0.00011 | 2.00 |
| 70 | 70.00006 | 69.9999 | 0.0002 | 0.00013 | 2.00 |
| 100 | 100.00006 | 99.9999 | 0.0002 | 0.00016 | 2.00 |
| 150 | 150.00009 | 149.9999 | 0.0002 | 0.00021 | 2.00 |
| 200 | 200.00016 | 199.9998 | 0.0004 | 0.00028 | 2.00 |

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

End

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Certificate of System Qualification

GC-OQ

System ID: UAE_TOX.007_CN11021007
Organization Name: United Analyst and Engineering Consultant Co., Ltd.
Organization Location: 3 Soi Udomsak 41, Sukhumvit Road, Bangkok, Phrakhanong, Bangkok 10260

Date: February 23, 2023 3:19:15 PM
EQP Name: AgilentRecommended
EQP Revision: GC.02.51
Overall Qualification Status: Pass

System Inspection and Basic Safety and Operation

Name: 7890
Setpoint Status: Pass

Overall System Inspection and Basic Safety and Operation Test Status

Pass

Inlet Pressure Decay

Name: 7890
Front SSL
Setpoint Status: Pass
Pressure: 25.0 psi
Pressure Change: -0.1 psi /5 minutes
Agilent Recommended: ≥ -2.0 and ≤ 0.5

Overall Inlet Pressure Decay Test Status

Pass

Inlet Pressure Accuracy

Name: 7890
Front SSL

Date: February 23, 2023 3:19:15 PM
System ID: UAE_TOX.007_CN11021007

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Setpoint Status: Pass
Inlet Pressure: Setpoint 25.0 psi Actual 25.0 psi
Accuracy: 0.0 psi
Agilent Recommended: ≤ 1.2

Overall Inlet Pressure Accuracy Test Status

Pass

Detector Flow Accuracy

Name: 7890
Front UECD
Setpoint Status: Pass
Flow Type: Makeup
Setpoint: 25.0 mL/min Measured Flow: 24.9 mL/min
Accuracy: 0.1 mL/min
Agilent Recommended: ≤ 10.0 % setpoint (2.5 mL/min)
Limit is percentage of setpoint or 0.5 mL/minute, whichever is largest.

Overall Detector Flow Accuracy Test Status

Pass

Detector Flow Accuracy

Name: 7890
Back FID
Setpoint Status: Pass
Flow Type: Fuel
Setpoint: 30.0 mL/min Measured Flow: 30.2 mL/min
Accuracy: 0.2 mL/min
Agilent Recommended: ≤ 10.0 % setpoint (3.0 mL/min)
Limit is percentage of setpoint or 0.5 mL/minute, whichever is largest.

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Setpoint Status: Pass
Flow Type: Oxidizer
Setpoint: 400.0 mL/min Measured Flow: 389.6 mL/min
Accuracy: 10.4 mL/min
Agilent Recommended: ≤ 10.0 % setpoint (40.0 mL/min)
Limit is percentage of setpoint or 0.5 mL/minute, whichever is largest.

Setpoint Status: Pass
Flow Type: Makeup
Setpoint: 25.0 mL/min Measured Flow: 24.9 mL/min
Accuracy: 0.1 mL/min
Agilent Recommended: ≤ 10.0 % setpoint (2.5 mL/min)
Limit is percentage of setpoint or 0.5 mL/minute, whichever is largest.

Overall Detector Flow Accuracy Test Status

Pass

GC Oven Temperature Accuracy

Name: 7890
Setpoint Status: Pass
Zone: Oven
Setpoint/Actual: 230.0 °C
Accuracy: 0.0 °C
Agilent Recommended: ≥ -1.0 % setpoint in K (-5.0 °C)
 ≤ 1.0 % setpoint in K (5.0 °C)

Date: February 23, 2023 3:19:15 PM
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Setpoint Status: Pass
Zone: Oven
Setpoint/Actual: 100.0 °C 100.8 °C
Accuracy: 0.8 °C
Agilent Recommended: ≥ -1.0 % setpoint in K (-3.7 °C)
 ≤ 1.0 % setpoint in K (3.7 °C)

Overall GC Oven Temperature Accuracy Test Status

Pass

GC Oven Temperature Stability

Name: 7890
Setpoint Status: Pass
Setpoint/Average: 100.0 °C 100.7893 °C
Stability: 0.1 °C
Agilent Recommended: ≤ 0.5

Overall GC Oven Temperature Stability Test Status

Pass

Scouting Run

Tested Combination1 Front SSL / Front UECD
Injection Tower
Name: 7890B

Setpoint Status: Completed
Injection Volume on Column: 1.0 µL

Overall Scouting Run Status

Completed

Noise and Drift

Tested Combination1 Front SSL / Front UECD

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System ID: UAE_TOX.007_CN11021007

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Name: 7890

Setpoint Status: Pass

Base Signal: 212 Hz

ASTM Noise: 1.24 Hz

Drift: 13.32 Hz/Hr

Agilent Recommended: <= 3.00 <= 15.00

Status: Pass Pass

Overall Noise and Drift Test Status

Pass

Injection Precision

Tested Combination1: Front SSL / Front UECD

Name: 7683B

Setpoint Status: Pass

Injection Volume on Column: 1.0 uL

Area RSD: 2.38 % Retention Time RSD: 0.03 %

Agilent Recommended: <= 3.00 <= 1.00

Overall Injection Precision Test Status

Pass

Signal to Noise

Tested Combination1: Front SSL / Front UECD

Name: 7890

Setpoint Status: Pass

Signal to Noise: 4533

Agilent Recommended: >= 1500

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Overall Signal to Noise Test Status

Pass

Scouting Run

Tested Combination2: Front SSL / Back FID

Injection Tower

Name: 7683B

Setpoint Status: Completed

Injection Volume on Column: 1.0 uL

Overall Scouting Run Status

Completed

Noise and Drift

Tested Combination2: Front SSL / Back FID

Name: 7890

Setpoint Status: Pass

Base Signal: 12.2 pA

ASTM Noise: 0.04 pA

Drift: 0.07 pA/Hr

Agilent Recommended: <= 0.10 <= 2.50

Status: Pass Pass

Overall Noise and Drift Test Status

Pass

Injection Precision

Tested Combination2: Front SSL / Back FID

Name: 7683B

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Setpoint Status: Pass

Injection Volume on Column: 1.0 uL

Area RSD: 0.57 % Retention Time RSD: 0.74 %

Agilent Recommended: <= 3.00 <= 1.00

Overall Injection Precision Test Status

Pass

Signal to Noise

Tested Combination2: Front SSL / Back FID

Injection Tower

Name: 7890

Setpoint Status: Pass

Signal to Noise: 1173500

Agilent Recommended: >= 300000

Overall Signal to Noise Test Status

Pass

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เอกสารไม่ควบคุม

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Instrument Details

Purpose: This section describes the as found system configuration.

Details

System

System ID: UAE.TOX.007_CN11021007

Manufacturer: Agilent Technologies

Name: 7890

Flow Data Input: Manual Data

Temperature Data Input: Manual Data or Other Data Logging

Tested Combination1

Injection Technique: Injection Tower

Inlet: Front

Detector: Front

LTM Included?: no

Tested Combination2

Injection Technique: Injection Tower

Inlet: Front

Detector: Back

LTM Included?: No

Sampler 1

Manufacturer: Agilent Technologies

Type: Injection Tower

Name: 7683B

Model Number: G2913A

Serial Number: CN28140436

Firmware Revision: A.11.02

Usage: Sample Injection

Location: Front

Syringe Volume (uL): 10

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Sampler 2

| | |
|-------------------|----------------------|
| Manufacturer | Agilent Technologies |
| Type | Tray |
| Name | 7883A |
| Model Number | G2614A |
| Serial Number | CN82248787 |
| Firmware Revision | A.02.01 |

Mainframe 1

| | |
|-------------------|----------------------|
| Manufacturer | Agilent Technologies |
| Name | 7890 |
| Model Number | G3440A |
| Serial Number | CN11021007 |
| Firmware Revision | A.01.11 |
| Oven Type | Standard |

Inlet 1

| | |
|--------------|-----------------------------------|
| Manufacturer | Agilent Technologies |
| Name | 7890 |
| Type | SSL |
| Location | Front |
| Carrier Gas | Helium |
| Control Type | Electronic Pressure Control (EPC) |
| Purged Inlet | Yes |

Detector 1

| | |
|---------------|-----------------------------------|
| Manufacturer | Agilent Technologies |
| Name | 7890 |
| Type | UECD |
| Serial Number | U16886 |
| Adapter | Capillary |
| Control Type | Electronic Pressure Control (EPC) |
| Location | Front |
| Makeup Gas | Nitrogen |

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Detector 2

| | |
|--------------|-----------------------------------|
| Manufacturer | Agilent Technologies |
| Name | 7890 |
| Type | FID |
| Adapter | Capillary |
| Control Type | Electronic Pressure Control (EPC) |
| Location | Back |
| Makeup Gas | Nitrogen |

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เอกสารไม่ควบคุม

User Name: saenguthai.tarak
Hostname: LAPTOP-CQ3SK0MV

System ID: UAE.TOX.007_CN11021007
Print Date: February 23, 2023 3:19:17 PM

UAE.TOX.007_CN11021007 Transaction Log:

| Time | Transaction State | Activity Performed | Type of Transaction | Optional Information |
|------------------------------|-------------------|--------------------|---|--|
| February 23, 2023 9:16:11 AM | Audit | SessionCreated | Session | None |
| February 23, 2023 9:16:11 AM | Audit | Data | Session | Transaction Log file is either corrupted or deleted |
| February 23, 2023 9:16:11 AM | Start | Configuration | Session | None |
| February 23, 2023 9:16:11 AM | Audit | Enrollment | Licensing | Session identifier generated: 0600-0002-0000-11M5-HR5 G |
| February 23, 2023 9:18:23 AM | Audit | Enrollment | Licensing | Successfully unlocked session identified by 0600-0002-0000-11M5-HR5 G with unlock code 989V-XB5Q-05N3-9801-V68 4C |
| February 23, 2023 9:25:56 AM | Audit | ExpLoaded | Session | ECP delete for primary technique (Sc) : File path: (Protocol\packs\Gx\Config\user\02_51\Gx\02_51.asp) ECP File Name: (Sc:02_51.asp) ECP Name: (AgilentRecommended)Prots not Revision (Sc:02_51) |
| February 23, 2023 9:26:00 AM | End | Configuration | Session | None |
| February 23, 2023 9:26:07 AM | Start | Qualification | Session | OQ |
| February 23, 2023 9:26:07 AM | Start | Execution | System Inspection and Basic Safety and Operation - 7090 - Qualitative Test - No setpoints associated. | None |

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Date: February 23, 2023 3:19:15 PM
System ID: UAE.TOX.007_CN11021007

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เอกสารไม่ควบคุม

User Name: saenguthai.tarak
Host Name: LAPTOP-CQ3SKOMV
System ID: UAE.TOX.007_CN11021007
Print Date: February 23, 2023 3:16:17 PM

UAE.TOX.007_CN11021007 Transaction log:

| Time | Transaction State | Activity Performed | Type of Transaction | Optional Information |
|------------------------------|-------------------|--------------------|---|----------------------|
| February 23, 2023 9:26:24 AM | End | Execution | System Inspection and Basic Safety and Operation - 7890 - Qualitative Test - No setpoints associated | Run Count: 1 |
| February 23, 2023 9:26:28 AM | Start | Execution | Inlet Pressure Decay - Front SSL - Pressure Controlled Inlet - S: 25.0 psi - L: >= 2.0 psi and <= 0.5 psi | None |
| February 23, 2023 9:26:37 AM | End | Execution | Inlet Pressure Decay - Front SSL - Pressure Controlled Inlet - S: 25.0 psi - L: >= 2.0 psi and <= 0.5 psi | Run Count: 1 |
| February 23, 2023 9:26:39 AM | Start | Execution | Inlet Pressure Accuracy - Front SSL - Pressure Controlled Inlet - S: 25.0 psi - L: <= 1.2 psi | None |
| February 23, 2023 9:26:44 AM | End | Execution | Inlet Pressure Accuracy - Front SSL - Pressure Controlled Inlet - S: 25.0 psi - L: <= 1.2 psi | Run Count: 1 |
| February 23, 2023 9:26:46 AM | Start | Execution | Detector Flow Accuracy - Front UECD - Type: Makeup - S: 25.0 mL/min - L: <= 10.0% setpoint | None |
| February 23, 2023 9:27:13 AM | Audit | Data | Detector Flow Accuracy - Front UECD - Type: Makeup - S: 25.0 mL/min - L: <= 10.0% setpoint | Manual Data Entry |
| February 23, 2023 9:27:19 AM | End | Execution | Detector Flow Accuracy - Front UECD - Type: Makeup - S: 25.0 mL/min - L: <= 10.0% setpoint | Run Count: 1 |
| February 23, 2023 9:27:22 AM | Start | Execution | Detector Flow Accuracy - Back FID - Type: Fuel - S: 30.0 mL/min - L: <= 10.0% setpoint | None |

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Date: February 23, 2023 3:16:15 PM
System ID: UAE.TOX.007_CN11021007

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เอกสารไม่ควบคุม

User Name: saenguthai.tarak
Host Name: LAPTOP-CQ3SKOMV
System ID: UAE.TOX.007_CN11021007
Print Date: February 23, 2023 3:16:17 PM

UAE.TOX.007_CN11021007 Transaction log:

| Time | Transaction State | Activity Performed | Type of Transaction | Optional Information |
|------------------------------|-------------------|--------------------|---|----------------------|
| February 23, 2023 9:27:55 AM | Audit | Data | Detector Flow Accuracy - Back FID - Type: Fuel - S: 30.0 mL/min - L: <= 10.0% setpoint | Manual Data Entry |
| February 23, 2023 9:27:57 AM | End | Execution | Detector Flow Accuracy - Back FID - Type: Fuel - S: 30.0 mL/min - L: <= 10.0% setpoint | Run Count: 1 |
| February 23, 2023 9:27:59 AM | Start | Execution | Detector Flow Accuracy - Back FID - Type: Oxidizer - S: 400.0 mL/min - L: <= 10.0% setpoint | None |
| February 23, 2023 9:28:22 AM | Audit | Data | Detector Flow Accuracy - Back FID - Type: Oxidizer - S: 400.0 mL/min - L: <= 10.0% setpoint | Manual Data Entry |
| February 23, 2023 9:28:26 AM | End | Execution | Detector Flow Accuracy - Back FID - Type: Oxidizer - S: 400.0 mL/min - L: <= 10.0% setpoint | Run Count: 1 |
| February 23, 2023 9:28:29 AM | Start | Execution | Detector Flow Accuracy - Back FID - Type: Makeup - S: 25.0 mL/min - L: <= 10.0% setpoint | None |
| February 23, 2023 9:28:03 AM | Audit | Data | Detector Flow Accuracy - Back FID - Type: Makeup - S: 25.0 mL/min - L: <= 10.0% setpoint | Manual Data Entry |
| February 23, 2023 9:29:06 AM | End | Execution | Detector Flow Accuracy - Back FID - Type: Makeup - S: 25.0 mL/min - L: <= 10.0% setpoint | Run Count: 1 |
| February 23, 2023 9:29:08 AM | Start | Execution | GC Oven Temperature Accuracy - 7890 - Temperature - Oven - S: 230.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K | None |
| February 23, 2023 9:30:02 AM | Audit | Data | GC Oven Temperature Accuracy - 7890 - Temperature - Oven - S: 230.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K | Manual Data Entry |

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Date: February 23, 2023 3:16:15 PM
System ID: UAE.TOX.007_CN11021007

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เอกสารไม่ควบคุม

User Name: saenguthai.tarak
Host Name: LAPTOP-CQ3SKOMV
System ID: UAE.TOX.007_CN11021007
Print Date: February 23, 2023 3:16:17 PM

UAE.TOX.007_CN11021007 Transaction log:

| Time | Transaction State | Activity Performed | Type of Transaction | Optional Information |
|------------------------------|-------------------|--------------------|---|----------------------|
| February 23, 2023 9:30:04 AM | End | Execution | GC Oven Temperature Accuracy - 7890 - Temperature - Oven - S: 230.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K | Run Count: 1 |
| February 23, 2023 9:30:06 AM | Start | Execution | GC Oven Temperature Accuracy - 7890 - Temperature - Oven - S: 100.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K | None |
| February 23, 2023 9:30:40 AM | Audit | Data | GC Oven Temperature Accuracy - 7890 - Temperature - Oven - S: 100.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K | Manual Data Entry |
| February 23, 2023 9:30:43 AM | End | Execution | GC Oven Temperature Accuracy - 7890 - Temperature - Oven - S: 100.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K | Run Count: 1 |
| February 23, 2023 9:30:45 AM | Start | Execution | GC Oven Temperature Stability - 7890 - Temperature - Oven - S: 100.0°C - L: <= 0.5°C | None |
| February 23, 2023 9:31:45 AM | Audit | Data | GC Oven Temperature Stability - 7890 - Temperature - Oven - S: 100.0°C - L: <= 0.5°C | Manual Data Entry |
| February 23, 2023 9:31:48 AM | End | Execution | GC Oven Temperature Stability - 7890 - Temperature - Oven - S: 100.0°C - L: <= 0.5°C | Run Count: 1 |
| February 23, 2023 9:31:53 AM | Start | Execution | GC Scouting Run - Injection Tower, Front SSL, Front UECD - Part of System Preparation - No limits associated | None |
| February 23, 2023 2:40:21 PM | Start | Execution | GC Scouting Run - Injection Tower, Front SSL, Front UECD - Part of System Preparation - No limits associated | None |

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Date: February 23, 2023 3:16:15 PM
System ID: UAE.TOX.007_CN11021007

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เอกสารไม่ควบคุม

User Name: saenguthai.tarak
Host Name: LAPTOP-CQ3SKOMV
System ID: UAE.TOX.007_CN11021007
Print Date: February 23, 2023 3:16:17 PM

UAE.TOX.007_CN11021007 Transaction log:

| Time | Transaction State | Activity Performed | Type of Transaction | Optional Information |
|------------------------------|-------------------|--------------------|--|---|
| February 23, 2023 2:40:56 PM | Start | Execution | GC Scouting Run - Injection Tower, Front SSL, Front UECD - Part of System Preparation - No limits associated | None |
| February 23, 2023 2:42:19 PM | Audit | Data | GC Scouting Run - Injection Tower, Front SSL, Front UECD - Part of System Preparation - No limits associated | Data File Path: E:\UAE\20230203_ECDD\2023-02-23\14-10-45\GC7890_ECDD_SC10.D\ECDD1A.dh |
| February 23, 2023 2:43:14 PM | End | Execution | GC Scouting Run - Injection Tower, Front SSL, Front UECD - Part of System Preparation - No limits associated | Run Count: 1 |
| February 23, 2023 2:43:17 PM | Start | Execution | Noise and Drift - Front UECD - Detector UECD - L (Noise): <= 3.00 Hz - L (Drift): <= 15.00 mHz | None |
| February 23, 2023 2:43:54 PM | Audit | Data | Noise and Drift - Front UECD - Detector UECD - L (Noise): <= 3.00 Hz - L (Drift): <= 15.00 mHz | Data File Path: E:\UAE\20230203_ECDD\2023-02-23\14-10-45\GC7890_ECDD_SC10.D\ECDD1A.dh |
| February 23, 2023 2:44:11 PM | End | Execution | Noise and Drift - Front UECD - Detector UECD - L (Noise): <= 3.00 Hz - L (Drift): <= 15.00 mHz | Run Count: 1 |
| February 23, 2023 2:44:14 PM | Start | Execution | Injection Precision - Injection Tower, Front SSL, Front UECD - GC - L (Area): <= 3.00% - L (Ret. Time): <= 1.00% | None |
| February 23, 2023 2:44:45 PM | Start | Execution | Injection Precision - Injection Tower, Front SSL, Front UECD - GC - L (Area): <= 3.00% - L (Ret. Time): <= 1.00% | None |

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Date: February 23, 2023 3:16:15 PM
System ID: UAE.TOX.007_CN11021007

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เอกสารไม่ควบคุม

User Name: saenguthai.tarak
Hostname: LAPTOP-CQ3SK0RV
System ID: UAE.TOX.007_CN11021007
Print Date: February 23, 2023 3:19:17 PM

UAE.TOX.007_CN11021007 Transaction log:

| Time | Transaction State | Activity Performed | Type of Transaction | Optional Information |
|------------------------------|-------------------|--------------------|--|---|
| February 23, 2023 2:48:43 PM | Audit | Data | Injection Precision - Injection Tower, Front SSL, Front UECD - GC - L (Area): <= 3.00% - L (Ret. Time): <= 1.00% | Data file Path: E:\UAE\2023020223_8\CD 2023-02-22 14-10-4500_GCT7890_UEC D_Ph001-020F.D\ECDD1A.ch |
| February 23, 2023 2:48:43 PM | Audit | Data | Injection Precision - Injection Tower, Front SSL, Front UECD - GC - L (Area): <= 3.00% - L (Ret. Time): <= 1.00% | Data file Path: E:\UAE\2023020223_8\CD 2023-02-22 14-10-4500_GCT7890_UEC D_Ph001-021F.D\ECDD1A.ch |
| February 23, 2023 2:48:43 PM | Audit | Data | Injection Precision - Injection Tower, Front SSL, Front UECD - GC - L (Area): <= 3.00% - L (Ret. Time): <= 1.00% | Data file Path: E:\UAE\2023020223_8\CD 2023-02-22 14-10-4500_GCT7890_UEC D_Ph001-022F.D\ECDD1A.ch |
| February 23, 2023 2:48:43 PM | Audit | Data | Injection Precision - Injection Tower, Front SSL, Front UECD - GC - L (Area): <= 3.00% - L (Ret. Time): <= 1.00% | Data file Path: E:\UAE\2023020223_8\CD 2023-02-22 14-10-4500_GCT7890_UEC D_Ph001-023F.D\ECDD1A.ch |
| February 23, 2023 2:48:52 PM | Audit | Data | Injection Precision - Injection Tower, Front SSL, Front UECD - GC - L (Area): <= 3.00% - L (Ret. Time): <= 1.00% | Data file Path: E:\UAE\2023020223_8\CD 2023-02-22 14-10-4500_GCT7890_UEC D_Ph001-024F.D\ECDD1A.ch |
| February 23, 2023 2:47:57 PM | End | Execution | Injection Precision - Injection Tower, Front SSL, Front UECD - GC - L (Area): <= 3.00% - L (Ret. Time): <= 1.00% | Run Count: 1 |

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Date: February 23, 2023 3:19:15 PM
System ID: UAE.TOX.007_CN11021007

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เอกสารไม่ควบคุม

User Name: saenguthai.tarak
Hostname: LAPTOP-CQ3SK0RV
System ID: UAE.TOX.007_CN11021007
Print Date: February 23, 2023 3:19:17 PM

UAE.TOX.007_CN11021007 Transaction log:

| Time | Transaction State | Activity Performed | Type of Transaction | Optional Information |
|------------------------------|-------------------|--------------------|--|---|
| February 23, 2023 2:48:02 PM | Start | Execution | Signal to Noise - Injection Tower, Front SSL, Front UECD - Detector UECD - L >= 1000 | None |
| February 23, 2023 2:48:26 PM | Start | Execution | Signal to Noise - Injection Tower, Front SSL, Front UECD - Detector UECD - L >= 1000 | None |
| February 23, 2023 2:49:10 PM | Audit | Data | Signal to Noise - Injection Tower, Front SSL, Front UECD - Detector UECD - L >= 1000 | Data file Path: E:\UAE\2023020223_8\CD1A.ch |
| February 23, 2023 2:51:07 PM | Start | Execution | Signal to Noise - Injection Tower, Front SSL, Front UECD - Detector UECD - L >= 1000 | None |
| February 23, 2023 2:51:24 PM | End | Execution | Signal to Noise - Injection Tower, Front SSL, Front UECD - Detector UECD - L >= 1000 | Run Count: 1 |
| February 23, 2023 2:51:35 PM | Start | Execution | GC Scouting Run - Injection Tower, Front SSL, Back FID - Part of System Preparation - No limits associated | None |
| February 23, 2023 2:52:00 PM | Audit | Data | GC Scouting Run - Injection Tower, Front SSL, Back FID - Part of System Preparation - No limits associated | Data file Path: E:\UAE\2023020223_8\CD1A.ch |
| February 23, 2023 2:52:37 PM | End | Execution | GC Scouting Run - Injection Tower, Front SSL, Back FID - Part of System Preparation - No limits associated | Run Count: 1 |
| February 23, 2023 2:52:44 PM | Start | Execution | Noise and Drift - Back FID - Detector FID - L (Noise): <= 0.10 pA - L (Drift): <= 2.50 pA/hour | None |

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System ID: UAE.TOX.007_CN11021007

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เอกสารไม่ควบคุม

User Name: saenguthai.tarak
Hostname: LAPTOP-CQ3SK0RV
System ID: UAE.TOX.007_CN11021007
Print Date: February 23, 2023 3:19:17 PM

UAE.TOX.007_CN11021007 Transaction log:

| Time | Transaction State | Activity Performed | Type of Transaction | Optional Information |
|------------------------------|-------------------|--------------------|--|---|
| February 23, 2023 2:53:29 PM | Start | Execution | Noise and Drift - Back FID - Detector FID - L (Noise): <= 0.10 pA - L (Drift): <= 2.50 pA/hour | None |
| February 23, 2023 2:53:53 PM | Audit | Data | Noise and Drift - Back FID - Detector FID - L (Noise): <= 0.10 pA - L (Drift): <= 2.50 pA/hour | Data file Path: E:\UAE\2023020223_8\CD1A.ch |
| February 23, 2023 2:54:10 PM | End | Execution | Noise and Drift - Back FID - Detector FID - L (Noise): <= 0.10 pA - L (Drift): <= 2.50 pA/hour | Run Count: 1 |
| February 23, 2023 2:54:13 PM | Start | Execution | Injection Precision - Injection Tower, Front SSL, Back FID - GC - L (Area): <= 3.00% - L (Ret. Time): <= 1.00% | None |
| February 23, 2023 2:57:04 PM | Start | Execution | Injection Precision - Injection Tower, Front SSL, Back FID - GC - L (Area): <= 3.00% - L (Ret. Time): <= 1.00% | None |
| February 23, 2023 2:57:37 PM | Start | Execution | Injection Precision - Injection Tower, Front SSL, Back FID - GC - L (Area): <= 3.00% - L (Ret. Time): <= 1.00% | None |
| February 23, 2023 2:59:21 PM | Audit | Data | Injection Precision - Injection Tower, Front SSL, Back FID - GC - L (Area): <= 3.00% - L (Ret. Time): <= 1.00% | Data file Path: E:\UAE\2023020223_8\CD1A.ch |
| February 23, 2023 2:59:21 PM | Audit | Data | Injection Precision - Injection Tower, Front SSL, Back FID - GC - L (Area): <= 3.00% - L (Ret. Time): <= 1.00% | Data file Path: E:\UAE\2023020223_8\CD1A.ch |

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Date: February 23, 2023 3:19:15 PM
System ID: UAE.TOX.007_CN11021007

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เอกสารไม่ควบคุม

User Name: saenguthai.tarak
Hostname: LAPTOP-CQ3SK0RV
System ID: UAE.TOX.007_CN11021007
Print Date: February 23, 2023 3:19:17 PM

UAE.TOX.007_CN11021007 Transaction log:

| Time | Transaction State | Activity Performed | Type of Transaction | Optional Information |
|------------------------------|-------------------|--------------------|--|---|
| February 23, 2023 2:59:22 PM | Audit | Data | Injection Precision - Injection Tower, Front SSL, Back FID - GC - L (Area): <= 3.00% - L (Ret. Time): <= 1.00% | Data file Path: E:\UAE\2023020223_8\CD1A.ch |
| February 23, 2023 2:59:22 PM | Audit | Data | Injection Precision - Injection Tower, Front SSL, Back FID - GC - L (Area): <= 3.00% - L (Ret. Time): <= 1.00% | Data file Path: E:\UAE\2023020223_8\CD1A.ch |
| February 23, 2023 2:59:26 PM | Audit | Data | Injection Precision - Injection Tower, Front SSL, Back FID - GC - L (Area): <= 3.00% - L (Ret. Time): <= 1.00% | Data file Path: E:\UAE\2023020223_8\CD1A.ch |
| February 23, 2023 2:59:28 PM | Audit | Data | Injection Precision - Injection Tower, Front SSL, Back FID - GC - L (Area): <= 3.00% - L (Ret. Time): <= 1.00% | Data file Path: E:\UAE\2023020223_8\CD1A.ch |
| February 23, 2023 3:00:43 PM | End | Execution | Injection Precision - Injection Tower, Front SSL, Back FID - GC - L (Area): <= 3.00% - L (Ret. Time): <= 1.00% | Run Count: 1 |
| February 23, 2023 3:00:56 PM | Start | Execution | Signal to Noise - Injection Tower, Front SSL, Back FID - Detector FID - L >= 300000 | None |
| February 23, 2023 3:03:10 PM | Start | Execution | Signal to Noise - Injection Tower, Front SSL, Back FID - Detector FID - L >= 300000 | None |
| February 23, 2023 3:02:36 PM | Start | Execution | Signal to Noise - Injection Tower, Front SSL, Back FID - Detector FID - L >= 300000 | None |
| February 23, 2023 3:03:13 PM | Audit | Data | Signal to Noise - Injection Tower, Front SSL, Back FID - Detector FID - L >= 300000 | Data file Path: E:\UAE\2023020223_8\CD1A.ch |

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Date: February 23, 2023 3:19:15 PM
System ID: UAE.TOX.007_CN11021007

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เอกสารไม่ควบคุม

User Name: xiangpuhai.sarak
Host Name: LAPTOP-CQ25KQWV

System ID: UAE.TOX.007_CN11021007
Print Date: February 23, 2023 3:19:17 PM

UAE.TOX.007_CN11021007 Transaction log:

| Time | Transaction State | Activity Performed | Type of Transaction | Optional Information |
|------------------------------|-------------------|--------------------|---|-----------------------------------|
| February 23, 2023 3:03:51 PM | End | Execution | Signal to Noise - Injection Tower: Front S/S, Back FID - Detector FID - L1: n= 300000 | Run Count : 1 |
| February 23, 2023 3:04:02 PM | End | Qualification | Session | OQ |
| February 23, 2023 3:04:00 PM | Start | Reporting | Session | None |
| February 23, 2023 3:19:15 PM | Audit | Reporting | Session | Report Generated : Certificate |

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เอกสารไม่ควบคุม



Agilent CrossLab Start Up Services Agilent 7890 Gas Chromatograph Preventive Maintenance Checklist

Agilent Preventive Maintenance provides factory recommended service for your analytical instruments to assure reliable operation and the accuracy of your results.

Delivered by highly trained and certified service engineers using genuine Agilent parts and supplies, Agilent Preventive Maintenance provides everything you need to reduce unplanned downtime and keep your systems operating at their peak. This checklist will be completed at the end of the service and provided to you as a record of the preventive maintenance activities.

Agilent 7890 GC Preventive Maintenance Checklist



Introduction

Customer Information

- Customers should provide all necessary operating supplies upon request of the engineer.
- A customer representative should be available to the engineer while performing the preventive maintenance procedures.
- Any parts, not included in the Parts Lists section of this document, are not part of the recommended Preventive Maintenance service, nor are they included in the price of this service.
- If a system requires the use of extra or special procedures and/or parts for the maintenance service, then these must be ordered separately and charged as a repair, which may incur additional costs.

Important Customer Web Links

- For more information about **Agilent Technologies services**, please visit our website using the following URL: <http://www.agilent.com/en-us/products/crosslab-instrument-services/service-repair>
- The **Agilent Community** is an excellent place to get answers, collaborate with others about applications and Agilent products, and find in-depth documents and videos relevant to Agilent technologies. Visit <https://community.agilent.com/welcome>.
- To access **Agilent University**, visit <http://www.agilent.com/crosslab/university/> to learn about training options, which include online, classroom and onsite delivery. A training specialist can work directly with you to help determine your best options.
- A useful **Agilent Resource Center** web page is available, which includes short videos on maintenance, quick lists of consumables for new instruments, and other valuable information. Check out the Resource Page here: <https://www.agilent.com/en-us/agilentresources>.
- Need technical support, FAQs, supplies? – visit our **Support Home page** <http://www.agilent.com/search/support>.
- Videos** about specific preparation requirements for your instrument can be found by searching the **Agilent YouTube** channel at <https://www.youtube.com/user/agilent>.
- 7890B Manuals** are also available on Agilent.com:
 - Safety**
https://www.agilent.com/cs/library/usermanuals/public/7890B_Safety.pdf
 - Installation and First Startup**
https://www.agilent.com/cs/library/usermanuals/public/7890B_installation.pdf
 - Operation Manual**
https://www.agilent.com/cs/library/usermanuals/public/7890B_Operation.pdf
 - Maintaining Your GC**
https://www.agilent.com/cs/library/usermanuals/public/G3430-90052%207890B_Maintaining%20Guide.pdf

Service Engineer's Responsibilities

- Contact the customer and ensure that all necessary supplies are available before the preventive maintenance visit.
- Only select those pages that relate to the system or module being serviced.
- Complete empty fields with the relevant information.
- Complete the relevant checkboxes in the checklist using either a "X" or tick mark "✓".
- Check "Section not applicable" check boxes to indicate services/tasks not delivered, as appropriate.
- Complete the Preventive Maintenance service in the order of the tasks listed.
- Complete the Service Review section together with the customer.
- Complete the fields for page numbers at the foot of each selected page.
- Complete the total number of pages field in the Service Completion section.
- **Ask the customer to sign the Service Completion section including the customer's and your signature.**

Additional Instruction Notes

- Check for any active service notes for this unit. If there are any applicable "Safety" or "Modification Recommended" Service notes, plan to implement the changes on this unit before doing any qualification service.
- Do not implement firmware updates, unless you get approval from the customer and are sure that they are compatible with the instrument control software.

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System Information

- ☒ Check this box if an instrument configuration report is attached instead of completing the table below.

Instrument System Name and ID

UAE.TOX.007

CN 11201007

Instrument System Site and Location

UAE

Analytical Laboratory

List System Component Product Numbers

List the Serial Numbers of each Component

1. B3940A
 2. G-2917A
 3. G-2614A

CN 11801007
 CN 82149496
 CN 82248782

Preparation

- ☒ Discuss any specific issues with the customer before starting.
- ☒ Review the instrument logbook for recorded problems and comments.
- ☒ Save instrument control settings before starting the procedure.
- ☒ Perform a general inspection of the system for cleanliness.
- ☒ Check for proper installation of parts, assemblies, sensors etc.
- ☒ Check system for required installation of components, settings as defined by current Service Notes.
- ☒ Check for required firmware updates and verify with customers if they would like them installed.
- ☒ Before starting the following procedures, record the Detector Signal Output(s) in the results table. If the GC is turned OFF or in a service mode, comparing the detector outputs before and after the service is not possible.

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Preventive Maintenance Procedure

Clean and inspect GC

- ☒ Unplug power cord from the power source.
- ☒ Open GC covers and vacuum/remove any dust/debris. Pay particular attention to cooling fans.
- ☒ Inspect internal connectors for proper contact and placement.
- ☒ Reconnect Power to the GC. Power the GC on and verify the power on self-test passed.
- ☒ Verify oven motor spins freely and turns on with the oven door closed; off when the door is opened.
- ☒ Verify operation of all other fans - the inlet and EPC cooling fans.
- ☒ Verify oven intake/outlet flap assembly is operating smoothly while heating and cooling the oven

Inlet and detector consumable replacement

- ☒ For the inlets installed, perform inlet maintenance as defined in the 7890 manual - "Maintaining Your GC" - for the inlet(s) installed.
- ☒ Replace the split vent trap cartridge filter on units with these inlets: Split/Splitless Capillary (SSL), Multi-Mode Inlet (MMI), Programmed Temperature Vaporizer (PTV), Volatiles Interface (VI).
- ☒ If the inlet system is used in Split Mode with viscous samples, inspect and clean the split vent tube on the inlet and flush or replace the tubing between the inlet and the split vent trap.
- ☒ If the GC includes a Flame Ionization Detector (FID), replace the jet. If the ignitor shows any buildup of sample or corrosion, replace the ignitor. Examine the FID collector and castle assemblies for contamination - clean as necessary.

Zero Sensors and Leak test

- ☒ Zero all pressure sensors per the procedure in the 7890 "Advanced User Guide".
- ☒ Perform inlet pressure decay test(s) as defined in the 7890 "Troubleshooting Manual".
 If the PM is done in preparation for an Operational Qualification, then the pressure decay test defined within that protocol can be used for the PM.
- ☒ Record if test passed or failed in the results table.

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ALS Maintenance

- ☐ Section NOT applicable
- ☒ Check all cabling and configuration settings between GC, tray, and injectors.
- ☒ Vacuum or remove any dust, especially around fans.
- ☒ Check operation of all fans.
- ☒ Check syringe for smooth plunger operation.
- ☒ Check for smooth operation of the needle support - clean if necessary

Restore Instrument

- ☒ Restore the normal operating conditions or customer method using the Data System.
- ☒ Purge the system with carrier flow for 15 minutes
- ☒ Bake out the system, then restore the normal operating conditions
- ☒ After equilibration, check and record the post PM detector signal output values.
 Results should be similar or lower than the detector outputs recorded prior to PM.
- ☒ Perform a chemical checkout. If this is a routine PM, inject the customer's sample using the ALS if applicable. This will act as a final checkout of both the ALS and the GC.

Note: If the PM Service is performed prior to a qualification service, then use the qualification procedure as a guide for final instrument set up and checkout.

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Signature Page

Service Review

- ☐ Attach available reports/printouts of all tests to this documentation.
- ☒ Record the Preventive Maintenance service activity in the customer's records/logbook.
- ☒ Update/reset instrument maintenance counters as appropriate.
- ☒ Affix the PM sticker to the system or instrument logbook based on the customer's request.
- ☒ Complete the Service Engineer Comments section if there are additional comments.
- ☒ Review with the customer this service, parts replaced, and test results obtained.
- ☐ If the instrument firmware was updated, record the details of the change in the Service Engineer's Comments box or if necessary, in the customer's IO records.
- ☐ Supply the customer with a copy of the Smart Alerts flyer.
- ☐ Describe Smart Alerts to the customer.
- ☐ Install Smart Alerts if requested.

7890 GC Test Results Table

| Detector Signal Outputs | Before PM Service | After PM Service |
|---------------------------------|----------------------|--------------------|
| Front detector output | N/A | 220 |
| Back detector output | N/A | 12 |
| AUX detector output | N/A | N/A |
| Pressure decay test | Expected test result | Actual test result |
| Front inlet pressure decay test | Pass | Pass |
| Back inlet pressure decay test | N/A | N/A |

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7890 Parts List Table

The following kits are recommended for capillary and purged packed inlets. If this is a general PM and the customer has a preferred set of consumables, you may use the customer's consumables.

| Part description | Part number | Product or model where used | Quantity consumed |
|--|-------------|-----------------------------|-------------------|
| SSL Capillary Inlet PM kit, Splitless | 5188-6497 | 7890A/B | 1 |
| SSL Capillary Inlet PM kit, split | 5188-6496 | 7890A/B | N/A |
| SSL Capillary Ultra Inert Inlet Gold Seal with Washer | 5190-6144 | 7890A/B | N/A |
| SSL Capillary Ultra Inert Inlet Splitless Liner - Single taper with Glass Wool | 5190-2293 | 7890A/B | N/A |
| SSL Capillary Ultra Inert Inlet Low Pressure Drop Split Liner - with Glass Wool | 5190-2295 | 7890A/B | N/A |
| PP Inlet PM kit | 5188-6498 | 7890A/B | N/A |
| Split vent trap PM kit, single cartridge (for MMI, PTV & V) | 5188-6495 | 7890A/B | N/A |
| MMI Cleaning Kit | G3510-60820 | 7890A/B | N/A |
| PTV Septumless Head Rebuild Kit | 5182-9747 | 7890A/B | N/A |
| PTV Septumless Head Teflon Guide | 5182-9748 | 7890A/B | N/A |
| Ignitor (glow plug) assembly with O-ring | 19231-60680 | 7890A/B | 1 |
| FID Collector Rebuild/Cleaning Kit | G1531-67000 | 7890A/B | N/A |
| Standard .011-inch FID Jet for capillary FID base | G1531-80560 | 7890A/B | 1 |
| High Temperature .018-inch FID Jet for capillary FID base | G1531-80620 | 7890A/B | N/A |
| Standard .018-inch FID Jet for packed column with packed FID base | 18710-20119 | 7890A/B | N/A |
| Standard .011-inch FID Jet for capillary column with packed/adaptable FID base | 19244-80560 | 7890A/B | N/A |
| High Temperature .018-inch FID Jet for capillary column with packed/adaptable FID base | 19244-80620 | 7890A/B | N/A |
| NPD Jet, universal fit, .011-inch ID | G1534-80580 | 7890A/B | N/A |
| NPD Jet, universal fit, .011-inch ID Extended tip | G1534-80590 | 7890A/B | N/A |
| SSL Capillary Ultra Inert Inlet Gold Seal with Washer | 5190-6144 | 7890A/B | N/A |
| SSL Capillary Ultra Inert Inlet Splitless Liner - Single taper with Glass Wool | 5190-2293 | 7890A/B | N/A |
| **FID Collector Replacement Kit, if needed | G1531-67001 | 7890A/B | N/A |

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Service Engineer Comments

If there are any specific points you wish to note as part of performing the service or other items of interest for the customer, please write include them in this box.

Service Completion

Service request number 10097469732 Date service completed 22 Feb 2023
 Agilent signature SA Customer signature _____
 Total number of pages in this document 10 pages

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Document Control Logs

Revision Log

| Revision | Date | Author | Reason for update |
|----------------------|------------------|--------------------|---|
| Revision of document | Date of issuance | Author of document | Author to describe main features/changes made for this specific revision |
| 1.0 Draft | 4-Mar-2011 | Dave Park | Migrated the content of revision A.01.05 to the new Agilent template. Reviewed by subject matter expert, Dave Park. |
| 1.1 Draft | 20-Jan-2015 | Dave Park | Added Split Vent trap to MMI, PTV and VE - also PTV and FID PM Parts |
| 1.2 Draft | 31-March-2015 | Dave Park | Added Ultra Inert Gold Seal and Liner to SS Consumables |
| A.01.11 | 10-Dec-2015 | Dave Park | Added step to perform maintenance on the Split Vent Tube and .018" FID Jet part numbers - Fixed broken web links |
| 2.00 | 30-Dec-2020 | Gary Boardman | Updated New Template and terminology change: Familiarization to Introduction. Create New Agile Document Number: D0007063 |

Approval Log

| Revision | Approver | Title of approver |
|---------------------|------------------------|---------------------------------------|
| Add revision number | Add approver name here | Add approver's function or title here |
| A.01.06 | Don Gage | Product support manager |
| A.01.09 | Kai Meng | Product support manager |
| A.01.10 | Suneetha Tippireddy | Product support manager |
| A.01.11 | Suneetha Tippireddy | Product support manager |
| 2.00 | Josh Roark | GC Product Support Manager |

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EQP Name: AgilentRecommended

Service Type: OQ

Company Name: United Analyst and Engineering Consultant Co., Ltd.

Customer Name/Title: Min Benjawan Niyayothai / Laboratory Manager

EQP Filename: QC.02.51.eqp

EQP Release Date: November 2020

Print Date: November 2, 2020 8:00:29 PM

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Scope and Purpose

Overview

The Equipment Qualification Plan (EQP) documents the activity program that is performed during the qualification services for the applicable systems. A complete description of the test specifications is provided for the supported services, including setpoints and acceptance criteria (or limits) for each test. The test specification section of this document is created directly from the EQP file name listed on the cover. This document is an abstraction of the EQP file used to perform the service and is generated directly from the electronic Agilent Equipment Qualification Plan (eEQP) Editor. The purpose of this document is to allow the user to review and record approval of the EQP that guides the delivery of compliance services provided by the Agilent Automated Compliance Engine.

CDS Software Pre-requisite for Hardware Qualifications

(Applies to hardware qualifications only) Agilent recommends that the customer data system (CDS) software used during the qualification has been qualified within the qualification period specified by the customer's software qualification SOP.

Statement of Intent

Unless otherwise requested, the qualification is delivered according to the standard test program described in the Agilent Recommended EQP. Agilent defines variances as changes to the default recommended values (as stated in the Agilent Recommended EQP) that fall within a well-defined range. These changes are considered to be within the intended use range of the system under test.

Customizations are values that (a) subject the system to limits that exceed the typical operational range or (b) additional tests that are not considered part of the core program required for completion of the selected service. Because custom setpoints and limits may exceed the operational envelope of the equipment, Agilent reserves the right to warrant conformance only to the closest variance value. The user is notified of this stipulation at EQP setup time and the qualification report (EQR) will reflect this situation.

A set of ink signature fields, as determined by the creator of this document, can be included at the end of this document. All fields should be completed or a single set of fields, initialed by an appropriate approver, run through any signature fields that are not to be used. This is an optional process that allows a paper record of signoff by the appropriate reviewers where a hybrid (electronic/ink) signature SOP is followed. If this document will be saved electronically and digitally signed in a document management system, it should be generated without ink signature fields. The customer must sign the EQP review documents and return an electronic copy to Agilent prior to qualification delivery. The delivery of the services is done according to the terms and conditions stated in the corresponding service exhibit. It is recommended that after approval, this EQP be archived with the electronic EQP file.

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Understanding the Test Specification Section in Tabular Review Documents

(Applies to hardware qualifications only) For Agilent-recommended setpoints and limits, the range of allowable values (L for low, H for high) is included. As applicable, variances, customizations, and additional setpoints are listed beneath the Agilent recommended values and marked W (within range) or O (outside of range) in the left margin; values for added setpoints are also marked W or O and displayed after all configurations values. Dual limits are marked DW or DO. Agilent is NOT responsible for test failures for out of range setpoints and limits. Optional tests that are enabled are included and marked as such; required tests that are disabled by the customer are included and marked as such.

NOTE: Limit ranges must be more tightly managed than setpoint ranges because they often reflect physical measurement limits and are directly linked to the testing method. Therefore "within range" user limits are subject to best effort repairs if they cannot be met. In particular, Agilent will not be responsible for test failures for limits tighter (more demanding or challenging) than the recommended values.

Customer Responsibilities

If Agilent representatives use a customer CDS account to acquire test data, they log off from the CDS account at the end of test acquisition. Agilent Technologies has no responsibility for those account credentials. It is up to the customer to protect the CDS from misuse.

- o (As applicable) Disable the account used by the Agilent representative to acquire CDS data.
- o Safely store and archive this EQP
- o Maintain change control and revision history
- o Review and optionally sign the EQP, making sure the service delivery is what was approved
- o Review and approve any of the following variances from the Agilent recommended:

- Within Variance Range: changes to the Agilent recommended that are identified by Agilent as within the operation ranges determined in our test development
- Outside of Variance Range: changes to the Agilent recommended that Agilent identifies as outside of the operational ranges determined in our test development. Agilent is not under any obligation to make the instrument pass the more stringent limits that fall in this range and this detail is called out in the EQP Test Specification
- Optional Tests: additional tests that are available but not part of the core testing suite and cost extra
- Disabled Tests: test for which all possible configurations have been disabled (tests are flagged in the test specification)

Agilent Responsibilities

- o Deliver the services following the test programs described in the customer EQP
- o Provide a locked and e-signed Qualification Report (EQR) upon completion of the service
- o If requested, provide an optional ink-signed EQR CD to the customer

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General Statements on the Testing Program

The recommended set of hardware OQ tests described in this EQP derives from Agilent's interpretation of authoritative expert literature issued by the FDA, USP, GAMP, ASTM 2500, and others. The OQ test design incorporates both modular and holistic testing, which is a proven approach, acceptable to regulators. As prescribed by the IQ qualification methodology for Analytical Instrumentation Qualification (AIQ), the OQ step is separated from the PQ as recommended by the regulatory guidelines.

Agilent CrossLab Compliance uses a balanced selection of metrology and chemical tests to directly determine the performance of the systems without unnecessary reliance on inferred or derived results. For example, direct metrology is used to test pump flow rates and thermal-controlled column compartment and autosampler modules. Holistic chemical testing is used for the evaluation of the following critical instrument characteristics: linearity, precision, signal to noise, and carry over.

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Agilent CrossLab Compliance Services

Agilent CrossLab is designed to fit traditional quality systems used by firms and recognized by regulatory agencies worldwide.

Note: Enterprise Edition has been renamed Agilent CrossLab Compliance; all functionality remains the same.

How Agilent CrossLab aligns with a traditional, paper-based methodology:

- Policy documents dictate the need for validation and qualification of GMP/SLP systems and usually mention the OQ/IQ/OQ/PQ model. The precise procedures for IQ and OQ for each type of equipment are prescribed in an approved SOP, perhaps called SOP #123: Qualification of HPLC Systems. In Agilent CrossLab, the equipment qualification plan (EQP) has the same role as the traditional qualification SOP.
- The traditional SOP provides lists of tests and limits for the range of system configurations found in the laboratory. The EQP follows this concept. The inventory of systems covered by an SOP or EQP changes over time, so this is kept as a separate record.
- The traditional qualification SOP typically has blank results forms as attachments to be photocopied for each IQ or OQ event—the results recorded in ink with manual calculations. In Agilent CrossLab, this execution process is streamlined and automated by use of Adobe Forms and the Agilent Compliance Engine (ACE) delivery tool. It provides reports with no handwriting errors, validated calculations, automated pass/fail report, traceability to raw data and the number of times a test was run. This automation provides efficiency and enforces compliance to procedure.
- The traditional qualification SOP is approved and released only once—replacing the need to author individual protocols for each chromatography system. This is the same concept for the EQP. The appropriate tests for each individual configuration are automatically selected by ACE from the list in the approved EQP—at time of delivery. The final reports are unique for each system and each qualification event—but the single approved EQP can cover a lab, department, or as wide a scope as desired.
- In the traditional qualification methodology, there is no convenient provision to record the actual workflow of the tests execution and results. In the event that a test is repeated during the Agilent CrossLab delivery, ACE maintains a counter per test which is automatically incremented for GxP compliant work, and the engineer generates a deviation note within the ACE report.



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Design Qualification (DQ)

DQ for commercial lab instruments is recommended by some, but not all, guidances and procedures. Definitions of DQ found in guidances and firm-specific validation procedures vary widely around the world. Some firms require nothing more than a record (such as certificate) from the instrument manufacturer demonstrating that the lab system has been designed for purpose and manufactured to a quality standard. Others treat DQ as the development of a user requirement specification document (URS) which can be matched to the IQ and OQ specifications for a manufacturer. Other firms consider DQ as including the vendor selection activities.

USP Chapter Literature definition of DQ:

Design qualification (DQ) is the documented collection of activities that define the functional and operational specifications of the instrument and criteria for selection of the vendor, based on the intended purpose of the instrument. Design qualification (DQ) may be performed not only by the instrument developer or manufacturer but also may be performed by the user. The manufacturer is generally responsible for robust design and maintaining information describing how the analytical instrument is manufactured (design specifications, functional requirements, etc.) and tested before shipment to users. Nonetheless, the user should ensure that commercial off-the-shelf (COTS) instruments are suitable for their intended application and that the manufacturer has adopted a quality system that provides for reliable equipment. Users should also determine capability of the manufacturer for support installation, services, and training.

For your reference, Agilent provides the following statements for DQ purposes:

- All Agilent hardware and software laboratory products including the ACE software used to deliver qualification services, are designed, manufactured, and tested according to Agilent internal Quality Life-Cycle Development Procedures.
- Certificates of Agilent testing, validation, and conformance to standards are provided with new Agilent instruments and similar certification is provided for ACE software. These documents are checked and recorded in Agilent CrossLab Compliance Services IQ.
- Agilent maintains information describing how products are manufactured and maintains a problem and bug reporting program as required by international software quality guidelines.
- The OQ specifications in this EQP can be used, as appropriate, by the user to prepare URS. The OQ specifications in this EQP represent the levels of performance acceptable to regulatory agencies for the technique, conform to typical specifications found in validation literature, are equally suitable for OQ at installation and on-going OQ throughout operational lifetimes, are equivalent to the OQ specifications published in the legacy Agilent Classic GxP protocols; and are suitable for most user requirements.
- Agilent Technologies is capable of installation, support, preventive maintenance, on-going qualification, and re-qualification after repair and user training worldwide.

Installation Qualification (IQ)

IQ checks and tests for Agilent hardware and software products include the following:

- Purchase Order Details: Allows the customer to verify that the instrument being qualified matches their design requirements (if available) and purchase order.
- Preparation and Installation Details: Gathers and records information about preparation and installation documents.
- Documentation: Gathers and records information about reference and user manuals for initial installations.
- Product Quality Assurance Details: Collects and records certificates and other forms that verify that the vendor has developed and built the product according to internal standards.
- Startup: Verifies that all modules start up properly.
- Instrument Check (hardware only): Demonstrates that all modules of the instrument are correctly installed and connected. It does not test instrument performance as fully as OQ. This test is not necessary and therefore skipped if an OQ is to be performed by Agilent operator at installation after IQ.
- Installation Verification (software only): Verifies the correctness of all installation-related files.

Operational Qualification (OQ)

Refer to the appropriate Test Definitions document for a detailed description of the testing program, setpoints, and acceptance limits for each system technique, category, and instrument configuration.

Dual-Acceptance Limits

(Applies to hardware qualifications only)

Within the EQP of Agilent CrossLab, each of the tests final result can be compared against two different limits if required. This allows customer-configured OQ to report against a User Limit (Limit 1) and the Agilent Recommended Limit (Limit 2) simultaneously.

In the standard EQP documents, Limit 1 and 2 values are the same—effectively de-activating this feature. Custom EQPs can also be prepared on request, making effective use of the two-limit feature of the Agilent Compliance Engine (ACE). In those cases, Limit 2 will always be the Agilent Recommended limit, and Limit 1 will be the limit requested by the user.

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Agilent will not be under any obligation regarding the OQ testing results against user-requested limits that are more stringent than the Agilent Recommended ones.

Re-Qualification after Repair (RQ) Hardware

(Applies to hardware qualifications only)

In the event of a hardware breakdown followed by an engineering repair of a qualified instrument, it is necessary to re-qualify the system to an appropriate level before release back into operational use.

For most of the instrument techniques, Agilent offers a service contract to repair and re-qualify an instrument during the period between scheduled annual OQs.

The level of re-testing is prescribed in the RQ section of ACE: a form is displayed for the operator showing all types of repair possible and the re-testing required. Part of an example form is shown below.

| Re-Qualification After Repair | | | |
|--|-------------------------|-----------|---|
| Pump Strategies | Repair/Replace Strategy | Modules | OQ/PV Testing |
| Isolator pump head parts, active inlet valve (or ANV cartridge), limits off check valves, reference valves, inlet manifold or pump drive, or taking pump head apart to clean (versus repair) | | Any pump | Flow Accuracy & Precision |
| | | Any pump | Flow Accuracy & Precision |
| | | Secondary | Flow Accuracy & Precision Gradient Composition |

The full list of repair and re-test guidance is available for review by customers of the RQ service.

The RQ form in ACE prescribes which tests the operator must perform for each repair circumstance. The test procedure, setpoints, and limits will be an exact repeat of the previous OQ test (a regression-testing strategy).

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Overview

Agilent CrossLab qualification services offer flexible choices for the delivery method as described below. The desired service delivery method is chosen according to the laboratory data integrity and general procedural requirements. To ensure complete data traceability, Agilent has devised two delivery methods that access data directly (default methods). An alternative method is also available that accesses data indirectly through a transfer location. In this document, data integrity refers to the who, what, and where of data used in generating an ACE equipment qualification report, or EQR.

ACE includes three main service delivery use cases that address data integrity requirements; the rest of this document provides details to determine which one best fits a customer's needs.

Regardless of the delivery method, ACE features and delivery procedures are compatible.

Available Methods

| Method | Definition |
|-------------|--|
| Preferred 1 | Network-distributed ACE (NDA), where the ACE software is installed on a network node within the laboratory LAN infrastructure. Requires collaboration with the customer to load ACE behind the customer firewall. Raw data locations are always captured in the equipment qualification report (EQR), which provides end-to-end traceability and a fully characterized data workflow in the delivery. |
| Preferred 2 | Dedicated spinning USB drive, where the ACE software resides on an independent drive that can be driven from the system controller, where the CDS resides. Because the USB spinning drive is connected to the CDS, the validity of this method is equivalent to the preferred 1 method. Raw data is imported directly into ACE by the Data Manager tool, with the data paths always captured in the report, which provides data traceability assurance. This is the most commonly used method. |
| Alternative | The ACE software is installed on and run from a PC not directly connected to the customer data system (CDS), such as the FSE's laptop. System data files are transferred indirectly from the CDS to the laptop instead of directly like preferred 1 and 2 methods. Requires customer pre-approval to remove later questions on data integrity. NOTE: The FSE's CDS used in this method is qualified for data collection purposes. |

EQR Storage

Select the checkbox below to authorize Agilent to store a copy of the Equipment Qualification Reports (EQRs) generated by Agilent Compliance Engine for internal assessments. The intention of the assessment is to evaluate the delivery of the qualification service, with a focus to improve delivery and assess the appropriateness of data integrity measures. The storage is exclusively for the internal assessment by Agilent and will not be shared with other organizations. It is not to be considered a backup for the EQR provided as qualification delivery.

Customer Approval of Alternative Method and EQR Storage

Authorize Agilent to use the alternative method (check for approval):

Authorize Agilent to store EQRs for their internal assessment (check for approval):

Approved by title: *Prasanna Nigamalai / Laboratory Manager*

Comments:

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Introduction

With heightened scrutiny of data integrity, Agilent's ACE (Automated Compliance Engine) software must be able to access instrument-generated raw data files one of two ways: (1) directly, using the connection between network nodes or with the server; (2) indirectly, through temporary storage in a transfer location. In this document, data integrity refers to the who, what, and where of data used in generating an ACE equipment qualification report, or EQR.

ACE includes three main service delivery use cases that address data integrity requirements; the rest of this document provides details to determine which one best fits a customer's needs.

Regardless of the delivery method, ACE features and delivery procedures are compatible.

Preferred Method 1: Network-distributed ACE (NDA)

Preferred Method 2: Dedicated spinning USB drive (most commonly used method)

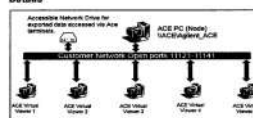
Alternative: Service portable laptop or other PC not directly connected to customer data system (CDS)

Preferred Method 1: Network-Distributed ACE (NDA)

Overview

ACE software is installed on a network node within the laboratory LAN infrastructure, which requires collaboration with the customer to load ACE behind their firewall. Raw data locations are always captured in the EQR, which provides end-to-end traceability and a fully characterized data workflow in the delivery.

Details



Installing ACE in a separate node (a.k.a. the host PC) on the same network as the system controller offers data traceability that is equivalent to an installation on the system controller itself. The system controller (where the CDS resides) and the ACE host PC are identified and seen by the server and subject to the customer's data access controls and general IT policies. The CDS's audit trail records data movements between nodes or between the client and server, and ACE's data traceability features identify the original data directory and therefore ensures end-to-end data traceability.

The ACE host PC has a separate/partitioned drive for ACE software. During ACE's installation, two services are setup on the operating system (OS): one for security and the other as a watchdog. Because the ACE host PC sits on the network as a shared drive, engineers access ACE through the networked drive. ACE is not installed on ACE Virtual Viewer PCs.

Requirements

Installation

- Install on a host PC with a separate drive (different from that of the OS)
- Attach to a network that clients can access
- 500 GB
- NTFS format
- User has local administration rights

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Operational

- User has an ACE node login with a minimum of power user rights permissions; user also has a personal ACE account and password added through the ACE licensing tool
- Up to 5 users with 3 open sessions each can access the NDA simultaneously
- Exception to ports 11121-11141 on ACE node, clients, and switch's/Smart Hubs to be open on the network

Preferred Method 2: Dedicated Spinning USB Drive

Overview



ACE software resides on an independent drive that can be driven from the system controller, where the CDS resides. Because the drive is connected to the CDS, this method's data integrity is equivalent to preferred 1 method's. Raw data is imported directly into ACE by ACE's Data Manager tool, and data paths are captured in reports to provide data traceability.

Details

A dedicated spinning USB drive can run ACE software without leaving a footprint on the host PC. Therefore, it can be connected directly to the system controller (where the CDS resides) without altering the system's qualification status. For additional protection, the drive can be driven by another host PC on the same network; also, the USB drive can remain on site with the customer for use by the Agilent FSE during service deliveries only.

Alternative Method

The ACE software is installed on and run from a PC not directly connected to the customer data system (CDS), such as the FSE's laptop. System data files are transferred indirectly from the CDS to the laptop instead of directly like preferred 1 and 2 methods.

Requires customer pre-approval to remove later questions on data integrity.

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Standard OQ Test Suite

This document describes the test program for qualifying GC systems, and the following table lists all OQ tests.

Note: Headspace tests apply only if a headspace sampler is an integral part of the system. Injection Carry Over is included in the standard OQ for GCs with headspace configurations but not for liquid sampler configurations (it can be ordered as EXTRA CDS TEST). Inlet Pressure Decay is not included for GCs configured with mass spectrometer detectors.

| Key | Fixed outputs/limits | Variances allowed |
|--|--|--|
| Test | Statistics and Parameters | Limits |
| System Inspection and Basic Safety and Operation | N/A | Gas, chassis electric grounding, interlocks, hydrogen shutdown, and so on all correct |
| GC Oven Temperature Accuracy and Stability (Agilent Intuvo 9000) | Column connector = 230.0°C Oven 1 = 230.0°C Oven 2 = 100.0°C Stability measured at oven 2 | Accuracy > -5.0% and < 5.0% of setpoint in K (oven) Accuracy > -1.0% and < 2.0% of setpoint in K (column connector) Stability < 0.0°C |
| GC Oven Temperature Accuracy and Stability | Temperature 1 = 230.0°C Temperature 2 = 100.0°C Stability measured at temperature 2 | Accuracy > -1.0% and < 1.0% of setpoint in K Stability < 0.0°C (Agilent) Stability < 1.0°C (Others) |
| Headspace Leak (7897A only) | N/A | Valve functions properly and HSS is leak tight |
| Headspace Vent and Pressurization Valve Integrity (G1880A and older) | N/A | Valve functions properly |
| Headspace Heater Zones Temperature Accuracy | Time: 115.0°C Sample Loop: 110.0°C Injector: 110.0°C Oven: 100.0°C Agilent: 100.0°C (Applicable across very few models: TurboHeater 4E, TurboHeater 16, TurboHeater 110, HSDXCL, HSI110, HSI10X, models only) | Time accuracy > -1.8 and < 5.2% of setpoint (7897A, 7897A w/tray) Time accuracy > -4.3 and < 4.3 % of setpoint (Others) Sample loop accuracy > -4.0°C and < 4.0°C (G1880, G1880A, 7897A w/tray) Sample loop accuracy > -5.0°C and < 5.0°C (Others) Injector heater accuracy > -3.0°C and < 3.0°C (GTC) Injector heater accuracy > -4.0°C and < 4.0°C (Others) Oven accuracy > -8.0°C and < 8.0°C (7894, G12896, G12898) Oven accuracy > -4.0°C and < 4.0°C (G1880, G1880A) Oven accuracy > -5.0°C and < 5.0°C (Prestoliner) Oven accuracy > -4.0°C and < 4.0°C (Prestoliner other models) Oven accuracy > -4.0°C and < 4.0°C (7897A, 7897A w/tray) Oven accuracy > -9.0°C and < 9.0°C (Others) Agilent accuracy > -2.0°C and < 2.0°C (GTC) DIE from setpoint 2 = 2.0°C, < 2.0°C |
| Vial Heater Temperature Accuracy | Temperature: 60.0°C | Pressure change / R reduction to < 3.0 psi and < 0.5 psi |
| Inlet Pressure Decay (from 440) (EPC or manual control only) | Inlet gas flow control | Accuracy < 1.2 psi |
| Inlet Pressure Accuracy (EPC or manual control only) | Inlet pressure: 25.0 psi | Accuracy < 1.0% |
| Inlet Flow Stability (EPC control only) | Inlet flow: 4.0 ml/minute | Precision < 5.0% |

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| Test | Setpoints and Parameters | Limits |
|--|--|---|
| Detector Flow Accuracy | Flow rate varies by detector type (N/A for NPD) | Accuracy $\pm 10.0\%$ of setpoint (or 0.5 mL/minute, whichever is larger) |
| Noise and Drift (FID) | Detector signal | Noise ≤ 0.18 pA Drift ≤ 2.50 pA/hour |
| Noise and Drift (TCD) | Detector signal | Noise ≤ 0.15 mV (He or H ₂ carrier and makeup [or no makeup]) Noise ≤ 0.25 mV (N ₂ carrier and makeup [or no makeup]) Drift ≤ 2.25 mV/hour |
| Noise and Drift (NPD) | Detector signal (N/A for 5890) | Noise ≤ 0.15 pA Drift ≤ 3.50 pA/hour |
| Noise and Drift (ECD) | Detector signal (N/A for 5890) | Noise ≤ 0.15 mV Drift ≤ 1.00 mV/hour |
| Noise and Drift (uECD) | Detector signal (N/A for 5890) | Noise ≤ 3.00 mV Drift ≤ 15.00 mV/hour |
| Noise and Drift (FPD new style) | Detector signal, sulfur (N/A for 5890) | Noise ≤ 5.00 mV Drift ≤ 5.00 mV/hour |
| Noise and Drift (FPD+) | Detector signal, sulfur (N/A for 5890) | Noise ≤ 4.00 mV Drift ≤ 3.00 mV/hour |
| Noise and Drift (FPD new style) | Detector signal, phosphorus (N/A for 5890) | Noise ≤ 5.00 mV Drift ≤ 5.00 mV/hour |
| Noise and Drift (FPD+) | Detector signal, phosphorus (N/A for 5890) | Noise ≤ 2.00 mV Drift ≤ 1.50 mV/hour |
| Noise and Drift (NCD, SCD) | Detector signal | Noise ≤ 0.05 pA/hour Drift ≤ 50.00 pA/hour |
| Sealing Run | Injection volume on column varies by configuration | N/A |
| Signal to Noise (PID/SS/MMI/ALS) | Signal height divided by ASTM baseline noise for known concentration and conditions | S/N $\geq 300,000$ (N ₂ makeup gas) S/N $\geq 240,000$ (He makeup gas) |
| Signal to Noise (FID/SS/MMI/HSS) | | S/N $\geq 5,000$ (He makeup gas) S/N $\geq 4,000$ (N ₂ makeup gas) |
| Signal to Noise (PID/VU/HSS) | | S/N $\geq 4,000$ (N ₂ makeup gas) S/N $\geq 3,200$ (He makeup gas) |
| Signal to Noise (PID/non-SS/using 78710-60170) | | S/N ≥ 800 (N ₂ makeup gas) S/N ≥ 600 (He makeup gas) |
| Signal to Noise (PID/non-SS/using 5168-6372) | | S/N ≥ 200 (N ₂ makeup gas) S/N ≥ 160 (He makeup gas) |
| Signal to Noise (NPD) | | S/N ≥ 300 |
| Signal to Noise (TCD/SS/MMI) | | S/N ≥ 750 (N ₂ makeup gas) S/N $\geq 5,000$ (He or H ₂ makeup gas) |
| Signal to Noise (TCD/non-SS/MMI) | | S/N ≥ 4 (N ₂ makeup gas) S/N ≥ 100 (He or H ₂ makeup gas) |
| Signal to Noise (uECD) | | S/N $\geq 1,500$ |
| Signal to Noise (FPD new style) | | S/N ≥ 700 (sulfur) S/N $\geq 1,000$ (phosphorus) |
| Signal to Noise (FPD+) | | S/N $\geq 1,400$ (sulfur) S/N $\geq 2,400$ (phosphorus) |
| Signal to Noise (NCD) | | S/N ≥ 400 (NCD) |
| Signal to Noise (SCD) | | S/N ≥ 550 (SCD) S/N ≥ 55 (SCD on FID base) |
| Injection Precision (Split/Splitless) | Injection volume on column: 1.0/100/250 μ L (ALS/Agilent HSS/CTC HSS with split/splitless FID) Injection time: 0.2 minutes (pressure-balanced HSS only) | Retention time RSD $\leq 1.00\%$ Area RSD $\leq 3.00\%$ (ALS, Agilent HSS) Area RSD $\leq 4.00\%$ (CTC HSS) Area RSD $\leq 8.00\%$ (NCD, SCD; ALS only) |

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| Test | Setpoints and Parameters | Limits |
|-------------------------------------|--|---|
| Injection Precision (Purged/Packed) | ALS with purged/packed injection port; without HSS | Retention time RSD $\leq 1.00\%$ Area RSD $\leq 3.00\%$ (PID, TCD) Area RSD $\leq 5.00\%$ (other detectors) |
| Injection Carry Over (HSS only) | Same as Injection Precision | Area carry over $\leq 1.00\%$ |

Test Design and Rationale

Overview

Many GMP/GLP enforcement agency inspectors now ask firms to provide a risk assessment of their equipment and computer systems plus a science-based rationale for subsequent validation and qualification testing.

GENERAL RISK STATEMENT: Any laboratory chemical system used for raw material testing or final drug product / medical device testing in GMP or used in formal GLP studies will likely fall into a HIGH RISK category. This risk assessment will imply the need for IQ & OQ & on-going qualification. ANY USER SPECIFIC RISK ANALYSIS SUPERCEDES THIS GENERAL RISK STATEMENT.

The rest of this section outlines the science-based rationale for each test in the Agilent hardware OQ plus a brief test design and procedure description.

The recommended set of hardware OQ tests described in this EQP derives from Agilent's interpretation of FDA, USP, and GAMP guidelines and other authoritative expert literature.

OQ test design incorporates both modular and holistic testing, which is a proven and regulatory acceptable approach. When applicable, direct metrology is used to test pump flow rates and thermal-controlled column compartments, for example. Holistic chemical testing is used to evaluate critical instrument characteristics.

When applicable, certified reference standards and calibrated equipment are used.

Considering the number of setpoints, parameters, and conditions of each recommended OQ test, the proven concepts of worst case, range, and representative have been applied. If a property or characteristic is known to have its worst performance at one end of a range of use, this is the setpoint that should be tested and other setpoints are not required. If a property or characteristic has no known worst case, testing at the high and low points of the range of use is required. If there are too many possible use cases and conditions to realistically test (and none is a worst case), a representative sample for test is the best approach.

System Inspection and Basic Safety and Operation

Description: System must be in safe and operational condition before starting the OQ tests.

Procedure: The instrument is given a general inspection and its basic safety features are challenged to ensure proper operation.

GC Oven Temperature Accuracy and Stability

Description: Oven temperature accuracy is important for comparability between systems and transferring methods. Oven temperature stability is critical for qualitative and quantitative analysis.

Procedure: At two different temperatures, accuracy is measured using an external calibrated thermometer and expressed as the difference between found and setpoint values. At one of these, a statistically significant number of additional readings are taken during the total duration of the test and stability is expressed as the delta between the highest and lowest temperatures.

Headspace Leak

Description: Proper operation of the valves is critical for repeatable peak areas and carry over.

Procedure: This test verifies that the valves operate properly with no excessive leaks or restricted internal flow paths.

Headspace Vent and Pressurization Valve Integrity

Description: Proper operation of the valves is critical for repeatable peak areas and carry over.

Procedure: This test verifies that the valves operate properly with no excessive leaks or restricted internal flow paths.

Headspace Heated Zones Temperature Accuracy

Description: Temperature accuracy of the heated zones is important for comparing systems and transferring methods. Oven accuracy is critical to quantitative headspace methods.

Procedure: The temperature is measured using an external calibrated thermometer with appropriate probe design. Accuracy is determined as the difference between found and setpoint values.

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Vial Heater Temperature Accuracy

Description: The 7693A vial heater option can be used during sample preparation. This test verifies that it heats accurately.

Procedure: The heater temperature is measured with an external thermometer and accuracy is calculated as the difference between the measured value and setpoint.

Inlet Pressure Decay

Description: Inlet pressure integrity is critical for repeatable injection and retention times. The pressure decay and pressure accuracy tests combine to demonstrate pressure integrity. **NOTE:** If there is too much air in the system, the MS system's Tune test indicates a leaking detector, so pressure decay is not necessary for MS-only systems.

Procedure: The inlet is capped, a pressure applied, and inlet flow turned off. The pressure decay is recorded over a specified time range.

Inlet Pressure Accuracy

Description: Inlet pressure integrity is critical for repeatable injection and retention times. The pressure decay and pressure accuracy tests combine to demonstrate pressure integrity. This test checks for accurate pressure to the head of the column. Column flow is achieved by maintaining a constant pressure against a known restriction. Because the restriction is a function of the column geometry, measuring pressure in the inlet is the most accurate way to determine flow.

Procedure: The inlet is capped, a pressure is applied, and the inlet pressure is recorded using an external calibrated manometer connected to the inlet.

Inlet Flow Stability

Description: Inlet flow stability is critical for repeatable injection and retention times. Inlet flow accuracy and precision tests combine to demonstrate inlet flow stability.

Procedure: Column flow setpoint is achieved, all detector flows are turned off, and calculations are made: flow accuracy as the absolute % difference of the mean of the ten flow readings and the setpoint; flow precision as the % RSD of ten flow readings.

Detector Flow Accuracy

Description: Detector flow accuracy is critical for a stable detector signal. Incorrect flows may have an impact on detector performance.

Procedure: Flow accuracy is determined by measuring the flow with a calibrated mass flowmeter and then comparing the results to the test setpoints and the values displayed by the GC.

Noise and Drift

Description: This test gives an indication of detector sensitivity and stability.

Procedure: The signal is monitored at specified conditions appropriate to the type of detector over a twenty-minute period. The signal noise is calculated based on ASTM E594-95 as the average peak-to-peak noise in a number of signal segments. The drift is calculated as the slope of the linear regression for the signal. Detector type and the gases used all contribute to different performance and therefore different limits for each configuration.

Sealing Run

Description: This test is used to determine the chromatogram for presence of expected peaks, sufficient run time, and proper integration events prior to the start of the actual qualification runs.

Signal to Noise

Description: Sensitivity of GC detection is a critical performance feature in quantitative and qualitative analysis. A signal-to-noise value of a representative compound at known concentration provides sensitivity statistics.

Procedure: A traceable standard is injected and signal to noise is calculated.

Injection Precision

Description: System precision is critical for quantitative analysis.

Procedure: An initial stabilizing injection is made, followed by six repeat injections of a traceable standard retrieved by a traceable blank injection. The % RSD of the six injections is calculated to provide precision statistics. There are separate dedicated instrument parameters and reference standards applicable to each inlet/detector combination. This test is performed with liquid and headspace sampler configurations.

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Report and Delivery Options

(For hyphenated system types only) If different options are chosen for the primary and supported system types, the primary system options are used for both techniques in the EQR.

- Show chromatograms
- Show header and footer on cover
- Include repeated run logs
- Include Transaction logs

Selected Signature Options

Status: EQP is not signed.

- Reporting variance is allowed in this EQP

เอกสารไม่ควบคุม

Customer Approval

Name:

Miss Panjawan Viriyothai

Title:

Laboratory Manager

Date:

Feb 2, 2021

Signature:

P. Viriyothai

Name:

Title:

Date:

Signature:

Name:

Title:

Date:

Signature:

Name:

Title:

Date:

Signature:

เอกสารไม่ควบคุม

Legal Notice

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Agilent CrossLabs Group Quality Manager: Julio Hector, Santa Clara, California USA.

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Protocol Details

Protocol Revision Used for this Document

GC.02.51

Protocol Revision Release Date

November 2020

NOTE: The Revision History - EQP Editor document includes details for above and other available revisions.

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Tel: 0-2274-2456 Fax: 0-2274-2443
Email: info@harikul.com www.harikul.com
Certificate of Calibration

CERT.No.: HS-U012C

Calibration Date : 1 Mar 23

Submitted by : United Analyst and Engineering Consultant Co., Ltd.
3 Soi Udomsuk 41, Sukhumvit Road, Bangchak,
Phrakhanong, Bangkok.(Head office)

Avg Room Temp : 20 °C

Avg Water Temp : 20 °C

Air Pressure : 760.00 mmHg

Salinity : 0 ppt

Model : YSI 5100

S/N : 11B101863

Probe : YSI 5010

S/N : 22B100125

ID NO. : -

Air Temp ref : S/N. E00522

Barometric ref : S/N. E00522

Water Temp ref : S/N. 11431

Technician : Kittipong M.

Calibration Details

| Calibration Point | 100% air sat. (@20 °C, DO = 9.09 mg/l) | (status) | (status) |
|-----------------------|---|----------|----------|
| Measurement 1 (mg/l) | 9.09 | (PASS) | - |
| Measurement 2 (mg/l) | 9.09 | (PASS) | - |
| Measurement 3 (mg/l) | 9.09 | (PASS) | - |
| Measurement 4 (mg/l) | 9.09 | (PASS) | - |
| Measurement 5 (mg/l) | 9.09 | (PASS) | - |
| Measurement 6 (mg/l) | 9.09 | (PASS) | - |
| Measurement 7 (mg/l) | 9.08 | (PASS) | - |
| Measurement 8 (mg/l) | 9.09 | (PASS) | - |
| Measurement 9 (mg/l) | 9.08 | (PASS) | - |
| Measurement 10 (mg/l) | 9.09 | (PASS) | - |
| Mean Measurement | 9.09 | mg/l | - |
| Inaccuracy | 0.00 | mg/l | - |
| Overall Status | (PASS) | | |

Manufacturer Specification

Accuracy = +/- 0.02 mg/l

- 1) This certificate is issued based on the result that are found as shown on date and place of test only.
- 2) The calibration procedure followed in accordance with Harikul Science Co., Ltd.
- 3) This result shall not be used for advertising purpose.

Technician Signature
(Kittipong Maekwong)

เอกสารไม่ควบคุม
Laboratory Manager
(Suprescha Sumartam)

ภาคผนวก ง

หนังสืออนุญาตขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน

ที่ อก ๐๓๑๐(๑)/ ๘ ๗ ๒ ๔



กรมโรงงานอุตสาหกรรม
ณพระนครที่ ๒ แขวงทุ่งพญาไท
เขตราชเทวี กรุงเทพฯ ๑๐๔๐๐

๒ ๕ พฤษภาคม ๒๕๖๖

เรื่อง เปลี่ยนแปลงบุคลากรของห้องปฏิบัติการวิเคราะห์

เรียน กรรมการผู้จัดการ บริษัท ยูโนเด็ค แอนาไลติกส์ แอนด์ เอ็นจิเนียริ่ง คอนซัลแตนท์ จำกัด

อ้างถึง คำขอขออนุญาต/เปลี่ยนแปลงบุคลากร และขอเปลี่ยนสถานที่ของห้องปฏิบัติการวิเคราะห์เอกชน
ลงวันที่ ๑๖ พฤษภาคม ๒๕๖๖

ตามที่หนังสือที่อ้างถึง บริษัท ยูโนเด็ค แอนาไลติกส์ แอนด์ เอ็นจิเนียริ่ง คอนซัลแตนท์ จำกัด
ห้องปฏิบัติการวิเคราะห์เอกชน เลขทะเบียน ๖-๑๔๕ สถานที่ตั้งเลขที่ ๑ ซอยอุดมสุข ๔๑ ถนนสุขุมวิท แขวงบางจาก
เขตพระโขนง กรุงเทพมหานคร ขอเปลี่ยนแปลงบุคลากรของห้องปฏิบัติการวิเคราะห์ ความละเอียดแจ้งแล้ว นั้น

กรมโรงงานอุตสาหกรรมพิจารณาแล้ว มีความเห็นดังนี้

๑. ให้ออกเลิกเจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์ จำนวน ๕ ราย

๑) นางสาววิภาดา เจริญชัยสมบัติ ทะเบียนเลขที่ ๖-๑๔๕-๖-๐๐๓๐

๒) นายสมภรณ์ นาคชัยทอง ทะเบียนเลขที่ ๖-๑๔๕-๖-๐๐๓๗

๓) นางสาวอรอนงค์ คุณาพันธ์ชัย ทะเบียนเลขที่ ๖-๑๔๕-๖-๐๐๓๖

๔) นางสาวอรอนงค์ ลาภพรม ทะเบียนเลขที่ ๖-๑๔๕-๖-๐๐๓๐

๕) นางสาวสุวิภากรณ์ จันทะระศักดิ์ ทะเบียนเลขที่ ๖-๑๔๕-๖-๐๐๓๕

๒. ให้เพิ่มเจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์ จำนวน ๔ ราย

๑) นางสาววิภาดา ฝ่ายสิงห์ ทะเบียนเลขที่ ๖-๑๔๕-๖-๐๐๓๖

๒) นางสาวเมธวสิน สุจริต ทะเบียนเลขที่ ๖-๑๔๕-๖-๐๐๓๔

๓) นางสาวเพ็ญพิชชา รอดทอง ทะเบียนเลขที่ ๖-๑๔๕-๖-๐๐๓๕

๔) นางสาวณิชา แผลสว่าง ทะเบียนเลขที่ ๖-๑๔๕-๖-๐๐๓๖

อนึ่ง หนังสือฉบับนี้จะหมดอายุพร้อมหนังสือต่ออายุวันขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์
เอกชน คือในวันที่ ๒ กุมภาพันธ์ ๒๕๖๘ ทั้งนี้ สามารถยื่นคำขอผ่านระบบอิเล็กทรอนิกส์ได้ที่หน้าเว็บไซต์

กรมโรงงานอุตสาหกรรม

จึงเรียนมาเพื่อทราบ

ขอแสดงความนับถือ

๖๖ ๑๔

(นายประจักษ์ สรรพกิจ)

ผู้อำนวยการกองส่งเสริมและสนับสนุนโรงงาน
ปฏิบัติการกรมส่งเสริมและสนับสนุนโรงงานอุตสาหกรรม

UNITED ANALYST AND ENGINEERING
CONSULTANT COMPANY LIMITED

สำเนาถูกต้อง

กองวิจัยและพัฒนาย่อยของโรงงาน

กลุ่มมาตรฐานวิธีการวิเคราะห์ทดสอบและทะเบียนห้องปฏิบัติการ

โทร. ๐ ๒๕๓๐ ๖๓๑๒ ต่อ ๒๑๐๖-๕

โทรสาร ๐ ๒๕๓๐ ๖๓๑๒ ต่อ ๒๑๐๖

ไปรษณีย์อิเล็กทรอนิกส์ sarabang@dw.mail.go.th



"อุตสาหกรรมก้าวไกล ประเทศไทยก้าวหน้า ร่วมกันพัฒนา อุตสาหกรรมสีเขียว"



- ๒ -

อนึ่ง หนังสือฉบับนี้จะหมดอายุพร้อมหนังสือต่ออายุวันขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์
เอกชน คือในวันที่ ๔ กุมภาพันธ์ ๒๕๖๘ ทั้งนี้ สามารถยื่นคำขอ
ผ่านระบบอิเล็กทรอนิกส์ได้ที่หน้าเว็บไซต์กรมโรงงานอุตสาหกรรม ตาม QR Code หายหนังสือฉบับนี้

จึงเรียนมาเพื่อทราบ

ขอแสดงความนับถือ

๖๖ ๑๔

(นายประจักษ์ สรรพกิจ)

ผู้อำนวยการกองส่งเสริมและสนับสนุนโรงงาน
ปฏิบัติการกรมส่งเสริมและสนับสนุนโรงงานอุตสาหกรรม



ทั้งนี้ขอผ่านระบบอิเล็กทรอนิกส์

กองวิจัยและพัฒนาย่อยของโรงงาน

กลุ่มมาตรฐานวิธีการวิเคราะห์ทดสอบและทะเบียนห้องปฏิบัติการ

โทร. ๐ ๒๕๓๐ ๖๓๑๒ ต่อ ๒๑๐๖-๕ โทรสาร ๐ ๒๕๓๐ ๖๓๑๒ ต่อ ๒๑๐๖

ไปรษณีย์อิเล็กทรอนิกส์ sarabang@dw.mail.go.th

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สำเนาถูกต้อง



"อุตสาหกรรมก้าวไกล ประเทศไทยก้าวหน้า ร่วมกันพัฒนา อุตสาหกรรมสีเขียว"



ที่ อก ๐๓๑๐(๑)/ ๖ ๐ ๒ ๘



กรมโรงงานอุตสาหกรรม
ณพระนครที่ ๒ แขวงทุ่งพญาไท
เขตราชเทวี กรุงเทพฯ ๑๐๔๐๐

๒ ๒ มีนาคม ๒๕๖๖

เรื่อง เปลี่ยนแปลงบุคลากรและสารเคมีที่วิเคราะห์

เรียน กรรมการผู้จัดการ บริษัท ยูโนเด็ค แอนาไลติกส์ แอนด์ เอ็นจิเนียริ่ง คอนซัลแตนท์ จำกัด

อ้างถึง คำขอขออนุญาต/เปลี่ยนแปลงบุคลากร และขอเปลี่ยนสถานที่ของห้องปฏิบัติการวิเคราะห์เอกชน
ลงวันที่ ๓๐ มกราคม ๒๕๖๖

สิ่งที่ส่งมาด้วย เอกสารแนบท้ายหนังสือเปลี่ยนแปลงบุคลากรและสารเคมีที่วิเคราะห์

บริษัท ยูโนเด็ค แอนาไลติกส์ แอนด์ เอ็นจิเนียริ่ง คอนซัลแตนท์ จำกัด จำนวน ๒ แผ่น

ตามที่หนังสือที่อ้างถึง บริษัท ยูโนเด็ค แอนาไลติกส์ แอนด์ เอ็นจิเนียริ่ง คอนซัลแตนท์ จำกัด
ห้องปฏิบัติการวิเคราะห์เอกชน เลขทะเบียน ๖-๑๔๕ สถานที่ตั้งเลขที่ ๑ ซอยอุดมสุข ๔๑ ถนนสุขุมวิท
แขวงบางจาก เขตพระโขนง กรุงเทพมหานคร ขอเปลี่ยนแปลงบุคลากรและสารเคมีที่วิเคราะห์
ความละเอียดแจ้งแล้ว นั้น

กรมโรงงานอุตสาหกรรมพิจารณาแล้ว มีความเห็นดังนี้

๑. ให้ออกเลิกเจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์ จำนวน ๒ ราย

๑) นายวิมล สุวรรณาวา ทะเบียนเลขที่ ๖-๑๔๕-๖-๐๐๓๖

๒) นายพิพัฒน์ ต้นนุกูล ทะเบียนเลขที่ ๖-๑๔๕-๖-๐๐๓๗

๒. ให้เพิ่มเจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์ จำนวน ๑๑ ราย

๑) นางสาวอรุณา ประสานศรี ทะเบียนเลขที่ ๖-๑๔๕-๖-๐๐๓๖

๒) นายพอล เบ็ญนิยม ทะเบียนเลขที่ ๖-๑๔๕-๖-๐๐๓๓

๓) นายศุภกร สอนศรี ทะเบียนเลขที่ ๖-๑๔๕-๖-๐๐๓๔

๔) นายคณพล ศิลานนท์ ทะเบียนเลขที่ ๖-๑๔๕-๖-๐๐๓๕

๕) นายชัชชัย พุ่มไธยะ ทะเบียนเลขที่ ๖-๑๔๕-๖-๐๐๓๖

๖) นายวันชัย กลิ่นบ้านเกาะ ทะเบียนเลขที่ ๖-๑๔๕-๖-๐๐๓๗

๗) นายธีรวัฒน์ อารมสุวรรณ ทะเบียนเลขที่ ๖-๑๔๕-๖-๐๐๓๘

๘) นายณัฏฐพงศ์ ระขุนทด ทะเบียนเลขที่ ๖-๑๔๕-๖-๐๐๓๙

๙) นางสาวณิชาภา พลนิกกิจ ทะเบียนเลขที่ ๖-๑๔๕-๖-๐๐๔๐

๑๐) นางสาวนิภาพร ทองสุรัตน์ ทะเบียนเลขที่ ๖-๑๔๕-๖-๐๐๔๑

๑๑) นางสาวพรวิภา ขจรเนติสุข ทะเบียนเลขที่ ๖-๑๔๕-๖-๐๐๔๒

๓. ให้เพิ่มสถานที่สารเคมีที่วิเคราะห์ใน ตามสิ่งที่ส่งมาด้วย

UNITED ANALYST AND ENGINEERING
CONSULTANT COMPANY LIMITED

สำเนาถูกต้อง

อนึ่ง

เอกสารแนบท้ายหนังสือเปลี่ยนแปลงบุคลากรและสารเคมีที่วิเคราะห์

บริษัท ยูโนเด็ค แอนาไลติกส์ แอนด์ เอ็นจิเนียริ่ง คอนซัลแตนท์ จำกัด เลขทะเบียน ๖-๑๔๕

ที่ อก ๐๓๑๐(๑)/ ๖ ๐ ๒ ๘

ลงวันที่ ๒ ๒ มีนาคม ๒๕๖๖

ขอขออนุญาตเปลี่ยนทะเบียนจากกรมโรงงานอุตสาหกรรม จำนวน ๑๖ รายการ

สิ้น จำนวน 16 รายการ

| ลำดับที่ | สารเคมี | วิธีการวิเคราะห์ |
|----------|----------------------------|--|
| 1 | Benzene | Equilibrium Headspace, Gas Chromatographic/ Mass Spectrometric Method (1,2) |
| 2 | Carbon tetrachloride | Equilibrium Headspace, Gas Chromatographic/ Mass Spectrometric Method (1,2) |
| 3 | 1,2-Dichloroethane | Equilibrium Headspace, Gas Chromatographic/ Mass Spectrometric Method (1,2) |
| 4 | 1,1-Dichloroethylene | Equilibrium Headspace, Gas Chromatographic/ Mass Spectrometric Method (1,2) |
| 5 | cis-1,2-Dichloroethylene | Equilibrium Headspace, Gas Chromatographic/ Mass Spectrometric Method (1,2) |
| 6 | trans-1,2-Dichloroethylene | Equilibrium Headspace, Gas Chromatographic/ Mass Spectrometric Method (1,2) |
| 7 | Ethylbenzene | Equilibrium Headspace, Gas Chromatographic/ Mass Spectrometric Method (1,2) |
| 8 | Methylene chloride | Equilibrium Headspace, Gas Chromatographic/ Mass Spectrometric Method (1,2) |
| 9 | Styrene | Equilibrium Headspace, Gas Chromatographic/ Mass Spectrometric Method (1,2) |
| 10 | Tetrachloroethylene | Equilibrium Headspace, Gas Chromatographic/ Mass Spectrometric Method (1,2) |
| 11 | Toluene | Equilibrium Headspace, Gas Chromatographic/ Mass Spectrometric Method (1,2) |
| 12 | Trichloroethylene | Equilibrium Headspace, Gas Chromatographic/ Mass Spectrometric Method (1,2) |
| 13 | m-Xylene | Equilibrium Headspace, Gas Chromatographic/ Mass Spectrometric Method (1,2) |
| 14 | o-Xylene | Equilibrium Headspace, Gas Chromatographic/ Mass Spectrometric Method (1,2) |
| 15 | p-Xylene | Equilibrium Headspace, Gas Chromatographic/ Mass Spectrometric Method (1,2) |
| 16 | Xylene (Total) | Equilibrium Headspace, Gas Chromatographic/ Mass Spectrometric Method (1,2) |

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สำเนาถูกต้อง

เอกสารอ้างอิง...

เอกสารอ้างอิง

1. United States Environmental Protection Agency. Test Methods for Evaluation Solid Waste Physical/Chemical Methods. Volatile Organic Compounds in Various Sample Matrices Using Equilibrium Headspace Analysis. SW-846 Method 5021A, 2014.
2. United States Environmental Protection Agency. Test Methods for Evaluation Solid Waste Physical/Chemical Methods. Volatile Organic Compounds by Gas Chromatography/Mass Spectrometry. SW-846 Method 8260D, 2018.

(Signature)



ดำเนินการถูกต้อง

กลุ่มมาตรฐานวิธีการวิเคราะห์ทางเคมีและเครื่องมือปฏิบัติการ ก่อตั้งและดำเนินการโดยสถาบัน กรมโรงงานอุตสาหกรรม โทร. 0 2620 3446 ต่อ 1000-1



ที่ อก ๐๓๐๐(๑)/ ๓๕๕๕๕

กรมโรงงานอุตสาหกรรม
ถนนพหลโยธินที่ ๖ แขวงทุ่งพญาไท
เขตราชเทวี กรุงเทพฯ ๑๐๐๐๐

๒๕ ตุลาคม ๒๕๖๕

เรื่อง เปลี่ยนแปลงบุคลากรของห้องปฏิบัติการวิเคราะห์

เรียน กรรมการผู้จัดการ บริษัท ยูนิค แอนาไลติก แอนด์ เอ็นจิเนียริ่ง คอนซัลแตนท์ จำกัด

อ้างถึง คำขอขึ้นทะเบียน/ต่ออายุ/เปลี่ยนแปลงบุคลากร และนิติศาสตร์ของห้องปฏิบัติการวิเคราะห์เอกชน
ลงวันที่ ๑๘ ตุลาคม ๒๕๖๕

ตามหนังสือที่อ้างถึง บริษัท ยูนิค แอนาไลติก แอนด์ เอ็นจิเนียริ่ง คอนซัลแตนท์ จำกัด
ห้องปฏิบัติการวิเคราะห์เอกชน เลขทะเบียน ๖-๑๕๕ สถานที่ตั้งเลขที่ ๓ ซอยอุดมสุข ๕๓ ถนนสุขุมวิท แขวงบางจาก
เขตพระโขนง กรุงเทพมหานคร ขอเปลี่ยนแปลงบุคลากรของห้องปฏิบัติการวิเคราะห์ ความละเอียดแจ้งแล้ว นั้น

กรมโรงงานอุตสาหกรรมพิจารณาแล้ว มีความเห็นดังนี้

๑. ให้ออกเลิกเจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์ จำนวน ๔ ราย

- | | |
|--------------------------------------|----------------------------|
| ๑) นางสาวรามา แก้วช้อยนอก | ทะเบียนเลขที่ ๖-๑๕๕-๙-๐๐๐๒ |
| ๒) นายกันตพงศ์ บุญพวง | ทะเบียนเลขที่ ๖-๑๕๕-๙-๐๐๒๕ |
| ๓) นายกฤษณ์ พงศ์ธาดาพร | ทะเบียนเลขที่ ๖-๑๕๕-๙-๐๐๒๕ |
| ๔) นางสาววิมลฤดีคุณิ์ ธนโชติกาญจนการ | ทะเบียนเลขที่ ๖-๑๕๕-๙-๐๐๒๕ |

๒. ให้เพิ่มผู้ควบคุมห้องปฏิบัติการวิเคราะห์ จำนวน ๒ ราย

- | | |
|---|----------------------------|
| ๑) นายกันตพงศ์ บุญพวง | ทะเบียนเลขที่ ๖-๑๕๕-๙-๐๐๒๕ |
| ๒) นางสาวรามา แก้วช้อยนอก | ทะเบียนเลขที่ ๖-๑๕๕-๙-๐๐๒๕ |
| ๓. ให้เพิ่มเจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์ จำนวน ๑๒ ราย | |
| ๑) นายชินวัฒน์ หอยสิงห์ | ทะเบียนเลขที่ ๖-๑๕๕-๙-๐๐๒๐ |
| ๒) นายประพันธ์ แก้วภาคำ | ทะเบียนเลขที่ ๖-๑๕๕-๙-๐๐๒๑ |
| ๓) นายศักดิ์สิทธิ์ มุสิกสุ | ทะเบียนเลขที่ ๖-๑๕๕-๙-๐๐๒๒ |
| ๔) นายศุภณานันท์ อุทธาคนานนท์ | ทะเบียนเลขที่ ๖-๑๕๕-๙-๐๐๒๓ |
| ๕) นายชาญณรงค์ อ้ายอ | ทะเบียนเลขที่ ๖-๑๕๕-๙-๐๐๒๔ |
| ๖) นางสาวจิราภรณ์ ศรีวรรณ | ทะเบียนเลขที่ ๖-๑๕๕-๙-๐๐๒๕ |
| ๗) นายสุจิต โปชันเงิน | ทะเบียนเลขที่ ๖-๑๕๕-๙-๐๐๒๖ |
| ๘) นายเจษฎา ชัยศิริ | ทะเบียนเลขที่ ๖-๑๕๕-๙-๐๐๒๗ |
| ๙) นายธวัช วัฒนสุทิน | ทะเบียนเลขที่ ๖-๑๕๕-๙-๐๐๒๘ |
| ๑๐) นายสุรศักดิ์ ชุมเอียด | ทะเบียนเลขที่ ๖-๑๕๕-๙-๐๐๒๙ |
| ๑๑) นายสุรศักดิ์ หล้าโ | ทะเบียนเลขที่ ๖-๑๕๕-๙-๐๐๓๐ |
| ๑๒) นายชัย บัวสด | ทะเบียนเลขที่ ๖-๑๕๕-๙-๐๐๓๑ |



ดำเนินการถูกต้อง

อนึ่ง หนังสือฉบับนี้...

- ๒ -

อนึ่ง หนังสือฉบับนี้จะมีผลต่ออายุ/ขึ้นทะเบียน/ต่ออายุ/เปลี่ยนแปลงบุคลากรของห้องปฏิบัติการวิเคราะห์เอกชน
ที่ อก ๐๓๐๐(๑)/๑๕๕๕๕ ลงวันที่ ๔ กุมภาพันธ์ ๒๕๖๕ คือในวันที่ ๒ กุมภาพันธ์ ๒๕๖๕ ทั้งนี้ สามารถยื่นคำขอ
ผ่านระบบอิเล็กทรอนิกส์ได้ที่หน้าเว็บไซต์กรมโรงงานอุตสาหกรรม ตาม QR Code ที่แนบหนังสือฉบับนี้

จึงเรียนมาเพื่อทราบ

ขอแสดงความนับถือ

(Signature)

(นายประสม คำพงษ์)

ผู้อำนวยการกองวิจัยและพัฒนาผลิตภัณฑ์โรงงาน
ปฏิบัติการทางเคมีและเครื่องมือปฏิบัติการ กรมโรงงานอุตสาหกรรม



ยื่นคำขอผ่านระบบอิเล็กทรอนิกส์

กองวิจัยและพัฒนาผลิตภัณฑ์โรงงาน
กลุ่มมาตรฐานวิธีการวิเคราะห์ทดสอบผลิตภัณฑ์ของห้องปฏิบัติการ
โทร. ๐ ๒๕๓๐ ๒๕๓๒ ต่อ ๒๐๐๓-๕
โทรสาร ๐ ๒๕๓๐ ๒๕๓๒ ต่อ ๒๐๐๔
ไปรษณีย์อิเล็กทรอนิกส์ sarabang@dlw.mail.go.th



ดำเนินการถูกต้อง



อุตสาหกรรมก้าวไกล ประเทไทยก้าวหน้า ร่วมกันพัฒนา อุตสาหกรรมสีเขียว



อนึ่ง หนังสือฉบับนี้...



ที่ อก ๐๓๐๐(๑)/ ๓๖๕๕๕

กรมโรงงานอุตสาหกรรม
ถนนพหลโยธินที่ ๖ แขวงทุ่งพญาไท
เขตราชเทวี กรุงเทพฯ ๑๐๐๐๐

๐๑ กันยายน ๒๕๖๕

เรื่อง เปลี่ยนแปลงบุคลากรของห้องปฏิบัติการวิเคราะห์

เรียน กรรมการผู้จัดการ บริษัท ยูนิค แอนาไลติก แอนด์ เอ็นจิเนียริ่ง คอนซัลแตนท์ จำกัด

อ้างถึง คำขอขึ้นทะเบียน/ต่ออายุ/เปลี่ยนแปลงบุคลากร และนิติศาสตร์ของห้องปฏิบัติการวิเคราะห์เอกชน
ลงวันที่ ๒๖ สิงหาคม ๒๕๖๕

ตามหนังสือที่อ้างถึง บริษัท ยูนิค แอนาไลติก แอนด์ เอ็นจิเนียริ่ง คอนซัลแตนท์ จำกัด
ห้องปฏิบัติการวิเคราะห์เอกชน เลขทะเบียน ๖-๑๕๕ สถานที่ตั้งเลขที่ ๓ ซอยอุดมสุข ๕๓ ถนนสุขุมวิท แขวงบางจาก
เขตพระโขนง กรุงเทพมหานคร ขอเปลี่ยนแปลงบุคลากรของห้องปฏิบัติการวิเคราะห์ ความละเอียดแจ้งแล้ว นั้น

กรมโรงงานอุตสาหกรรมพิจารณาแล้ว มีความเห็นดังนี้

๑. ให้ออกเลิกเจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์ จำนวน ๘ ราย

- | | |
|--------------------------------|----------------------------|
| ๑) นายปริดา ไชยภูมิสุล | ทะเบียนเลขที่ ๖-๑๕๕-๙-๐๐๓๓ |
| ๒) นายปิยะณัฐ ศรีรุ่งโรจน์ | ทะเบียนเลขที่ ๖-๑๕๕-๙-๐๐๓๔ |
| ๓) นายธีรเมธ สุขศรี | ทะเบียนเลขที่ ๖-๑๕๕-๙-๐๐๓๕ |
| ๔) นางสาวศิริวรรณ ขอนพา | ทะเบียนเลขที่ ๖-๑๕๕-๙-๐๐๓๖ |
| ๕) นายศักดิ์สิทธิ์ เกียรติ | ทะเบียนเลขที่ ๖-๑๕๕-๙-๐๐๓๗ |
| ๖) นางสาวลัดดาวัลย์ โพธิ์พันธ์ | ทะเบียนเลขที่ ๖-๑๕๕-๙-๐๐๓๘ |
| ๗) นางสาวกมลวรรณ เข็มจันทร์ | ทะเบียนเลขที่ ๖-๑๕๕-๙-๐๐๓๙ |
| ๘) นางสาวจันทิรา ประกอบทรัพย์ | ทะเบียนเลขที่ ๖-๑๕๕-๙-๐๐๔๐ |

๒. ให้เพิ่มเจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์ จำนวน ๑๑ ราย


- | | |
|---------------------------|----------------------------|
| ๑) นางสาวนิตยา แกร่นเมือง | ทะเบียนเลขที่ ๖-๑๕๕-๙-๐๐๔๑ |
| ๒) นางสาวพัชราวรรณ สิมมา | ทะเบียนเลขที่ ๖-๑๕๕-๙-๐๐๔๒ |
| ๓) นายบัณฑิต วัฒนคำ | ทะเบียนเลขที่ ๖-๑๕๕-๙-๐๐๔๓ |
| ๔) นายประพันธ์ วัฒนคำ | ทะเบียนเลขที่ ๖-๑๕๕-๙-๐๐๔๔ |
| ๕) นางสาวกมลวิภา อ้ายจิต | ทะเบียนเลขที่ ๖-๑๕๕-๙-๐๐๔๕ |
| ๖) นางสาวกนกพร ขันบุญ | ทะเบียนเลขที่ ๖-๑๕๕-๙-๐๐๔๖ |
| ๗) นางสาวณัฐญา มงคลคุณ | ทะเบียนเลขที่ ๖-๑๕๕-๙-๐๐๔๗ |
| ๘) นายณัฐพล อมรสิทธิ์ | ทะเบียนเลขที่ ๖-๑๕๕-๙-๐๐๔๘ |
| ๙) นางสาวศิริพร ทองขาว | ทะเบียนเลขที่ ๖-๑๕๕-๙-๐๐๔๙ |
| ๑๐) นางสาวนิชากร ศุภชาติ | ทะเบียนเลขที่ ๖-๑๕๕-๙-๐๐๕๐ |
| ๑๑) นางสาววิมลวรรณ คำดี | ทะเบียนเลขที่ ๖-๑๕๕-๙-๐๐๕๑ |



ดำเนินการถูกต้อง

อนึ่ง หนังสือฉบับนี้จะหมดอายุพร้อมหนังสือต่ออายุรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน
ที่ อก ๐๓๓๐(๑)/๑๘๘๙๙ ลงวันที่ ๕ กุมภาพันธ์ ๒๕๖๕ คือในวันที่ ๒ กุมภาพันธ์ ๒๕๖๘ ทั้งนี้ สามารถยื่นคำขอ
ผ่านระบบอิเล็กทรอนิกส์ได้ทั้งหน้าเว็บไซต์กรมโรงงานอุตสาหกรรม ตาม QR Code ท้ายหนังสือฉบับนี้

จึงเรียนมาเพื่อทราบ

ขอแสดงความนับถือ

(นางจินดา เศรษฐินพร)
ผู้อำนวยการกองส่งเสริมและพัฒนาระบบมาตรฐาน
ปฏิบัติการกรมส่งเสริมและพัฒนาระบบมาตรฐาน



ยื่นคำขอผ่านระบบอิเล็กทรอนิกส์

กองวิจัยและพัฒนายุทธศาสตร์โรงงาน
กลุ่มมาตรฐานวิธีการวิเคราะห์ทดสอบผลิตภัณฑ์และทะเบียนห้องปฏิบัติการ
โทร. ๐ ๒๕๓๐ ๒๓๒๒ ถึง ๒๕๐๓-๕
โทรสาร ๐ ๒๕๓๐ ๒๓๒๒ ถึง ๒๕๑๙
ไปรษณีย์อิเล็กทรอนิกส์ sarabang@dlw.mail.go.th



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อุตสาหกรรมสีเขียว ปันผลไทยก้าวหน้า ร่วมกันพัฒนา อุตสาหกรรมสีเขียว



ที่ อก ๐๓๓๐(๑)/ ๑๘๘๙๙

กรมโรงงานอุตสาหกรรม
ถนนพระรามที่ ๖ แขวงทุ่งพญาไท
เขตราชเทวี กรุงเทพฯ ๑๐๖๐๐

๒๑ เมษายน ๒๕๖๕

เรื่อง เปลี่ยนแปลงบุคลากรห้องปฏิบัติการวิเคราะห์

เรียน กรรมการผู้จัดการ บริษัท ยูไนเต็ด แอนาไลติก แอนด์ เอ็นจิเนียริ่ง คอนซัลแตนท์ จำกัด

อ้างถึง คำขอขึ้นทะเบียน/ต่ออายุ/เปลี่ยนแปลงบุคลากร และชนิดสารเคมีของห้องปฏิบัติการวิเคราะห์เอกชน
ลงวันที่ ๓๐ มีนาคม ๒๕๖๕

ตามหนังสือที่อ้างถึง บริษัท ยูไนเต็ด แอนาไลติก แอนด์ เอ็นจิเนียริ่ง คอนซัลแตนท์ จำกัด
ขอปฏิบัติการวิเคราะห์เอกชน เลขทะเบียน ๖-๑๘๕ สถานที่ตั้งเลขที่ ๓ ซอยสุขุมสุข ถนนสุขุมวิท แขวงบางจาก
เขตพระโขนง กรุงเทพมหานคร ขอเปลี่ยนแปลงบุคลากรห้องปฏิบัติการวิเคราะห์ ความละเอียดแจ้งแล้ว นั้น

กรมโรงงานอุตสาหกรรมพิจารณาแล้ว มีความเห็นดังนี้

1. ให้อยู่ในบัญชีควบคุมของห้องปฏิบัติการวิเคราะห์ จำนวน ๒ ราย
- ๑) นางจินดา เศรษฐินพร ทะเบียนเลขที่ ๖-๑๘๕-๙-๐๐๐๕
- ๒) นางสาวนภสรณ คงคำ ทะเบียนเลขที่ ๖-๑๘๕-๙-๐๐๑๒
2. ให้อยู่ในบัญชีเจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์ จำนวน ๒ ราย
- ๑) นางสาวศิริพร อภิการณ์ ทะเบียนเลขที่ ๖-๑๘๕-๙-๐๐๒๔
- ๒) นางสาวพรวิภา กาสิณุน ทะเบียนเลขที่ ๖-๑๘๕-๙-๐๐๓๔
๓. ให้เพิ่มเจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์ จำนวน ๒ ราย
- ๑) นางสาวณัฐณิชา วัฒนศิริกุลกุล ทะเบียนเลขที่ ๖-๑๘๕-๙-๐๐๓๗
- ๒) นางสาวจันทร์จิรา ประกอบพรหมดี ทะเบียนเลขที่ ๖-๑๘๕-๙-๐๐๓๘

อนึ่ง หนังสือฉบับนี้จะหมดอายุพร้อมหนังสือต่ออายุรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน
ที่ อก ๐๓๓๐(๑)/๑๘๘๙๙ ลงวันที่ ๕ กุมภาพันธ์ ๒๕๖๕ คือในวันที่ ๒ กุมภาพันธ์ ๒๕๖๘ ทั้งนี้ สามารถยื่นคำขอ
ผ่านระบบอิเล็กทรอนิกส์ได้ทั้งหน้าเว็บไซต์กรมโรงงานอุตสาหกรรม ตาม QR Code ท้ายหนังสือฉบับนี้

จึงเรียนมาเพื่อทราบ

ขอแสดงความนับถือ


(นางจินดา เศรษฐินพร)
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ปฏิบัติการกรมส่งเสริมและพัฒนาระบบมาตรฐาน



ยื่นคำขอผ่านระบบอิเล็กทรอนิกส์

กองวิจัยและพัฒนายุทธศาสตร์โรงงาน

กลุ่มมาตรฐานวิธีการวิเคราะห์ทดสอบผลิตภัณฑ์และทะเบียนห้องปฏิบัติการ
โทร. ๐ ๒๕๓๐ ๒๓๒๒ ถึง ๒๕๐๓-๕ โทรสาร ๐๒๕๓๐ ๒๓๒๒ ถึง ๒๕๑๙
ไปรษณีย์อิเล็กทรอนิกส์ sarabang@dlw.mail.go.th



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อุตสาหกรรมสีเขียว ปันผลไทยก้าวหน้า ร่วมกันพัฒนา อุตสาหกรรมสีเขียว



ที่ อก ๐๓๓๐(๑)/ ๑๘๘๙๙

กรมโรงงานอุตสาหกรรม
ถนนพระรามที่ ๖ แขวงทุ่งพญาไท
เขตราชเทวี กรุงเทพฯ ๑๐๖๐๐
๑๙ กุมภาพันธ์ ๒๕๖๕

เรื่อง ต่ออายุหนังสือรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน

เรียน กรรมการผู้จัดการ บริษัท ยูไนเต็ด แอนาไลติก แอนด์ เอ็นจิเนียริ่ง คอนซัลแตนท์ จำกัด

อ้างถึง คำขอขึ้นทะเบียน/ต่ออายุ/เปลี่ยนแปลงบุคลากร และชนิดสารเคมีของห้องปฏิบัติการวิเคราะห์เอกชน
ลงวันที่ ๒๙ ธันวาคม ๒๕๖๔

- สิ่งที่ส่งมาด้วย
๑. รายชื่อผู้ควบคุมดูแลห้องปฏิบัติการวิเคราะห์ จำนวน ๔๐ ราย
 ๒. รายชื่อเจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์ จำนวน ๑๐๒ ราย
 ๓. ขอบข่ายสารเคมีที่ได้รับขึ้นทะเบียนจากกรมโรงงานอุตสาหกรรม

ตามหนังสือที่อ้างถึง บริษัท ยูไนเต็ด แอนาไลติก แอนด์ เอ็นจิเนียริ่ง คอนซัลแตนท์ จำกัด
ขอต่ออายุหนังสือรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน เลขทะเบียน ๖-๑๘๕ สถานที่ตั้งเลขที่ ๓
ซอยสุขุมสุข ๓๓ ถนนสุขุมวิท แขวงบางจาก เขตพระโขนง กรุงเทพมหานคร ต่อกรมโรงงานอุตสาหกรรม นั้น

กรมโรงงานอุตสาหกรรมพิจารณาแล้ว ให้บริษัท ยูไนเต็ด แอนาไลติก แอนด์ เอ็นจิเนียริ่ง
คอนซัลแตนท์ จำกัด ต่ออายุหนังสือรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน โดยมีองค์ประกอบดังนี้

- ก. ผู้ควบคุมดูแลห้องปฏิบัติการวิเคราะห์ จำนวน ๔๐ ราย ตามสิ่งที่ส่งมาด้วย ๑
- ข. เจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์ จำนวน ๑๐๒ ราย ตามสิ่งที่ส่งมาด้วย ๒
- ค. ขอบข่ายสารเคมีที่ได้รับขึ้นทะเบียนในคราวนี้ในน้ำเสีย น้ำดื่ม อากาศเสีย สิ่งปฏิกูล
หรือวัสดุที่ไม่ใช่แล้ว และดิน ตามสิ่งที่ส่งมาด้วย ๓

หนังสือฉบับนี้จะหมดอายุในวันที่ ๒ กุมภาพันธ์ ๒๕๖๘ หากประสงค์จะต่ออายุหนังสือ
รับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน ให้ยื่นคำขอต่ออายุพร้อมเอกสารประกอบคำขอต่อ
กรมโรงงานอุตสาหกรรมภายใน ๓๐ วัน ก่อนวันสิ้นสุดของหนังสือรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน
ทั้งนี้ สามารถยื่นคำขอผ่านระบบอิเล็กทรอนิกส์ได้ทั้งหน้าเว็บไซต์กรมโรงงานอุตสาหกรรม ตาม QR Code ท้าย
หนังสือฉบับนี้

จึงเรียนมาเพื่อทราบ

ขอแสดงความนับถือ


(นางจินดา เศรษฐินพร)
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ยื่นคำขอผ่านระบบอิเล็กทรอนิกส์

กองวิจัยและพัฒนายุทธศาสตร์โรงงาน

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โทรสาร ๐ ๒๕๓๐ ๒๓๒๒ ถึง ๒๕๑๙
ไปรษณีย์อิเล็กทรอนิกส์ sarabang@dlw.mail.go.th




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ทะเบียนเลขที่ 7-๓๕๕-ก-๐๐๓๖
ทะเบียนเลขที่ 7-๓๕๕-ก-๐๐๓๗
ทะเบียนเลขที่ 7-๓๕๕-ก-๐๐๓๘
ทะเบียนเลขที่ 7-๓๕๕-ก-๐๐๓๙
ทะเบียนเลขที่ 7-๓๕๕-ก-๐๐๔๐

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 ๒-๓๓๕๕-๖-๐๐๐๖๕
 ๒-๓๓๕๕-๖-๐๐๐๖๕
 ๒-๓๓๕๕-๖-๐๐๐๖๕
 ๒-๓๓๕๕-๖-๐๐๐๖๕


 ทะเบียนเลขที่ 7-๑๕๕-4-0๐๐๓๔
 ทะเบียนเลขที่ 7-๑๕๕-4-0๐๐๓๔
 ทะเบียนเลขที่ 7-๑๕๕-4-0๐๐๓๔
 ทะเบียนเลขที่ 7-๑๕๕-4-0๐๐๓๔
 ทะเบียนเลขที่ 7-๑๕๕-4-0๐๐๓๔
 (นายวิชาญ เทพศรีพนทรี)
 ผู้อำนวยการกองนโยบายการเงินและนโยบายการเงิน
 (นายวิชาญ เทพศรีพนทรี)

๑) นายบภลีน...

ผู้ชำนาญการภาควิจัยและพัฒนาระบบบริหาร
ปฏิบัติราชการแบบใหม่ : ศึกษาวิจัยระบบราชการแบบใหม่

เอกสารแนบท้ายหนังสือรับต่ออายุขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกสาร
บริษัท ยูนิเทค แอแนลิสต์ แอนด์ เอ็นจิเนียริ่ง คอมพิวเตอร์ จำกัด เลขทะเบียน ๖-๑๕๕
ที่ ๑๓ ๐๓๑๐(๑)/ ๑๘๗ ๙ ลงวันที่ ๐๙ กุมภาพันธ์ ๒๕๖๕

ขอขยายสารมลพิษที่ได้รับขึ้นทะเบียนจากกรมโรงงานอุตสาหกรรม จำนวน ๑๕๗ รายการ

บัญชี จำนวน 46 รายการ

| ลำดับ | สารมลพิษ | วิธีวิเคราะห์ |
|-------|---------------------------|--|
| 1 | Aldrin | Liquid-Liquid Extraction, Gas Chromatographic Method ⁽¹⁾ |
| 2 | Arsenic | 1) Digestion, Hydride Generation/Atomic Absorption Spectrometric Method ⁽¹⁾ 2) Digestion, Inductively Coupled Plasma Method ⁽⁴⁾ |
| 3 | Barium | Digestion, Inductively Coupled Plasma Method ⁽⁴⁾ |
| 4 | α-BHC | Liquid-Liquid Extraction, Gas Chromatographic Method ⁽¹⁾ |
| 5 | β-BHC | Liquid-Liquid Extraction, Gas Chromatographic Method ⁽¹⁾ |
| 6 | δ-BHC | Liquid-Liquid Extraction, Gas Chromatographic Method ⁽¹⁾ |
| 7 | γ-BHC | Liquid-Liquid Extraction, Gas Chromatographic Method ⁽¹⁾ |
| 8 | Biochemical Oxygen Demand | 1) 5-Day BOD Test, Azide Modification Method ⁽¹⁾ 2) 5-Day BOD Test, Membrane Electrode Method ⁽⁴⁾ |
| 9 | Cadmium | 1) Digestion, Direct Air-Acetylene Flame Method ⁽¹⁾ 2) Digestion, Electrothermal Atomic Absorption Spectrometric Method ⁽¹⁾ 3) Digestion, Inductively Coupled Plasma Method ⁽⁴⁾ |
| 10 | Chemical Oxygen Demand | 1) Closed Reflux, Titrimetric Method ⁽¹⁾ 2) Closed Reflux, Colorimetric Method ⁽¹⁾ 3) Open Reflux, Titrimetric Method ⁽¹⁾ |
| 11 | Chlordane | Liquid-Liquid Extraction, Gas Chromatographic Method ⁽¹⁾ |
| 12 | Chromium | 1) Digestion, Direct Air-Acetylene Flame Method ⁽¹⁾ 2) Digestion, Electrothermal Atomic Absorption Spectrometric Method ⁽¹⁾ 3) Digestion, Inductively Coupled Plasma Method ⁽⁴⁾ |
| 13 | Color | ADMI Weighted-Ordinate Spectrophotometric Method ⁽¹⁾ |
| 14 | Copper | 1) Digestion, Direct Air-Acetylene Flame Method ⁽¹⁾ 2) Digestion, Electrothermal Atomic Absorption Spectrometric Method ⁽¹⁾ |
| 15 | Cyanide | 1) Digestion, Inductively Coupled Plasma Method ⁽⁴⁾ 2) Digestion, Cold-Vapor Atomic Absorption Spectrometric Method ⁽¹⁾ 3) Digestion, Inductively Coupled Plasma Method ⁽⁴⁾ |

16 o,p'-DDT...

๗๑) นายอิทธิพงษ์ ศรีวิเศษ
๗๒) นางสาวกรรณิการ์ สาลีหา
๗๓) นายสุภากรณิคม พิมพ์
๗๔) นายพรชัย คุ้มวงศ์
๗๕) นางสาวศศิธร ไทยหา
๗๖) นายอิทธิพงษ์ ศรีวิเศษ
๗๗) นางสาวณัฐชา พรหมศิริ
๗๘) นางสาวลลิตาวัลย์ โพธิ์พันธ์
๗๙) นางสาวกรรณิคม เจิมจันทร์
๘๐) นายณัฏฐ์ ชื่นทะเล
๘๑) นายณัฏฐ์ ชื่นทะเล
๘๒) นายณัฏฐ์ ชื่นทะเล
๘๓) นายณัฏฐ์ ชื่นทะเล
๘๔) นางสาวพรนัชชา กลิ่นธนู
๘๕) นายณัฏฐ์ ศรีวิเศษ
๘๖) นางสาวลลิตาวัลย์ โพธิ์พันธ์
๘๗) นายณัฏฐ์ ชื่นทะเล
๘๘) นางสาวลลิตาวัลย์ โพธิ์พันธ์
๘๙) นายณัฏฐ์ ชื่นทะเล
๙๐) นายณัฏฐ์ ชื่นทะเล
๙๑) นางสาวณัฐชา พรหมศิริ
๙๒) นางสาวกรรณิคม เจิมจันทร์
๙๓) นายณัฏฐ์ ชื่นทะเล
๙๔) นางสาวลลิตาวัลย์ โพธิ์พันธ์
๙๕) นายณัฏฐ์ ชื่นทะเล
๙๖) นายณัฏฐ์ ชื่นทะเล
๙๗) นายณัฏฐ์ ชื่นทะเล
๙๘) นางสาวพรนัชชา กลิ่นธนู
๙๙) นายณัฏฐ์ ศรีวิเศษ
๑๐๐) นางสาวลลิตาวัลย์ โพธิ์พันธ์
๑๐๑) นายณัฏฐ์ ชื่นทะเล
๑๐๒) นายณัฏฐ์ ชื่นทะเล
๑๐๓) นายณัฏฐ์ ชื่นทะเล
๑๐๔) นายณัฏฐ์ ชื่นทะเล
๑๐๕) นางสาวณัฐชา พรหมศิริ
๑๐๖) นายณัฏฐ์ ชื่นทะเล

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(นางธิษณา เกษมธนากร)
ผู้อำนวยการศูนย์วิเคราะห์และเฝ้าระวังมลพิษ
ปฏิจาการทางมลพิษจากโรงงานอุตสาหกรรม

สำนักงานถูกต้อง

| ลำดับ | สารมลพิษ | วิธีวิเคราะห์ |
|-------|---------------------|--|
| 16 | o,p'-DDT | Liquid-Liquid Extraction, Gas Chromatographic Method ⁽¹⁾ |
| 17 | 4,4'-DDD | Liquid-Liquid Extraction, Gas Chromatographic Method ⁽¹⁾ |
| 18 | 4,4'-DDE | Liquid-Liquid Extraction, Gas Chromatographic Method ⁽¹⁾ |
| 19 | 4,4'-DDT | Liquid-Liquid Extraction, Gas Chromatographic Method ⁽¹⁾ |
| 20 | Dieldrin | Liquid-Liquid Extraction, Gas Chromatographic Method ⁽¹⁾ |
| 21 | Endosulfan I | Liquid-Liquid Extraction, Gas Chromatographic Method ⁽¹⁾ |
| 22 | Endosulfan II | Liquid-Liquid Extraction, Gas Chromatographic Method ⁽¹⁾ |
| 23 | Endosulfan sulfate | Liquid-Liquid Extraction, Gas Chromatographic Method ⁽¹⁾ |
| 24 | Endrin | Liquid-Liquid Extraction, Gas Chromatographic Method ⁽¹⁾ |
| 25 | Endrin aldehyde | Liquid-Liquid Extraction, Gas Chromatographic Method ⁽¹⁾ |
| 26 | Formaldehyde | Distillation, Colorimetric Method ⁽¹⁾ |
| 27 | Free Chlorine | 1) Iodometric Method ⁽¹⁾ 2) DPD Ferrous Titrimetric Method ⁽¹⁾ |
| 28 | Heptachlor | Liquid-Liquid Extraction, Gas Chromatographic Method ⁽¹⁾ |
| 29 | Heptachlor Epoxide | Liquid-Liquid Extraction, Gas Chromatographic Method ⁽¹⁾ |
| 30 | Hexavalent Chromium | 1) Colorimetric Method ⁽¹⁾ 2) Extraction, Direct Air-Acetylene Flame Method ⁽¹⁾ 3) Digestion, Direct Air-Acetylene Flame Method ⁽¹⁾ 4) Digestion, Electrothermal Atomic Absorption Spectrometric Method ⁽¹⁾ 5) Digestion, Inductively Coupled Plasma Method ⁽⁴⁾ |
| 31 | Lead | 1) Digestion, Direct Air-Acetylene Flame Method ⁽¹⁾ 2) Digestion, Electrothermal Atomic Absorption Spectrometric Method ⁽¹⁾ 3) Digestion, Inductively Coupled Plasma Method ⁽⁴⁾ |
| 32 | Manganese | 1) Digestion, Direct Air-Acetylene Flame Method ⁽¹⁾ 2) Digestion, Electrothermal Atomic Absorption Spectrometric Method ⁽¹⁾ 3) Digestion, Inductively Coupled Plasma Method ⁽⁴⁾ |
| 33 | Mercury | Digestion, Cold-Vapor Atomic Absorption Spectrometric Method ⁽¹⁾ |
| 34 | Methoxychlor | Liquid-Liquid Extraction, Gas Chromatographic Method ⁽¹⁾ |
| 35 | Nickel | 1) Digestion, Direct Air-Acetylene Flame Method ⁽¹⁾ 2) Digestion, Electrothermal Atomic Absorption Spectrometric Method ⁽¹⁾ 3) Digestion, Inductively Coupled Plasma Method ⁽⁴⁾ |

36 Oil & Grease...

| ลำดับ | สารมลพิษ | วิธีวิเคราะห์ |
|-------|-------------------------|--|
| 36 | Oil & Grease | 1) Liquid-Liquid, Partition-Gravimetric Method ⁽¹⁾ 2) Soxhlet Extraction Method ⁽¹⁾ |
| 37 | pH | Electrometric Method ⁽¹⁾ |
| 38 | Phenols | 1) Distillation, Chloroform Extraction Method ⁽¹⁾ 2) Distillation, Direct Photometric Method ⁽¹⁾ |
| 39 | Selenium | 1) Digestion, Hydride Generation/Atomic Absorption Spectrometric Method ⁽¹⁾ 2) Digestion, Inductively Coupled Plasma Method ⁽⁴⁾ |
| 40 | Sulfide | 1) Iodometric Method ⁽¹⁾ 2) Methylene Blue Method ⁽¹⁾ |
| 41 | Temperature | Laboratory and Field Methods ⁽¹⁾ |
| 42 | Total Dissolved Solids | Dried at 180 °C ⁽¹⁾ |
| 43 | Total Kjeldahl Nitrogen | Semi-Micro-Kjeldahl Method ⁽¹⁾ |
| 44 | Total Suspended Solids | Dried at 103-105 °C ⁽¹⁾ |
| 45 | Trivalent Chromium | 1) Digestion, Direct Air-Acetylene Flame Method; Colorimetric Method; Calculation ⁽¹⁾ 2) Digestion, Inductively Coupled Plasma Method; Colorimetric Method; Calculation ⁽¹⁾ |
| 46 | Zinc | 1) Digestion, Direct Air-Acetylene Flame Method ⁽¹⁾ 2) Digestion, Electrothermal Atomic Absorption Spectrometric Method ⁽¹⁾ 3) Digestion, Inductively Coupled Plasma Method ⁽⁴⁾ |

บัญชี จำนวน 126 รายการ

| ลำดับ | สารมลพิษ | วิธีวิเคราะห์ |
|-------|--------------|--|
| 1 | Acenaphthene | 1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽¹⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽¹⁾ |
| 2 | Acetone | Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽¹⁾ |
| 3 | Aldrin | 1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽¹⁾ 2) Digestion, Direct Air-Acetylene Flame Method ⁽¹⁾ 3) Digestion, Electrothermal Atomic Absorption Spectrometric Method ⁽¹⁾ 4) Digestion, Inductively Coupled Plasma Method ⁽⁴⁾ |

4 Anthracene...

| ลำดับ | สารเคมี | วิธีวิเคราะห์ |
|-------|----------------------|---|
| 4 | Anthracene | 1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾ |
| 5 | Antimony | Digestion, Inductively Coupled Plasma Method ⁽⁴⁾ |
| 6 | Arsenic | 1) Digestion, Hydride Generation/Atomic Absorption Spectrometric Method ⁽⁴⁾ 2) Digestion, Inductively Coupled Plasma Method ⁽⁴⁾ |
| 7 | Atrazine | Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾ |
| 8 | Barium | 1) Digestion, Electrothermal Atomic Absorption Spectrometric Method ⁽⁴⁾ 2) Digestion, Inductively Coupled Plasma Method ⁽⁴⁾ |
| 9 | Benz(a)anthracene | 1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾ |
| 10 | Benzene | Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾ |
| 11 | Benzo(b)fluoranthene | 1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾ |
| 12 | Benzo(k)fluoranthene | 1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾ |
| 13 | Benzoic acid | Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾ |
| 14 | Benzo(a)pyrene | 1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾ |

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15 Benzo(g,h,i)perylene...

| ลำดับ | สารเคมี | วิธีวิเคราะห์ |
|-------|----------------------------|--|
| 15 | Benzo(g,h,i)perylene | 1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾ |
| 16 | Beryllium | Digestion, Inductively Coupled Plasma Method ⁽⁴⁾ |
| 17 | Bis(2-chloroethyl)ether | Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾ |
| 18 | Bis(2-ethylhexyl)phthalate | Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾ |
| 19 | Bromodichloromethane | Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾ |
| 20 | Bromoform | Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾ |
| 21 | Butanol | Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾ |
| 22 | Butyl benzyl phthalate | Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾ |
| 23 | Cadmium | 1) Digestion, Direct Air-Acetylene Flame Method ⁽⁴⁾ 2) Digestion, Electrothermal Atomic Absorption Spectrometric Method ⁽⁴⁾ 3) Digestion, Inductively Coupled Plasma Method ⁽⁴⁾ |
| 24 | Carbazole | Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾ |
| 25 | Carbon disulfide | Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾ |
| 26 | Carbon tetrachloride | Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾ |
| 27 | Chlordane | 1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾ |
| 28 | p-Chloroaniline | Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾ |
| 29 | Chlorobenzene | Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾ |

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30 Chlorodibromomethane...

| ลำดับ | สารเคมี | วิธีวิเคราะห์ |
|-------|----------------------|--|
| 30 | Chlorodibromomethane | Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾ |
| 31 | Chloroform | Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾ |
| 32 | 2-Chlorophenol | Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾ |
| 33 | Chromium | 1) Digestion, Direct Air-Acetylene Flame Method ⁽⁴⁾ 2) Digestion, Electrothermal Atomic Absorption Spectrometric Method ⁽⁴⁾ 3) Digestion, Inductively Coupled Plasma Method ⁽⁴⁾ |
| 34 | Chromium (III) | 1) Digestion, Direct Air-Acetylene Flame Method; Colorimetric Method; Calculation ⁽⁴⁾ 2) Digestion, Inductively Coupled Plasma Method; Colorimetric Method; Calculation ⁽⁴⁾ |
| 35 | Chromium (VI) | 1) Colorimetric Method ⁽⁴⁾ 2) Extraction, Air-Acetylene Flame Method ⁽⁴⁾ |
| 36 | Chrysene | 1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾ |
| 37 | Cyanide | Distillation, Colorimetric Method ⁽⁴⁾ |
| 38 | 2,4-D | Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ |
| 39 | DOD | 1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾ |
| 40 | DDE | 1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾ |
| 41 | DDT | 1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾ |

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42 Dibenz(a,h)anthracene...

| ลำดับ | สารเคมี | วิธีวิเคราะห์ |
|-------|----------------------------|---|
| 42 | Dibenz(a,h)anthracene | 1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾ |
| 43 | Di-n-butyl phthalate | Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾ |
| 44 | 1,2-Dichlorobenzene | Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾ |
| 45 | 1,3-Dichlorobenzene | Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾ |
| 46 | 1,4-Dichlorobenzene | Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾ |
| 47 | 3,3'-Dichlorobenzidine | Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾ |
| 48 | 1,1-Dichloroethane | Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾ |
| 49 | 1,2-Dichloroethane | Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾ |
| 50 | 1,1-Dichloroethylene | Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾ |
| 51 | cis-1,2-Dichloroethylene | Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾ |
| 52 | trans-1,2-Dichloroethylene | Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾ |
| 53 | 2,4-Dichlorophenol | Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾ |
| 54 | 1,2-Dichloropropene | Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾ |
| 55 | 1,3-Dichloropropane | Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾ |
| 56 | 1,3-Dichloropropene | Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾ |
| 57 | Dieldrin | 1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾ |

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58 Diethyl phthalate...

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|-------|----------------------|---|
| 58 | Diethyl phthalate | Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾ |
| 59 | 2,4-Dimethylphenol | Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾ |
| 60 | 2,4-Dinitrophenol | Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾ |
| 61 | 2,4-Dinitrotoluene | Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾ |
| 62 | 2,6-Dinitrotoluene | Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾ |
| 63 | Di-n-Octyl phthalate | Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾ |
| 64 | Endosulfan | 1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾ |
| 65 | Endrin | 1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾ |
| 66 | Ethylbenzene | Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾ |
| 67 | Fluoranthene | 1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾ |
| 68 | Fluorene | 1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾ |
| 69 | Heptachlor | 1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾ |

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70 Heptachlor epoxide...

| ลำดับ | สารมลพิษ | วิธีวิเคราะห์ |
|-------|---------------------------|--|
| 70 | Heptachlor epoxide | 1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾ |
| 71 | Hexachlorobenzene | Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾ |
| 72 | Hexachloro-1,3-butadiene | Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾ |
| 73 | n-Hexane | Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾ |
| 74 | α -HCH | 1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾ |
| 75 | β -HCH | 1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾ |
| 76 | γ -HCH | 1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾ |
| 77 | Hexachlorocyclopentadiene | Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾ |
| 78 | Hexachloroethane | Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾ |
| 79 | Indeno(1,2,3-cd)pyrene | Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾ |
| 80 | Isophorone | Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾ |
| 81 | Lead | 1) Digestion, Direct Air-Acetylene Flame Method ⁽⁴⁾ 2) Digestion, Electrothermal Atomic Absorption Spectrometric Method ⁽⁴⁾ 3) Digestion, Inductively Coupled Plasma Method ⁽⁴⁾ |

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82 Manganese...

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|-------|---------------------------|--|
| 82 | Manganese | 1) Digestion, Direct Air-Acetylene Flame Method ⁽⁴⁾ 2) Digestion, Electrothermal Atomic Absorption Spectrometric Method ⁽⁴⁾ 3) Digestion, Inductively Coupled Plasma Method ⁽⁴⁾ |
| 83 | Mercury | Digestion, Cold-Vapor Atomic Absorption Spectrometric Method ⁽⁴⁾ |
| 84 | Methanol | Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾ |
| 85 | Methoxychlor | Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ |
| 86 | Methyl bromide | Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾ |
| 87 | Methylene chloride | Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾ |
| 88 | 2-Methylphenol | Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾ |
| 89 | 2-Methylnaphthalene | 1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾ |
| 90 | Methyl tert-butyl ether | Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾ |
| 91 | Naphthalene | 1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾ |
| 92 | Nickel | 1) Digestion, Direct Air-Acetylene Flame Method ⁽⁴⁾ 2) Digestion, Electrothermal Atomic Absorption Spectrometric Method ⁽⁴⁾ 3) Digestion, Inductively Coupled Plasma Method ⁽⁴⁾ |
| 93 | Nitrobenzene | Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾ |
| 94 | N-Nitrosodiphenylamine | Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾ |
| 95 | N-Nitrosodi-n-propylamine | Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾ |

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96 Polychlorinated Biphenyls...

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|-------|---|---|
| 96 | Polychlorinated Biphenyls - PCB 1016 - PCB 1221 - PCB 1232 - PCB-1242 - PCB-1248 - PCB-1254 - PCB-1260 | 1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾ |
| 97 | Pentachlorophenol | Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾ |
| 98 | pH | Electrometric Method ⁽⁴⁾ |
| 99 | Phenanthrene | 1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾ |
| 100 | Phenol | 1) Distillation, Chloroform Extraction Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾ |
| 101 | Pyrene | 1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾ |
| 102 | Selenium | 1) Digestion, Hydride Generation/Atomic Absorption Spectrometric Method ⁽⁴⁾ 2) Digestion, Inductively Coupled Plasma Method ⁽⁴⁾ |
| 103 | Silver | Digestion, Inductively Coupled Plasma Method ⁽⁴⁾ |
| 104 | Styrene | Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾ |
| 105 | 1,1,2,2-Tetrachloroethane | Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾ |
| 106 | Tetrachloroethylene | Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾ |
| 107 | Toluene | Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾ |

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108 Toxaphene...

| ลำดับ | สารมลพิษ | วิธีวิเคราะห์ |
|-------|--|---|
| 108 | Toxaphene | 1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾ |
| 109 | TPH (C ₉ - C ₉) | 1) Purge and Trap, Gas Chromatographic Method ^(1,12,1) 2) Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(1,23) |
| 110 | TPH (C _{9,8} - C ₁₄) | Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method ^(9,21) |
| 111 | TPH (C _{9,18} - C ₁₉) | Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method ^(9,21) |
| 112 | 1,2,4-Trichlorobenzene | Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾ |
| 113 | 1,1,1-Trichloroethane | Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾ |
| 114 | 1,1,2-Trichloroethane | Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾ |
| 115 | Trichloroethylene | Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾ |
| 116 | 2,4,5-Trichlorophenol | Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾ |
| 117 | 2,4,6-Trichlorophenol | Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾ |
| 118 | 1,3,5-Trimethylbenzene | Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾ |
| 119 | Vanadium | Digestion, Inductively Coupled Plasma Method ⁽⁴⁾ |
| 120 | Vinyl acetate | Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾ |
| 121 | Vinyl chloride | Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾ |
| 122 | m-Xylene | Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾ |
| 123 | o-Xylene | Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾ |

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124 p-Xylene...

| ลำดับ | สารมลพิษ | วิธีวิเคราะห์ |
|-------|----------------|--|
| 124 | p-Xylene | Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾ |
| 125 | Xylene (Total) | Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾ |
| 126 | Zinc | 1) Digestion, Direct Air-Acetylene Flame Method ⁽⁴⁾ 2) Digestion, Electrothermal Atomic Absorption Spectrometric Method ⁽⁴⁾ 3) Digestion, Inductively Coupled Plasma Method ⁽⁴⁾ |

ภาคเคปีย (ปัสสาวะ) จำนวน 25 รายการ

| ลำดับ | สารมลพิษ | วิธีวิเคราะห์ |
|-------|-----------------|--|
| 1 | Antimony | Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method ⁽³⁾ |
| 2 | Arsenic | 1) Isokinetic Sampling, Digestion, Hydride Generation/Atomic Absorption Spectrometric Method ⁽³⁾ 2) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method ⁽³⁾ |
| 3 | Cadmium | 1) Isokinetic Sampling, Digestion, Direct Air-Acetylene Flame Method ⁽³⁾ 2) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method ⁽³⁾ |
| 4 | Carbon Monoxide | Instrumental Analyzer Method ⁽³⁾ |
| 5 | Chlorine | Isokinetic Sampling, Ion Chromatographic Method ⁽³⁾ |
| 6 | Chromium | 1) Isokinetic Sampling, Digestion, Direct Air-Acetylene Flame Method ⁽³⁾ 2) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method ⁽³⁾ |
| 7 | Cobalt | Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method ⁽³⁾ |
| 8 | Copper | 1) Isokinetic Sampling, Digestion, Direct Air-Acetylene Flame Method ⁽³⁾ 2) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method ⁽³⁾ |
| 9 | Cresol | Absorption Sampling, Gas Chromatographic Method ⁽³⁾ |

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10 Dioxins/Furans...

| ลำดับ | สารมลพิษ | วิธีวิเคราะห์ |
|-------|-----------------------------|--|
| 10 | Dioxins/Furans | Isokinetic Sampling ⁽³⁾ |
| 11 | Hydrogen Chloride | Isokinetic Sampling, Ion Chromatographic Method ⁽³⁾ |
| 12 | Hydrogen Fluoride | Isokinetic Sampling, Ion Chromatographic Method ⁽³⁾ |
| 13 | Hydrogen Sulfide | Absorption Sampling, Iodometric Method ⁽³⁾ |
| 14 | Lead | 1) Isokinetic Sampling, Digestion, Direct Air-Acetylene Flame Method ⁽³⁾ 2) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method ⁽³⁾ |
| 15 | Manganese | 1) Isokinetic Sampling, Digestion, Direct Air-Acetylene Flame Method ⁽³⁾ 2) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method ⁽³⁾ |
| 16 | Mercury | Isokinetic Sampling, Digestion, Cold-Vapor Atomic Absorption Spectrometric Method ⁽³⁾ |
| 17 | Nickel | 1) Isokinetic Sampling, Digestion, Direct Air-Acetylene Flame Method ⁽³⁾ 2) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method ⁽³⁾ |
| 18 | Opacity | Ringelmann's Method ⁽¹⁾ |
| 19 | Oxides of Nitrogen | 1) Absorption Sampling, Phenoldisulfonic acid Method ⁽³⁾ 2) Instrumental Analyzer Method ⁽³⁾ |
| 20 | Selenium | 1) Isokinetic Sampling, Digestion, Hydride Generation/Atomic Absorption Spectrometric Method ⁽³⁾ 2) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method ⁽³⁾ |
| 21 | Sulfur Dioxide | 1) Absorption Sampling, Barium-Thorin Titrimetric Method ⁽³⁾ 2) Instrumental Analyzer Method ⁽³⁾ |
| 22 | Sulfuric Acid | Isokinetic Sampling, Barium-Thorin Titrimetric Method ⁽³⁾ |
| 23 | Total Suspended Particulate | Isokinetic Sampling, Gravimetric Method ⁽³⁾ |
| 24 | Vanadium | Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method ⁽³⁾ |
| 25 | Xylene | 1) Gas Sampling, Gas Chromatographic Method ⁽³⁾ 2) Absorption Sampling, Gas Chromatographic Method ⁽³⁾ |

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สิ่งปลูก...

สิ่งปลูกหรือวัตถุที่ไม่ใช่จำนวน 35 รายการ

| ลำดับ | สารมลพิษ | วิธีวิเคราะห์ |
|-------|-----------|--|
| 1 | Aldrin | 1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method ^(2,4,22) 2) Ultrasonic Extraction, Gas Chromatographic Method ^(10,22) |
| 2 | Antimony | Digestion, Inductively Coupled Plasma Method ^(7,13) |
| 3 | Arsenic | 1) Waste Extraction, Digestion, Hydride Generation/Atomic Absorption Spectrometric Method ^(2,4,13) 2) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(2,4,13) 3) Digestion, Hydride Generation/Atomic Absorption Spectrometric Method ^(7,13) 4) Digestion, Inductively Coupled Plasma Method ^(7,13) |
| 4 | Barium | 1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(2,4,13) 2) Digestion, Inductively Coupled Plasma Method ^(7,13) |
| 5 | Beryllium | 1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(2,4,13) 2) Digestion, Inductively Coupled Plasma Method ^(7,13) |
| 6 | Cadmium | 1) Waste Extraction, Digestion, Flame Atomic Absorption Spectrometric Method ^(2,4,14) 2) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(2,4,13) 3) Digestion, Flame Atomic Absorption Spectrometric Method ^(7,14) 4) Digestion, Inductively Coupled Plasma Method ^(7,13) |
| 7 | Chlordane | 1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method ^(2,9,22) 2) Ultrasonic Extraction, Gas Chromatographic Method ^(10,22) |
| 8 | Chromium | 1) Waste Extraction, Digestion, Flame Atomic Absorption Spectrometric Method ^(2,4,14) 2) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(2,4,13) |

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3) Digestion,...

| ลำดับ | สารเคมี | วิธีวิเคราะห์ |
|-------|----------------|---|
| 9 | Chromium (III) | 3) Digestion, Flame Atomic Absorption Spectrometric Method ^(7,14) 4) Digestion, Inductively Coupled Plasma Method ^(7,13) 1) Waste Extraction, Digestion, Flame Atomic Absorption Spectrometric Method; Waste Extraction, Colorimetric Method; Calculation ^(2,6,14,16) 2) Waste Extraction, Digestion, Inductively Coupled Plasma Method; Waste Extraction, Colorimetric Method; Calculation ^(2,6,13,16) 3) Digestion, Flame Atomic Absorption Spectrometric Method; Alkaline Digestion, Colorimetric Method; Calculation ^(7,8,14,16) 4) Digestion, Inductively Coupled Plasma Method; Alkaline Digestion, Colorimetric Method; Calculation ^(7,8,13,16) |
| 10 | Chromium (VI) | 1) Waste Extraction, Colorimetric Method ^(3,16) 2) Alkaline Digestion, Colorimetric Method ^(9,16) |
| 11 | Cobalt | 1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(2,6,13) 2) Digestion, Inductively Coupled Plasma Method ^(7,13) |
| 12 | Copper | 1) Waste Extraction, Digestion, Flame Atomic Absorption Spectrometric Method ^(2,6,14) 2) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(2,8,13) 3) Digestion, Flame Atomic Absorption Spectrometric Method ^(7,14) 4) Digestion, Inductively Coupled Plasma Method ^(7,13) |
| 13 | 2,4-D | 1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method ^(2,9,22) 2) Ultrasonic Extraction, Gas Chromatographic Method ^(10,22) |
| 14 | DDD | 1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method ^(2,9,22) 2) Ultrasonic Extraction, Gas Chromatographic Method ^(10,22) |

15 DDE...

| ลำดับ | สารเคมี | วิธีวิเคราะห์ |
|-------|------------|--|
| 15 | DDE | 1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method ^(2,9,22) 2) Ultrasonic Extraction, Gas Chromatographic Method ^(10,22) |
| 16 | DDT | 1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method ^(2,9,22) 2) Ultrasonic Extraction, Gas Chromatographic Method ^(10,22) |
| 17 | Dieldrin | 1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method ^(2,9,22) 2) Ultrasonic Extraction, Gas Chromatographic Method ^(10,22) |
| 18 | Endrin | 1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method ^(2,9,22) 2) Ultrasonic Extraction, Gas Chromatographic Method ^(10,22) |
| 19 | Heptachlor | 1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method ^(2,9,22) 2) Ultrasonic Extraction, Gas Chromatographic Method ^(10,22) |
| 20 | Lead | 1) Waste Extraction, Digestion, Flame Atomic Absorption Spectrometric Method ^(2,6,14) 2) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(2,6,13) 3) Digestion, Flame Atomic Absorption Spectrometric Method ^(7,14) 4) Digestion, Inductively Coupled Plasma Method ^(7,13) |
| 21 | Lindane | 1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method ^(2,9,22) 2) Ultrasonic Extraction, Gas Chromatographic Method ^(10,22) |
| 22 | Mercury | 1) Waste Extraction, Digestion, Cold-Vapor Atomic Absorption Spectrometric Method ^(2,17) 2) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(2,6,13) |

3) Digestion,...

| ลำดับ | สารเคมี | วิธีวิเคราะห์ |
|-------|---|--|
| 23 | Methoxychlor | 3) Digestion, Cold-Vapor Atomic Absorption Spectrometric Method ^(7,16) 4) Digestion, Inductively Coupled Plasma Method ^(7,13) 5) Thermal Decomposition Amalgamation and Atomic Absorption Spectrometric Method ⁽¹⁹⁾ 1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method ^(2,9,22) 2) Ultrasonic Extraction, Gas Chromatographic Method ^(10,22) |
| 24 | Molybdenum | 1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(2,6,13) 2) Digestion, Inductively Coupled Plasma Method ^(7,13) |
| 25 | Nickel | 1) Waste Extraction, Digestion, Flame Atomic Absorption Spectrometric Method ^(2,6,14) 2) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(2,6,13) 3) Digestion, Flame Atomic Absorption Spectrometric Method ^(7,14) 4) Digestion, Inductively Coupled Plasma Method ^(7,13) |
| 26 | Polychlorinated Biphenyls - Aroclor 1016 - Aroclor 1221 - Aroclor 1232 - Aroclor 1242 - Aroclor 1248 - Aroclor 1254 - Aroclor 1260 - 2-Chlorobiphenyl - 2,3-Dichlorobiphenyl - 2,2',5-Trichlorobiphenyl - 2,4',5-Trichlorobiphenyl - 2,2',3,5'-Tetrachlorobiphenyl - 2,2',5,5'-Tetrachlorobiphenyl - 2,3',4,4'-Tetrachlorobiphenyl - 2,2',3,4,5'- Pentachlorobiphenyl | 1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method ^(2,9,22) 2) Ultrasonic Extraction, Gas Chromatographic Method ^(10,22) 3) Digestion, Cold-Vapor Atomic Absorption Spectrometric Method ^(7,16) 4) Digestion, Inductively Coupled Plasma Method ^(7,13) |

- 2,2',6,5,5'...

| ลำดับ | สารเคมี | วิธีวิเคราะห์ |
|-------|--|--|
| | - 2,2',4,5,5'- Pentachlorobiphenyl - 2,3,3',4',6- Pentachlorobiphenyl - 2,2',3,4,4',5'- Hexachlorobiphenyl - 2,2',3,4,5,5'- Hexachlorobiphenyl - 2,2',3,5,5',6- Hexachlorobiphenyl - 2,2',4,4',5,5'- Hexachlorobiphenyl - 2,2',3,3',4,4',5- Heptachlorobiphenyl - 2,2',3,4,4',5,5'- Heptachlorobiphenyl - 2,2',3,4,4',5,6- Heptachlorobiphenyl - 2,2',3,4',5,5',6- Heptachlorobiphenyl - 2,2',3,3',4,4',5,6- Nonachlorobiphenyl | |
| 27 | Pentachlorophenol | 1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^(2,9,26) 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26) Electrometric Method ^(21,36) |
| 28 | pH | |
| 29 | Selenium | 1) Waste Extraction, Digestion, Hydride Generation/Atomic Absorption Spectrometric Method ^(2,6,20) 2) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(2,6,13) 3) Digestion, Hydride Generation/Atomic Absorption Spectrometric Method ^(2,6,20) 4) Digestion, Inductively Coupled Plasma Method ^(7,13) |

30 Silver...

| ลำดับ | สารเคมี | วิธีวิเคราะห์ |
|-------|-------------------|---|
| 30 | Silver | 1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(2,6,13) |
| 31 | Thallium | 2) Digestion, Inductively Coupled Plasma Method ^(7,13) |
| 32 | Toxaphene | 1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(2,6,13) |
| | | 2) Digestion, Inductively Coupled Plasma Method ^(7,13) |
| | | 1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method ^(2,9,22) |
| | | 2) Ultrasonic Extraction, Gas Chromatographic Method ^(10,22) |
| 33 | Trichloroethylene | 1) Waste Extraction, Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(2,12,23) |
| | | 2) Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,23) |
| 34 | Vanadium | 1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(2,6,13) |
| | | 2) Digestion, Inductively Coupled Plasma Method ^(7,13) |
| 35 | Zinc | 1) Waste Extraction, Digestion, Flame Atomic Absorption Spectrometric Method ^(2,6,14) |
| | | 2) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(2,6,13) |
| | | 3) Digestion, Flame Atomic Absorption Spectrometric Method ^(7,14) |
| | | 4) Digestion, Inductively Coupled Plasma Method ^(7,13) |

สิ้น จำนวน 125 รายการ

| ลำดับ | สารเคมี | วิธีวิเคราะห์ |
|-------|--------------|--|
| 1 | Acenaphthene | 1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,24) |
| | | 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,24) |
| 2 | Acetone | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,24) |

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ดำเนินการโดย

3 Aldrin...

| ลำดับ | สารเคมี | วิธีวิเคราะห์ |
|-------|----------------------|--|
| 3 | Aldrin | 1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,25) |
| | | 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26) |
| 4 | Anthracene | 1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,26) |
| | | 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26) |
| 5 | Antimony | Digestion, Inductively Coupled Plasma Method ^(7,13) |
| 6 | Arsenic | 1) Digestion, Hydride Generation/Atomic Absorption Spectrometric Method ^(7,13) |
| | | 2) Digestion, Inductively Coupled Plasma Method ^(7,13) |
| 7 | Atrazine | Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26) |
| 8 | Barium | Digestion, Inductively Coupled Plasma Method ^(7,13) |
| 9 | Benz(a)anthracene | 1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,26) |
| | | 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26) |
| 10 | Benzene | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,25) |
| 11 | Benzo(b)fluoranthene | 1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,26) |
| | | 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26) |
| 12 | Benzo(k)fluoranthene | 1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,26) |
| | | 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26) |
| 13 | Benzoic acid | Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26) |
| 14 | Benzo(a)pyrene | 1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,26) |
| | | 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26) |

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ดำเนินการโดย

15 Benzo(g,h,i)perylene...

| ลำดับ | สารเคมี | วิธีวิเคราะห์ |
|-------|----------------------------|--|
| 15 | Benzo(g,h,i)perylene | 1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,27) |
| | | 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26) |
| 16 | Beryllium | Digestion, Inductively Coupled Plasma Method ^(7,13) |
| 17 | Bis(2-chloroethyl)ether | Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,28) |
| 18 | Bis(2-ethylhexyl)phthalate | Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,28) |
| 19 | Bromodichloromethane | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,29) |
| 20 | Bromoform | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,29) |
| 21 | Butanol | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,29) |
| 22 | Butyl benzyl phthalate | Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,28) |
| 23 | Cadmium | 1) Digestion, Flame Atomic Absorption Spectrometric Method ^(7,14) |
| | | 2) Digestion, Inductively Coupled Plasma Method ^(7,13) |
| 24 | Carbazole | Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,28) |
| 25 | Carbon disulfide | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,29) |
| 26 | Carbon tetrachloride | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,29) |
| 27 | Chlordane | 1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,28) |
| | | 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,28) |
| 28 | p-Chloroaniline | Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,28) |
| 29 | Chlorobenzene | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,29) |
| 30 | Chlorodibromomethane | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,29) |

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ดำเนินการโดย

31 Chloroform...

| ลำดับ | สารเคมี | วิธีวิเคราะห์ |
|-------|-----------------------|---|
| 31 | Chloroform | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,29) |
| 32 | 2-Chlorophenol | Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,28) |
| 33 | Chromium | 1) Digestion, Flame Atomic Absorption Spectrometric Method ^(7,14) |
| | | 2) Digestion, Inductively Coupled Plasma Method ^(7,13) |
| 34 | Chromium (III) | 1) Digestion, Flame Atomic Absorption Spectrometric Method; Alkaline Digestion, Colorimetric Method; Calculation ^(7,8,14,16) |
| | | 2) Digestion, Inductively Coupled Plasma Method; Alkaline Digestion, Colorimetric Method; Calculation ^(7,8,13,14) |
| 35 | Chromium (VI) | Alkaline Digestion, Colorimetric Method ^(8,14) |
| 36 | Chrysene | 1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,28) |
| | | 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26) |
| 37 | Cyanide | Extraction, Distillation, Colorimetric Method ^(28,29,30) |
| 38 | 2,4-D | Ultrasonic Extraction, Gas Chromatographic Method ⁽²⁷⁾ |
| 39 | DDD | 1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,27) |
| | | 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26) |
| 40 | DDE | 1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,27) |
| | | 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26) |
| 41 | DDT | 1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,27) |
| | | 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26) |
| 42 | Dibenz(a,h)anthracene | 1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,26) |
| | | 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26) |

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ดำเนินการโดย

43 Di-n-butyl phthalate...

| ลำดับ | สารมลพิษ | วิธีวิเคราะห์ |
|-------|----------------------------|---|
| 43 | Di-n-butyl phthalate | Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26) |
| 44 | 1,2-Dichlorobenzene | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,25) |
| 45 | 1,3-Dichlorobenzene | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,25) |
| 46 | 1,4-Dichlorobenzene | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,25) |
| 47 | 3,3'-Dichlorobenzidine | Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26) |
| 48 | 1,1-Dichloroethane | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,25) |
| 49 | 1,2-Dichloroethane | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,25) |
| 50 | 1,1-Dichloroethylene | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,25) |
| 51 | cis-1,2-Dichloroethylene | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,25) |
| 52 | trans-1,2-Dichloroethylene | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,25) |
| 53 | 2,4-Dichlorophenol | Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26) |
| 54 | 1,2-Dichloropropane | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,25) |
| 55 | 1,3-Dichloropropane | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,25) |
| 56 | 1,3-Dichloropropene | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,25) |
| 57 | Dieldrin | 1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,22) 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26) |
| 58 | Diethyl phthalate | Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26) |
| 59 | 2,4-Dimethylphenol | Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26) |

60 2,4-Dinitrophenol...

| ลำดับ | สารมลพิษ | วิธีวิเคราะห์ |
|-------|----------------------|---|
| 60 | 2,4-Dinitrophenol | Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26) |
| 61 | 2,4-Dinitrotoluene | Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26) |
| 62 | 2,6-Dinitrotoluene | Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26) |
| 63 | Di-n-Octyl phthalate | Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26) |
| 64 | Endosulfan | 1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,22) 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26) |
| 65 | Endrin | 1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,22) 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26) |
| 66 | Ethylbenzene | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,25) |
| 67 | Fluoranthene | 1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,24) 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26) |
| 68 | Fluorene | 1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,24) 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26) |
| 69 | Heptachlor | 1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,22) 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26) |
| 70 | Heptachlor epoxide | 1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,24) 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26) |


71 Hexachlorobenzene...

| ลำดับ | สารมลพิษ | วิธีวิเคราะห์ |
|-------|---------------------------|---|
| 71 | Hexachlorobenzene | 1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,22) 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26) |
| 72 | Hexachloro-1,3-butadiene | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,25) |
| 73 | n-Hexane | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,25) |
| 74 | α-HCH | 1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,22) 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26) |
| 75 | β-HCH | 1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,22) 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26) |
| 76 | γ-HCH | 1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,22) 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26) |
| 77 | Hexachlorocyclopentadiene | Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26) |
| 78 | Hexachloroethane | Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26) |
| 79 | Indeno(1,2,3-cd)pyrene | 1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,24) 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26) |
| 80 | Isophorone | Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26) |
| 81 | Lead | 1) Digestion, Flame Atomic Absorption Spectrometric Method ^(7,14) 2) Digestion, Inductively Coupled Plasma Method ^(7,15) |
| 82 | Manganese | 1) Digestion, Flame Atomic Absorption Spectrometric Method ^(7,14) 2) Digestion, Inductively Coupled Plasma Method ^(7,15) |

83 Mercury...

| ลำดับ | สารมลพิษ | วิธีวิเคราะห์ |
|-------|---------------------------|--|
| 83 | Mercury | 1) Digestion, Cold-Vapor Atomic Absorption Spectrometric Method ^(7,14) 2) Digestion, Inductively Coupled Plasma Method ^(7,15) 3) Thermal Decomposition Amalgamation and Atomic Absorption Spectrometric Method ^(7,15) |
| 84 | Methanol | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,25) |
| 85 | Methoxychlor | 1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,22) 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26) |
| 86 | Methyl bromide | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,25) |
| 87 | Methylene chloride | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,25) |
| 88 | 2-Methylphenol | Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26) |
| 89 | 2-Methylnaphthalene | Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26) |
| 90 | Methyl tert-butyl ether | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,25) |
| 91 | Naphthalene | 1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,24) 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26) |
| 92 | Nickel | 1) Digestion, Flame Atomic Absorption Spectrometric Method ^(7,14) 2) Digestion, Inductively Coupled Plasma Method ^(7,15) |
| 93 | Nitrobenzene | Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26) |
| 94 | N-Nitrosodiphenylamine | Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26) |
| 95 | N-Nitrosodi-n-propylamine | Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26) |

96 Polychlorinated Biphenyls...

| ลำดับ | สารมลพิษ | วิธีวิเคราะห์ |
|-------|--|--|
| 96 | Polychlorinated Biphenyls - Aroclor 1016 - Aroclor 1221 - Aroclor 1232 - Aroclor 1242 - Aroclor 1248 - Aroclor 1254 - Aroclor 1260 Polychlorinated Biphenyls - 2-Chlorobiphenyl - 2,3-Dichlorobiphenyl - 2,2',5-Trichlorobiphenyl - 2,4',5-Trichlorobiphenyl - 2,2',3,5'-Tetrachlorobiphenyl - 2,2',5,5'-Tetrachlorobiphenyl - 2,3',4,4'-Tetrachlorobiphenyl - 2,2',3,4,5'- Pentachlorobiphenyl - 2,2',4,5,5'- Pentachlorobiphenyl - 2,3,3',4,6'- Pentachlorobiphenyl - 2,2',3,4,4',5'- Hexachlorobiphenyl - 2,2',3,4,5,5'- Hexachlorobiphenyl - 2,2',3,5,5',6'- Hexachlorobiphenyl - 2,2',4,4',5,5'- Hexachlorobiphenyl - 2,2',3,3',4,4',5'- Heptachlorobiphenyl - 2,2',3,4,4',5,5'- Heptachlorobiphenyl - 2,2',3,4,4',5,6'- Heptachlorobiphenyl | 1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,28) 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,28) Ultrasonic Extraction, Gas Chromatographic Method ^(10,28)  ดำเนินการถูกต้อง |

- 2,2',3,4',5,5',6..

| ลำดับ | สารมลพิษ | วิธีวิเคราะห์ |
|-------|---|--|
| | - 2,2',3,4',5,5',6- Heptachlorobiphenyl - 2,2',3,3',4,4',5,5',6- Nonachlorobiphenyl Pentachlorophenol | Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,28) |
| 97 | Phenanthrene | 1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,28) 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,28) |
| 98 | Phenol | Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,28) |
| 99 | Pyrene | 1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,28) 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,28) |
| 100 | Selenium | 1) Digestion, Hydride Generation/Atomic Absorption Spectrometric Method ^(7,22) 2) Digestion, Inductively Coupled Plasma Method ^(7,13) Digestion, Inductively Coupled Plasma Method ^(7,13) |
| 101 | Silver | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,25) |
| 102 | Styrene | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,25) |
| 103 | 1,1,2,2-Tetrachloroethane | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,25) |
| 104 | Tetrachloroethylene | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,25) |
| 105 | Toluene | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,25) |
| 106 | Toxaphene | Ultrasonic Extraction, Gas Chromatographic Method ^(10,28) |
| 107 | TPH (C ₈ -C ₁₆) | 1) Purge and Trap, Gas Chromatographic Method ^(12,21) 2) Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,21) |
| 108 | TPH (C ₁₈ -C ₃₅) | Ultrasonic Extraction, Gas Chromatographic Method ^(10,28) |
| 109 | TPH (C ₁₈ -C ₃₅) | Ultrasonic Extraction, Gas Chromatographic Method ^(10,28) |
| 110 | 1,2,4-Trichlorobenzene | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,25) |
| 111 | | |

112 1,1,1-Trichloroethane...

| ลำดับ | สารมลพิษ | วิธีวิเคราะห์ |
|-------|------------------------|---|
| 112 | 1,1,1-Trichloroethane | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,25) |
| 113 | 1,1,2-Trichloroethane | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,25) |
| 114 | Trichloroethylene | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,25) |
| 115 | 2,4,5-Trichlorophenol | Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,28) |
| 116 | 2,4,6-Trichlorophenol | Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,28) |
| 117 | 1,3,5-Trimethylbenzene | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,25) |
| 118 | Vanadium | Digestion, Inductively Coupled Plasma Method ^(7,13) |
| 119 | Vinyl acetate | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,25) |
| 120 | Vinyl chloride | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,25) |
| 121 | m-Xylene | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,25) |
| 122 | o-Xylene | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,25) |
| 123 | p-Xylene | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,25) |
| 124 | Xylene (Total) | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,25) |
| 125 | Zinc | 1) Digestion, Flame Atomic Absorption Spectrometric Method ^(7,14) 2) Digestion, Inductively Coupled Plasma Method ^(7,13) |

เอกสารอ้างอิง

- กระทรวงอุตสาหกรรม, ประกาศกระทรวงอุตสาหกรรม, พ.ศ. 2549, เรื่อง กำหนดค่าปริมาณค่าพิกัดที่เลือกในอากาศที่ระบายออกจากปล่องของหม้อไอน้ำที่ใช้ถ่านหินเป็นเชื้อเพลิง, ราชกิจจานุเบกษา, 4 ธันวาคม 2549, เล่มที่ 123 ตอนที่ 125
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 **ดำเนินการถูกต้อง**

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สำนักงานลูกค้า

28. United States...

ข้อมูลมาตรฐานวิธีการวิเคราะห์ทางเคมีและพิษวิทยาสิ่งแวดล้อม (SW-846) ของสำนักงานคุ้มครองสิ่งแวดล้อมแห่งชาติสหรัฐอเมริกา (USEPA) ได้รับการแปลและเรียบเรียงขึ้นโดย บริษัท ยูเออี จำกัด (มหาชน) ในปี ๒๕๖๓