

ภาคผนวก จ

เอกสารสอบเทียบเครื่องมือที่ใช้ในการวิเคราะห์

รายการใบรับรองสอบเทียบเครื่องมือหลักประจำห้องปฏิบัติการสำหรับวิเคราะห์คุณภาพสิ่งแวดล้อม

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration*	Remark
Laboratory Instrument/Equipments. (Air Quality Analysis)									
1	Analytical Balance (Readability 0.1 mg)	TSP, PM-10	Mettler-Toledo	AB204-S / 1128312528	Mettler-Toledo (Thailand) Ltd.	TH2058-097-040722- ACC-TH	7 Apr 22	6 Apr 23	-
2	Analytical Balance (Readability 0.1 mg)		Mettler-Toledo	AB204-S/FACT / B108115858	Mettler-Toledo (Thailand) Ltd.	TH2058-098-040722- ACC-TH	7 Apr 22	6 Apr 23	-

Due Date of Calibration* : Schedule the program once a year at least once a year.

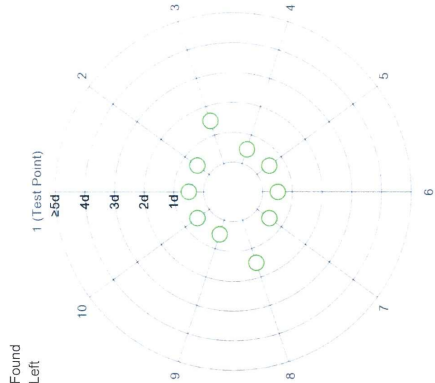
Measurement Results

Repeatability

Test Load: 100 g

	As Found	As Left
1	99.9999 g	N/A
2	100.0000 g	N/A
3	99.9998 g	N/A
4	100.0000 g	N/A
5	99.9999 g	N/A
6	100.0000 g	N/A
7	99.9999 g	N/A
8	100.0001 g	N/A
9	99.9999 g	N/A
10	100.0000 g	N/A

Standard Deviation	0.00008 g	N/A
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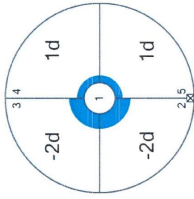


The "d" in the graph represents the readability of the range/interval in which the test was performed.
The results of this graph are based upon the absolute values of the differences from the mean value.

Eccentricity

Test Load: 100 g

Position	As Found	As Left
1	100.0000 g	N/A
2	99.9998 g	N/A
3	99.9998 g	N/A
4	100.0001 g	N/A
5	100.0001 g	N/A



Maximum Deviation	0.0002 g	N/A
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The "d" in the graph represents the readability of the range/interval in which the test was performed.

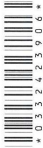
Mettler-Toledo (Thailand) Ltd.
846/4 - 846/5 Lasalle Rd., Bangna Tai Sub-District
Bangna District, Bangkok 10260
+66 2723 0382
MT-TH.ServicesSupport@mt.com



Accuracy Calibration Certificate

Customer

Company:	United Analyst and Engineering Consultant Co., Ltd.
Address:	3 Soi Udom Suk 41, Sukhumvit Rd., Bang Chak
City:	Phra Khanong
Zip / Postal:	10260
State / Province:	Bangkok
Order Number:	
Contact:	Suwit Chotnok



Weighing Device

Manufacturer:	Mettler Toledo	Instrument Type:	Weighing Instrument
Model:	AB204-S	Asset Number:	UAE-AIR.019/2550
Serial No.:	1128312528	Terminal Model:	N/A
Building:	N/A	Terminal Serial No.:	N/A
Floor:	2	Terminal Asset No.:	N/A
Room:	Balance Room 2 (206)		

Range	Max. Capacity	Readability (d)
1	220 g	0.0001 g

Procedure

Calibration Guideline:

METTLER TOLEDO Work Instruction:

EURAMET cg-18 v. 4.0 (11/2015)
CPIW002/20
This calibration certificate contains measurements for As Found calibration. No As Left calibration was performed because the device was not modified after As Found calibration. Therefore, results for As Left correspond to As Found.

The sensitivity/span of the weighing instrument was adjusted before calibration with a built-in weight.

In accordance with EURAMET cg-18 (11/2015), the test loads were selected to reflect the specific use of the weighing device or to accommodate specific calibration conditions.

As Found	Temperature	Humidity
	Start: 22.5 °C End: 21.4 °C	Start: 56.1 % End: 63.2 %

As Found Calibration Date:

As Left Calibration Date:

Issue Date:

Calibrator:

Approved Signatory:

Signature

Signature

☒ Kassakorn Tassanachaisakul
☐ Santi Jitinyom
☐ Surachet Sukkate

Remarks

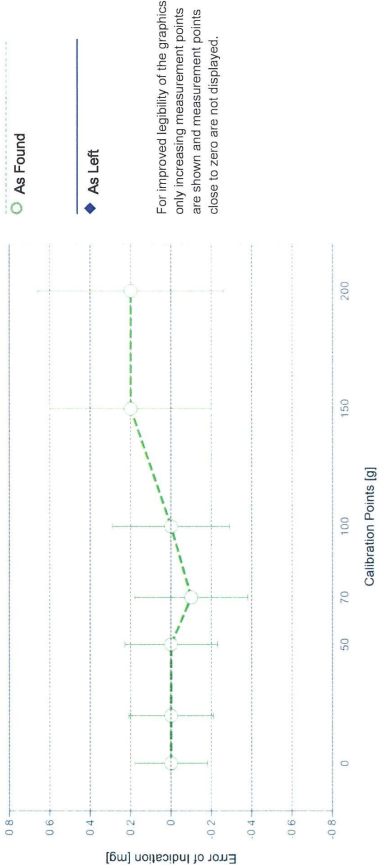
Equipment condition: Good
Next calibration according to customer's procedure
Calibration data not decide by calibration laboratory
Test weight by Filter pan : 1 g = 0.9999 g, 3 g = 3.0000 g, 5 g = 5.0000 g

End of Accredited Section

The information below and any attachments to this calibration certificate are not part of the accredited calibration.

Error of Indication

As Found				
	Reference Value	Indication	Error of Indication	Expanded Uncertainty
1	0.0000 g	0.0000 g	0.0000 g	0.18 mg
2	0.1000 g	0.1000 g	0.0000 g	0.19 mg
3	1.0000 g	0.9999 g	-0.0001 g	0.19 mg
4	5.0000 g	5.0000 g	0.0000 g	0.19 mg
5	10.0000 g	9.9999 g	-0.0001 g	0.20 mg
6	20.0000 g	20.0000 g	0.0000 g	0.21 mg
7	50.0000 g	50.0000 g	0.0000 g	0.23 mg
8	70.0001 g	70.0000 g	-0.0001 g	0.28 mg
9	100.0000 g	100.0000 g	0.0000 g	0.29 mg
10	150.0000 g	150.0002 g	0.0002 g	0.40 mg
11	200.0001 g	200.0003 g	0.0002 g	0.46 mg



The uncertainty stated is the expanded uncertainty at calibration obtained by multiplying the standard combined uncertainty by the coverage factor k – which can be larger than 2 according to EURAMET cg-18. The value of the measurand lies within the assigned range of values with a probability of approximately 95%.

The user is responsible for maintaining environmental conditions and the settings of the weighing instrument when it was calibrated.

Test Equipment

All weights used for metrological testing are traceable to national or international standards. The weights were calibrated and certified by an accredited calibration laboratory.

Weight Set 1: OIML E2

Weight Set No.:	WS80	Date of Issue:	23-Feb-2022
Certificate Number:	C208581631	Calibration Due Date:	14-Aug-2023

Thermo Hygrometer

Equipment No.:	IN161	Date of Issue:	14-Jun-2021
Certificate Number:	21H1220	Calibration Due Date:	01-Jun-2022

Measurement Uncertainty of the Weighing Instrument in Use

Stated is the expanded uncertainty with k=2 in use. The formula shall be used for the estimation of the uncertainty under consideration of the errors of indication. The value R represents the net load indication in the unit of measure of the device.

Temperature coefficient for the evaluation of the measurement uncertainty in use: 3.0 · 10⁻⁶ / K

Temperature range on site for the evaluation of the measurement uncertainty in use: 3 K

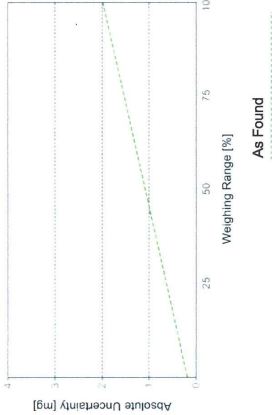
Linearization of Uncertainty Equation

Range			As Found	As Left
	d	Max		
1	0.0001 g	220 g	$U_1 = 0.19 \text{ mg} + 0.00817 \text{ mg/g} \cdot R$	N/A

To optimize the stability of the linearization, besides of the zero load only increasing measurement points with a test load of 5% of the measurement range or larger are taken for the calculation of the linear equation.

Absolute and Relative Measurement Uncertainty in Use for Various Net Indications (Examples)

Net Indication	As Found		As Left	
0.0220 g	0.19 mg	0.86%	N/A	N/A
0.2200 g	0.19 mg	0.087%	N/A	N/A
2.2000 g	0.21 mg	0.0095%	N/A	N/A
22.0000 g	0.37 mg	0.0017%	N/A	N/A
220.0000 g	2.0 mg	0.00090%	N/A	N/A



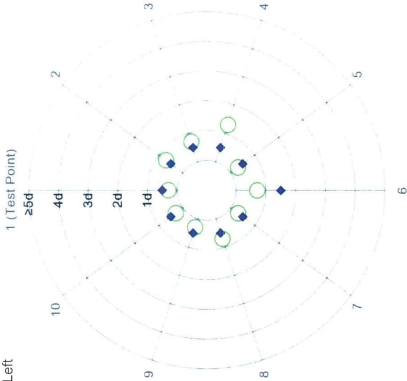
Measurement Results

Repeatability

Test Load: 100 g

	As Found	As Left
1	100.0005 g	99.9999 g
2	100.0004 g	100.0000 g
3	100.0004 g	99.9999 g
4	100.0006 g	100.0000 g
5	100.0005 g	99.9999 g
6	100.0004 g	99.9998 g
7	100.0005 g	100.0000 g
8	100.0004 g	100.0000 g
9	100.0005 g	100.0000 g
10	100.0005 g	100.0000 g

Standard Deviation	0.00007 g	0.00007 g
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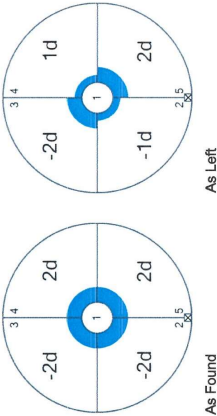
The "g" in the graph represents the readability of the range/interval in which the test was performed.
The results of this graph are based upon the absolute values of the differences from the mean value.

Eccentricity

Test Load: 100 g

Position	As Found	As Left
1	100.0005 g	100.0000 g
2	100.0003 g	99.9999 g
3	100.0003 g	99.9998 g
4	100.0007 g	100.0001 g
5	100.0007 g	100.0002 g

Maximum Deviation	0.0002 g	0.0002 g
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The "g" in the graph represents the readability of the range/interval in which the test was performed.



Mettler-Toledo (Thailand) Ltd.
846/4 - 846/5 Lasalle Rd., Bangna Tai Sub-District
Bangna District, Bangkok 10260
+66 2723 0382
MT-TH.ServiceSupport@mt.com

Accuracy Calibration Certificate

Customer

Company:	United Analyst and Engineering Consultant Co., Ltd.		
Address:	3 Soi Udom Suk 41, Sukhumvit Rd., Bang Chak		
City:	Phra Khanong	Contact:	Swit Chotnok
Zip / Postal:	10260		
State / Province:	Bangkok		
Order Number:	 * 0 3 3 4 2 3 9 0 6 *		

Weighing Device

Manufacturer:	Mettler Toledo	Instrument Type:	Weighing Instrument
Model:	AB204-S/FACT	Asset Number:	UAE-AIR.016/2555
Serial No.:	B108115858	Terminal Model:	N/A
Building:	N/A	Terminal Serial No.:	N/A
Floor:	2	Terminal Asset No.:	N/A
Room:	Balance Room 2 (206)		

Range	Max. Capacity	Readability (d)
1	220 g	0.0001 g

Procedure

Calibration Guideline:
METTLER TOLEDO Work Instruction:

EURAMET cg-18 v. 4.0 (11/2015)
CP/W002/20

This calibration certificate contains measurements for As Found and As Left calibrations.

The sensitivity/span of the weighing instrument was adjusted before As Found and As Left calibrations with a built-in weight.

In accordance with EURAMET cg-18 (11/2015), the test loads were selected to reflect the specific use of the weighing device or to accommodate specific calibration conditions.

	Temperature	Humidity
As Found	Start: 22.6 °C End: 22.1 °C	Start: 56.0 % End: 51.9 %
As Left	Start: 22.3 °C End: 22.4 °C	Start: 46.2 % End: 55.8 %

As Found Calibration Date:

07-Apr-2022

Calibrator:



As Left Calibration Date:

07-Apr-2022

Issue Date:

08-Apr-2022

Approved Signatory:



☒ Kassakorn Tassanachaisakul
☐ Santi Jitriyom
☐ Surachet Sukkate

Test Equipment

All weights used for metrological testing are traceable to national or international standards. The weights were calibrated and certified by an accredited calibration laboratory.

Weight Set 1: OIML E2

Weight Set No.:	WS80	Date of Issue:	23-Feb-2022
Certificate Number:	C208581631	Calibration Due Date:	14-Aug-2023

Thermo Hygrometer

Equipment No.:	IN161	Date of Issue:	14-Jun-2021
Certificate Number:	21H1220	Calibration Due Date:	01-Jun-2022

Remarks

FACT adjustment functionality activated

Value of the built-in weight adjusted

Equipment condition: Good

Next calibration according to customer's procedure

Calibration data not decide by calibration laboratory

Test weight by Filter pan : 1 g = 1.0000 g, 3 g = 3.0000 g, 5 g = 5.0000 g

End of Accredited Section

The information below and any attachments to this calibration certificate are not part of the accredited calibration.

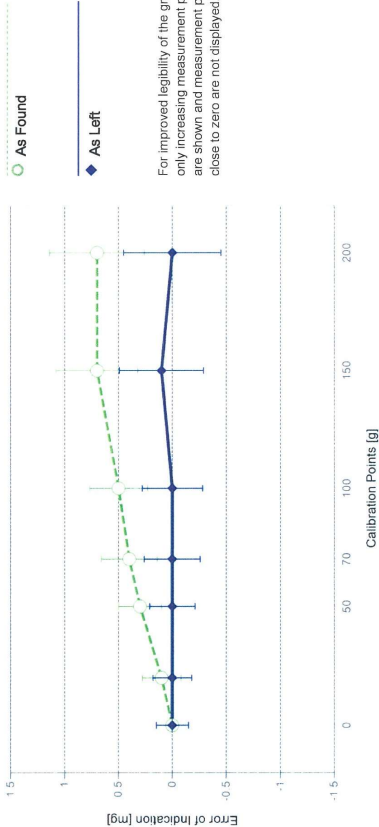
Error of Indication

As Found

	Reference Value	Indication	Error of Indication	Expanded Uncertainty	k
1	0.0000 g	0.0000 g	0.0000 g	0.15 mg	2
2	0.1000 g	0.1001 g	0.0001 g	0.16 mg	2
3	1.0000 g	0.9999 g	-0.0001 g	0.16 mg	2
4	5.0000 g	5.0000 g	0.0000 g	0.16 mg	2
5	10.0000 g	10.0001 g	0.0001 g	0.17 mg	2
6	20.0000 g	20.0001 g	0.0001 g	0.18 mg	2
7	50.0000 g	50.0003 g	0.0003 g	0.20 mg	2
8	70.0001 g	70.0005 g	0.0004 g	0.26 mg	2
9	100.0000 g	100.0005 g	0.0005 g	0.27 mg	2
10	150.0000 g	150.0007 g	0.0007 g	0.38 mg	2
11	200.0001 g	200.0008 g	0.0007 g	0.44 mg	2

As Left

	Reference Value	Indication	Error of Indication	Expanded Uncertainty	k
1	0.0000 g	0.0000 g	0.0000 g	0.15 mg	2
2	0.1000 g	0.1000 g	0.0000 g	0.16 mg	2
3	1.0000 g	0.9999 g	-0.0001 g	0.17 mg	2
4	5.0000 g	5.0000 g	0.0000 g	0.17 mg	2
5	10.0000 g	10.0000 g	0.0000 g	0.17 mg	2
6	20.0000 g	20.0000 g	0.0000 g	0.18 mg	2
7	50.0000 g	50.0000 g	0.0000 g	0.21 mg	2
8	70.0001 g	70.0001 g	0.0000 g	0.26 mg	2
9	100.0000 g	100.0000 g	0.0000 g	0.28 mg	2
10	150.0000 g	150.0001 g	0.0001 g	0.39 mg	2
11	200.0001 g	200.0001 g	0.0000 g	0.45 mg	2



The uncertainty stated is the expanded uncertainty at calibration obtained by multiplying the standard combined uncertainty by the coverage factor k – which can be larger than 2 according to EURAMET cg-18. The value of the measurand lies within the assigned range of values with a probability of approximately 95%.

The user is responsible for maintaining environmental conditions and the settings of the weighing instrument when it was calibrated.

Measurement Uncertainty of the Weighing Instrument in Use

Stated is the expanded uncertainty with $k=2$ in use. The formula shall be used for the estimation of the uncertainty under consideration of the errors of indication. The value R represents the net load indication in the unit of measure of the device.

Temperature coefficient for the evaluation of the measurement uncertainty in use: 2.5 · 10⁻⁴ / K

Temperature range on site for the evaluation of the measurement uncertainty in use: 3 K

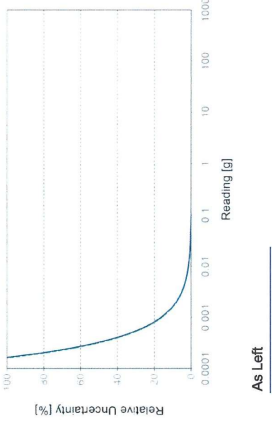
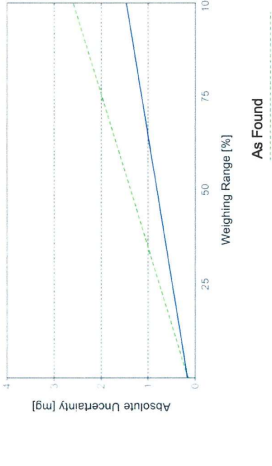
Linearization of Uncertainty Equation

Range		As Found	As Left
d	Max		
1	0.0001 g	220 g	$U_1 = 0.16 \text{ mg} + 0.0111 \text{ mg/g} \cdot R$ $U_1 = 0.16 \text{ mg} + 0.00592 \text{ mg/g} \cdot R$

To optimize the stability of the linearization, besides of the zero load only increasing measurement points with a test load of 5% of the measurement range or larger are taken for the calculation of the linear equation.

Absolute and Relative Measurement Uncertainty in Use for Various Net Indications (Examples)

Net Indication	As Found		As Left	
0.0220 g	0.16 mg	0.73%	0.16 mg	0.73%
0.2200 g	0.16 mg	0.074%	0.16 mg	0.073%
2.2000 g	0.18 mg	0.0084%	0.17 mg	0.0079%
22.0000 g	0.40 mg	0.0018%	0.29 mg	0.0013%
220.0000 g	2.6 mg	0.0012%	1.5 mg	0.00066%



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)	Andersen Instruments, Inc	G25A 11MX	Tisch Environmental, Inc.	28062022	28 Jun 21	27 Jun 23	-
2	U-Tube Manometer	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM ₁₀)	Dwyer	1221-36-W/M -	Technology Promotion Association (Thailand-Japan)	22P800	12 Mar 22	11 Mar 23	-
3	Aneroid Barometer	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM ₁₀)	Barigo, Germany	-	Technology Promotion Association (Thailand-Japan)	21P2502	21 Jul 21	20 Jul 22	-
4	Dial Thermo-Hygrometer	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM ₁₀)	Barigo, Germany	-	Technology Promotion Association (Thailand-Japan)	22H770	5 Apr 22	4 Apr 23	-
5	Wind Speed/Wind Direction	WS/WD	Scarlet Tech Ltd.	WL-21 2111DT0004	Scarlet Tech Ltd.	22022022	22 Feb 22	21 Feb 23	-
6	Wind Speed/Wind Direction	WS/WD	Scarlet Tech Ltd.	WL-21 2111DT0041	Scarlet Tech Ltd.	25032022	25 Mar 22	24 Mar 23	-
7	Wind Speed/Wind Direction	WS/WD	Scarlet Tech Ltd.	WL-21 2111DT0052	Scarlet Tech Ltd.	25032022	25 Mar 22	24 Mar 23	-
8	Wind Speed/Wind Direction	WS/WD	Scarlet Tech Ltd.	WL-21 2111DT0058	Scarlet Tech Ltd.	25032022	25 Mar 22	24 Mar 23	-
9	Sound Level Calibrator (Acoustic Calibrator)	Calibrate Sound Level Meter	Svantek	SV36 107224	Innovative Instrument Co.,Ltd.	21-ACT-326	24 Aug 21	23 Aug 22	-
10	Sound Level Meter	L _{Aeq} 24 hr, L _{Amax} , L _{Ain} , L _{A90}	Larson Davis	LxT2 0006614	Innovative Instrument Co.,Ltd.	22-ACT-104	11 Feb 22	10 Feb 23	-
11	Sound Level Meter	L _{Aeq} 24 hr, L _{Amax} , L _{Ain} , L _{A90}	Larson Davis	LxT2 0006615	Innovative Instrument Co.,Ltd.	22-ACT-102	11 Feb 22	10 Feb 23	-
12	Sound Level Meter	L _{Aeq} 24 hr, L _{Amax} , L _{Ain} , L _{A90}	Larson Davis	LxT2 0006616	Innovative Instrument Co.,Ltd.	22-ACT-113	15 Feb 22	14 Feb 23	-

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									
13	Sound Level Meter	L _{Aeq} 24 hr, L _{Amax} , L _{Ain} , L _{A90}	Larson Davis	LxT2 0006617	Innovative Instrument Co.,Ltd.	22-ACT-100	11 Feb 22	10 Feb 23	-



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
53/44 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG, BANGKOK 10250
TEL. 0-2717-3000-24 FAX. 0-2719-9484

Certificate of Calibration

Certificate No.: 22P800
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: 03 March 2022
Calibration Date: 12 March 2022
Reference: 2203-013/WSC
Ambient Temperature: (23 ± 2) °C
Relative Humidity: (50 ± 15) %
Atmospheric Pressure: 1010 mbar

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, Bangkok,
Phraekhanong, Bangkok 10260

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	Model	Serial No.	Certificate No.	Due Date
1) Pressure Calibrator	PC106P	1189	MP-0110-21	09 Aug 2022

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

3. Scale and conversion factor is 1 kPa = 4.0146293 inH₂O

4. This instrument was used clean air 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 at:-

-National Institute of Metrology Thailand (NIMT)

Calibrated by: Suwit Aussanee
Issue Date: 14 March 2022

Approved Signatory: Attapol P.
☐ Phalinee Prabpaipal
☐ Sura Suwanasri
☒ Attapol Panurach

เอกสารไม่ควบคุม

B 0282413



RECALIBRATION
DUE DATE:
June 28, 2022

Certificate of Calibration

Calibration Certification Information				
Cal. Date:	June 28, 2021	Rootsmeier S/N:	438320	Ta: 297 °K
Operator:	Jim Tisch			Pa: 753.6 mm Hg
Calibration Model #:	G25A	Calibrator S/N:	11MX	

Run	Vol. Init (m3)	Vol. Final (m3)	ΔVol. (m3)	ΔTime (min)	ΔP (mm Hg)	ΔH (in H ₂ O)
1	1	2	1	1.3910	3.3	2.00
2	3	4	1	0.9890	6.4	4.00
3	5	6	1	0.8850	8.0	5.00
4	7	8	1	0.8430	9.0	5.50
5	9	10	1	0.6970	12.9	8.00

Data Tabulation

Vstd (m3)	Qstd (x-axis)	$\sqrt{\Delta H \left(\frac{Pa}{Pstd} \right) \left(\frac{Tstd}{Ta} \right)}$ (y-axis)	Va	Qa (x-axis)	$\sqrt{\Delta H \left(\frac{Ta}{Pa} \right)}$ (y-axis)
0.9906	0.7121	1.4106	0.9956	0.7158	0.8878
0.9865	0.9975	1.9949	0.9915	1.0025	1.2555
0.9844	1.1123	2.2304	0.9894	1.1179	1.4037
0.9831	1.1661	2.3393	0.9881	1.1721	1.4723
0.9779	1.4030	2.8213	0.9829	1.4102	1.7756
QSTD	m= 2.04215 b= -0.04258 r= 1.00000	QA	m= 1.27876 b= -0.02680 r= 1.00000		

Calculations

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

Standard Conditions

Tstd:	298.15 °K
Pstd:	760 mm Hg
Key	
ΔH:	calibrator manometer reading (in H ₂ O)
ΔP:	rootsmeier manometer reading (mm Hg)
Ta:	actual absolute temperature (°K)
Pa:	actual barometric pressure (mm Hg)
b:	intercept
m:	slope

RECALIBRATION

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

Tisch Environmental, Inc.
145 South Miami Avenue
Village of Cleves, OH 45002

www.tisch-env.com

TOLL FREE: (877)263-7610

FAX: (513)467-9009

เอกสารไม่ควบคุม



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



Certificate of Calibration

Certificate No. : 21P2502
Page : 1 of 2

Equipment : Aneroid Barometer
Manufacturer : Barigo
Model : -
Serial No. : -
ID No. : UAE.ANV.151/2550
Condition As-Received: Used Item
Received Date: 20 July 2021
Calibration Date: 21 July 2021

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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.

Reference: 2107-0570WSC
Ambient Temperature: (23 ± 2) °C
Relative Humidity: (50 ± 15) %
Atmospheric Pressure: 1009 mbar

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-0053-21	08 Apr 2022

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 instrument was used clean air as pressure media.

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

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

-National Institute of Metrology Thailand (NIMT)

Calibrated by : Suwit Aussarree
Issue Date : 22 July 2021

Approved Signatory : Attapol P.

[] Phalinee Prabpaipal
[] Sura Suwannasri
[x] Attapol Panurach

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Cert.No.: 22P800
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)	UUC Indication		Error (inH ₂ O)
	High-port side (inH ₂ O)	Low-port side (inH ₂ O)	
0.00	0.00	0.00	0.00
2.00	1.00	-1.00	0.00
4.00	2.00	-2.00	0.00
6.00	3.00	-3.00	0.00
8.00	4.00	-4.00	0.00
10.00	5.00	-5.02	0.02
12.00	6.00	-6.02	0.02
14.00	7.00	-7.04	0.04
16.00	8.00	-8.04	0.04
18.00	9.00	-9.04	0.04
20.00	10.00	-10.04	0.04
22.00	11.00	-11.02	0.02
24.00	12.00	-12.02	0.02
26.00	13.00	-13.02	0.02
28.00	14.00	-14.04	0.04
30.00	15.00	-15.04	0.04
32.00	16.00	-16.04	0.04
34.00	16.98	-17.06	0.04
35.80	17.98	-18.00	0.18

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 %.

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



NSC-TS1-TS17025
CALIBRATION 0008

Certificate of Calibration

Certificate No. : 22H770
Page : 1 of 2

Equipment : Dial Thermo-Hygrometer
Manufacturer: Barigo
Model : -
Serial No.: -
ID No.: UAE.ANV.003/2545
Condition As-Received: Used Item
Received Date: 30 March 2022
Calibration Date: 01 April 2022
Reference: to 05 April 2022
Ambient Temperature: 2203-1124WSC
Relative Humidity: (25 ± 3) °C
(50 ± 20) %

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Corporate Services 3: Equipment Calibration and Testing Services.

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

81 Soi Udomsuk 41, Sukhumvit Road, Bangkok,
Phrakhanong, 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) Standard Chilled Mirror Hygrometer Sensor	Dew Prime II	31863	19714	17 Sep 2022
2) Standard Humidity/Temperature Meter	400	10203027	TH-0063-21	01 Jul 2022

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 at:-

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

Calibrated by : Somchai Dumwor
Issue Date : 08 April 2022

Approved Signatory :

☒ Chakrit Waewanjua
☐ Pornthippa Tameyakul
☐ Viporn Tantiyawutti



Cert.No.: 21P2502
Page: 2 of 2

Result of calibration:- Without adjustment
Function:- Absolute Pressure Measurement
Scale Interval: 1 hPa(The Fifth Estimate)

Increasing Pressure	Applied Pressure (hPa)	959.18	970.39	980.57	990.77	1000.79	1010.71	1020.54	1030.39
UUC* Indication (hPa)	960.0	970.0	980.0	990.0	1000.0	1010.0	1020.0	1030.0	1030.0
Error (hPa)	0.82	-0.39	-0.57	-0.77	-0.79	-0.71	-0.54	-0.39	-0.39

Decreasing Pressure	Applied Pressure (hPa)	1030.46	1020.42	1010.54	1000.67	990.64	980.74	970.54	959.39
UUC* Indication (hPa)	1030.0	1020.0	1010.0	1000.0	990.0	980.0	970.0	960.0	960.0
Error (hPa)	-0.46	-0.42	-0.54	-0.67	-0.64	-0.74	-0.54	0.61	0.61

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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SCARLET | TECH

Certificate of Calibration

WL-21 Wireless Anemometer

Scarlet Tech Ltd. hereby certifies that the WL-21 wireless anemometer listed below was thoroughly calibrated, tested and inspected following the standard calibration procedure (st-wl-21) and is within manufacturer's specification at the time when the calibration is done.

Client: Envir Service Co., Ltd.

Serial No.: 2111DT0004

Calibration Date: 2022/2/22

Calibration Expiry Date: 2023/2/21

The Result of Calibration

Velocity Measured Value (m/s)	Actual Value (m/s)	Deviation	Tolerance	Result
1.0	0.9	0.1	0.9 - 1.1	Pass
2.0	2	0	1.8 - 2.2	Pass
5.0	4.8	0.2	4.7 - 5.3	Pass
7.0	7.1	0.1	6.0 - 8.0	Pass
10.0	9.7	0.3	9.5 - 10.5	Pass
20.0	20	0	19.0 - 21.0	Pass

Wind Direction Measured Value	Actual Value	Deviation	Tolerance	Result
45°	48	3	42 - 48	Pass
135°	134	1	132 - 138	Pass
225°	227	2	222 - 228	Pass
315°	315	0	312 - 318	Pass
0°	1	1	357 - 3	Pass

Inspection Room Temp	Actual Value	Deviation	Tolerance	Result
22.5°C	22.1	0.4	21.5-23.5	Pass

Atmospheric Pressure Inspection	Actual Value	Deviation	Tolerance	Result
998	1000	2	994-1002	Pass

Environment conditions :

Air temperature: 24 °C
Relative humidity: 58 %
Static pressure: 118.3 kPa

Performed by:

Jim Lin

Certified by
Head of Engineering department

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Cert. No.: 22H770
Page.: 2 of 2

Result of Calibration:-
Function: Without Adjustment

Reference Temperature (°C)	Standard Humidity (%R.H.)	UUC* Reading (%R.H.)	Error (%R.H.)	Uncertainty of Measurement (±%R.H.)
25.0	40.1	56.0	15.9	1.5
25.0	60.0	60.5	0.5	1.7
25.0	80.0	63.0	-17.0	1.7

Result of Calibration:-
Function: Without Adjustment

Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of Measurement (±°C)
20.02	20.0	-0.02	0.72
29.98	30.0	0.02	0.72
35.02	35.5	0.48	0.72
40.03	41.0	0.97	0.72

UUC* : Unit Under Calibration

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

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Jim Lin

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SCARLET | TECH

Certificate of Calibration

WL-21 Wireless Anemometer

Scarlet Tech Ltd. hereby certifies that the WL-21 wireless anemometer listed below was thoroughly calibrated, tested and inspected following the standard calibration procedure (st-wl-21) and is within manufacturer's specification at the time when the calibration is done.

Client: Envir Service Co., Ltd.

Serial No.: 2111DT0052

Calibration Date: 2022/3/25

Calibration Expiry Date: 2023/3/24

The Result of Calibration

Velocity	Measured Value (m/s)	Actual Value (m/s)	Deviation	Tolerance	Result
1.0	0.9	0.9	0.1	0.9 - 1.1	Pass
2.0	1.9	1.9	0.1	1.8 - 2.2	Pass
5.0	4.8	4.8	0.2	4.7 - 5.3	Pass
7.0	7.0	7.0	0	6.0 - 8.0	Pass
10.0	9.9	9.9	0.1	9.5 - 10.5	Pass
20.0	20.0	20.0	0	19.0 - 21.0	Pass

Wind Direction	Measured Value	Actual Value	Deviation	Tolerance	Result
45°	45	45	0	42 - 48	Pass
135°	137	137	2	132 - 138	Pass
225°	223	223	2	222 - 228	Pass
315°	316	316	2	312 - 318	Pass
0°	1	1	1	357 - 3	Pass

Inspection Room Temp	Actual Value	Deviation	Tolerance	Result
24.2°C	24.0	0.2	23.2-25.2	Pass

Atmospheric Pressure Inspection	Actual Value	Deviation	Tolerance	Result
998	1000	2	994-1002	Pass

Environment conditions :

Air temperature: 22 °C
Relative humidity: 62 %
Static pressure: 102.2 kPa

Performed by:

Jim Lin

Certified by
Head of Engineering department

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Certificate of Calibration

WL-21 Wireless Anemometer

Scarlet Tech Ltd. hereby certifies that the WL-21 wireless anemometer listed below was thoroughly calibrated, tested and inspected following the standard calibration procedure (st-wl-21) and is within manufacturer's specification at the time when the calibration is done.

Client: Envir Service Co., Ltd.

Serial No.: 2111DT0041

Calibration Date: 2022/3/25

Calibration Expiry Date: 2023/3/24

The Result of Calibration

Velocity	Measured Value (m/s)	Actual Value (m/s)	Deviation	Tolerance	Result
1.0	1	1	0	0.9 - 1.1	Pass
2.0	1.8	1.8	0.2	1.8 - 2.2	Pass
5.0	5	5	0	4.7 - 5.3	Pass
7.0	7.2	7.2	0.2	6.0 - 8.0	Pass
10.0	9.9	9.9	0.1	9.5 - 10.5	Pass
20.0	20	20	0	19.0 - 21.0	Pass

Wind Direction	Measured Value	Actual Value	Deviation	Tolerance	Result
45°	43	43	2	42 - 48	Pass
135°	135	135	0	132 - 138	Pass
225°	227	227	2	222 - 228	Pass
315°	318	318	3	312 - 318	Pass
0°	0	0	0	357 - 3	Pass

Inspection Room Temp	Actual Value	Deviation	Tolerance	Result
24.2°C	24.8	0.6	23.2-25.2	Pass

Atmospheric Pressure Inspection	Actual Value	Deviation	Tolerance	Result
998	1001	3	994-1002	Pass

Environment conditions :

Air temperature: 22 °C
Relative humidity: 62 %
Static pressure: 102.2 kPa

Performed by:

Jim Lin

Certified by
Head of Engineering department

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Certificate of Calibration

Customer

Name : UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD. **Certificate No** : 21-ACT-326

Address : 81 Soi Udomsuk 41, Sukhumvit Road, Bangchak, **Request No** : Req-2021-0994

Prakanong, Bangkok 10260

Unit Under Calibration Details

Measurement item : Acoustic Calibrator **Class** : 1

Manufacturer : SVANTEK **Range** : 94 , 114 dB / 1000 Hz

Model : SV36 **Instrumnet Status** : Used

Serial Number : 107224

ID : UAE.EFM.171/2564

Calibration Environment and Details

Temperature : (23 ±2 °C)

Humidity : (50 ± 20 %RH)

Barometric Pressure : (1013 ±10.0 hPa)

Received Date : 22 July 2021

Calibration Date : 24 August 2021

Location of Calibration : LAB 1 Acoustic

Calibration Procedure : In-house method CP-ACT-02 based on IEC 60942:2017 Electroacoustics - Sound calibrators

Reference Standard	Model	Serial Number	Traceable	Due Calibration
Sound Calibrator	SV 35A	58079	EEL	14 May 2022
THD Multimeter	2015	1047765	NIMT	21 January 2022

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 %.

Calibrated By : Mr. Noppadon Luangart **Approved By :** Mr. Pacit Mathavorn

Service Calibration Engineer Calibration Engineer Supervisor

Issue Date : 24 August 2021



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Certificate of Calibration

WL-21 Wireless Anemometer

Scarlet Tech Ltd. hereby certifies that the WL-21 wireless anemometer listed below was thoroughly calibrated, tested and inspected following the standard calibration procedure (st-wl-21) and is within manufacturer's specification at the time when the calibration is done.

Client: Envir Service Co., Ltd.

Serial No.: 2111DT0058

Calibration Date: 2022/3/25

Calibration Expiry Date: 2023/3/24

The Result of Calibration

Velocity	Measured Value (m/s)	Actual Value (m/s)	Deviation	Tolerance	Result
1.0		1.0	0.0	0.9 – 1.1	Pass
2.0		1.9	0.1	1.8 – 2.2	Pass
5.0		5.0	0.0	4.7 – 5.3	Pass
7.0		7.2	0.2	6.0 – 8.0	Pass
10.0		9.8	0.2	9.5 – 10.5	Pass
20.0		20.0	0	19.0 – 21.0	Pass

Wind Direction	Measured Value	Actual Value	Deviation	Tolerance	Result
45°		47	2	42 – 48	Pass
135°		135	0	132 – 138	Pass
225°		224	1	222 – 228	Pass
315°		315	0	312 – 318	Pass
0°		359	1	357 – 3	Pass

Inspection Room Temp	Actual Value	Deviation	Tolerance	Result
24.2°C	24.5	0.3	23.2-25.2	Pass

Atmospheric Pressure Inspection	Actual Value	Deviation	Tolerance	Result
998	1000	2	994-1002	Pass

Environment conditions :

Air temperature: 22 °C
Relative humidity: 62 %
Static pressure: 102.2 kPa

Performed by:

Jim Lin

Certified by
Head of Engineering department

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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 : 22-ACT-104
Request No : Req-2022-0232

Unit Under Calibration Details

Measurement item : Microphone Class : 2

Manufacturer : LARSON DAVIS
Model : LxT2
Serial Number : 0006614
ID : UAE.EFM.045/2564

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 : 31 January 2022
Calibrated Date : 11 February 2022
Calibration Procedure : In-house method CP-SLM-01 based on IEC 61672-3 : 2013 Electroacoustics - Sound level meters - Part 3: Periodic tests
Location of Calibration : Lab Acoustic

Reference Standard

Instrument	Brand	Model	SN.	Due calibration	Traceability
Standard Microphone	GRAS	40AN	188273	15 September 2022	GRAS
Multifrequency Calibrator	Quest	Quest-cal	EFA000234	14 June 2022	TSI
Audio Generator	Svantek	Svan401	131	18 October 2022	WK Electric

Note

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

Calibrated By : 

Mr. Noppadon Luangart
Calibration Officer

Approved By : 

Mr. Pacit Mathavorn
Calibration Engineer Supervisor

Issue Date : 11 February 2022

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-SLM-01 Rev.0 Issue date 01/07/15

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Certificate No : 21-ACT-326
Request No : Req-2021-0994

Calibration Results : Without Adjustment

Sound pressure level	Calibration Range (dB)	Without Adjustment (dB)		Adjustment (dB)		Uncertainty (± dB)	Acceptance limit Class 1 (± dB)
		Measured	Error	Measured	Error		
	94 dB / 1000 Hz	94.08	0.08	-	-	0.11	0.25
	114 dB / 1000 Hz	114.13	0.13	-	-	0.11	0.25

Frequency of Sound pressure level

Calibration Range (Hz)	Without Adjustment		Adjustment		Uncertainty (± %)	Acceptance limit Class 1 (± %)
	Measured (Hz)	Error (%)	Measured (Hz)	Error (%)		
94 dB / 1000 Hz	999.96	0.004	-	-	0.10	0.70
114 dB / 1000 Hz	999.98	0.002	-	-	0.10	0.70

Total Harmonic Distortion plus Noise of Sound pressure level (THD+N %)

Calibration Range (Hz)	Without Adjustment		Adjustment		Uncertainty (± %)	Acceptance limit Class 1 (± %)
	Measured (%)	Error (%)	Measured (%)	Error (%)		
94 dB / 1000 Hz	0.43	-	-	-	0.40	2.5
114 dB / 1000 Hz	0.35	-	-	-	0.40	2.5

Note :

- Acceptance limit was IEC60942:2017 Class 1
- The calibration results exclude the calibrator pressure correction
- The calibration results exclude the microphone volume correction

End of Calibration

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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 Innovative Instrument Co., Ltd

Certificate No : 22-ACT-102

Request No : Req-2022-0233

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

UUC Setting		Deviation from various Frequency			UNCERTAINTY (± dB)	Acceptance Limit (± dB)
FAST / 37-139		Weighting Response curve				
STD Setting		A (dB)	C (dB)	Z (dB)		
63 Hz		-0.2	0.0	0.0	0.2	2.0
125 Hz		-0.1	0.0	0.0		1.5
250 Hz		-0.1	0.0	0.0		1.5
500 Hz		-0.1	0.0	0.0		1.5
1000 Hz		0.0	0.0	0.0		1.0
2000 Hz		0.0	0.0	0.0		2.0
4000 Hz		0.0	0.0	0.0		3.0
8000 Hz		0.0	0.0	0.0		5.0
16000 Hz		-0.1	-0.1	-0.1		+5, -INF.

6. Frequency and time weightings at 1kHz

UUC Setting	STD REF (dB)	Measured		UNCERTAINTY (± dB)	Acceptance Limit (± dB)
		UUC (dB)	ERR (dB)		
FAST / 37-139					
UUC Weighting					
A	114.00	114.0	0.0	0.2	0.2
C	114.00	114.0	0.0		0.2
Z	114.00	114.0	0.0		0.2

UUC Setting	STD REF (dB)	Measured		UNCERTAINTY (± dB)	Acceptance Limit (± dB)
		UUC (dB)	ERR (dB)		
37-139 / A					
UUC Time Response					
Fast	114.00	114.0	0.0		0.1
Slow	114.00	114.0	0.0	0.2	0.1
Leq	114.00	114.0	0.0		0.1

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-SLM-01 Rev.0 Issue date 01/07/15

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Certificate No : 22-ACT-102

Request No : Req-2022-0233

1. Indication at the calibration check frequency

UUC Setting	Nominal		Before Adjust		Adjust		UNCERTAINTY (± dB)	Acceptance Limit (± dB)
	FAST / A / 37-139	Level (dB)	UUC (dB)	ERR (dB)	UUC (dB)	ERR (dB)		
Calibrator Setting								
1000 Hz 114.00 dB		113.85	113.9	+0.05	113.9	0.05	0.20	0.3

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

2. Self-generated noise, Microphone installed

UUC Setting	Measured		UNCERTAINTY (± dB)
	FAST / 37-139		
	UUC Weighting		
A	27.8	0.10	

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

UUC Setting	Measured	UNCERTAINTY	
FAST / 37-139			
UUC Weighting			
A	27.7	0.10	
C	27.5	0.10	
Z	34.0	0.10	

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

UUC Setting	Deviation from various Frequency				UNCERTAINTY	Acceptance Limit
	Weighting Response curve					
	A	C	Z			
FAST / 37-139					(± dB)	
STD Setting						
125 Hz	-0.1	0.1	0.1		0.50	2.0
1000 Hz	0.0	0.0	0.0		0.60	1.0
4000 Hz	0.5	0.5	0.6		0.60	3.0
8000 Hz	0.3	0.3	0.4		0.70	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

FM-708-SLM-01 Rev.0 Issue date 01/07/15

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Certificate No : 22-ACT-102
Request No : Req-2022-0233

9. Level linearity including the level range control

UUC Setting	STD	Measured		UNCERTAINTY (± dB)	Acceptance	
		UUC (dB)	ERR (dB)		Limit (± dB)	
FAST / A	REF (dB)	43.2	42.9	-0.3	0.3	1.1
	UUC Range	114	114.0	0.0		1.1

10. Tone burst response

UUC Setting	STD	Toneburst (ms)	Anticipated Ref (dB)	Measured		UNCERTAINTY (± dB)	Acceptance Limit (± dB)
				UUC (dB)	ERR (dB)		
A / 37-139	Fast	200	135.0	135.0	0.0	0.3	1.0
		2	118.0	117.8	-0.2		+1.0, -2.5
		0.25	109.0	108.6	-0.4		+1.5, -5.0
Slow	200	200	128.6	128.5	-0.1		1.0
		2	109.0	108.9	-0.1		+1.0, -5.0
		200	129.0	129.0	0.0		1.0
SEL	2	200	109.0	109.0	0.0	-0.2	+1.0, -2.5
		0.25	100.0	99.8	-0.2		+1.5, -5.0

11. Peak C Sound level

UUC Setting	Anticipated REF (dB)	Measured		UNCERTAINTY (± dB)	Acceptance Limit (± dB)
		UUC (dB)	ERR (dB)		
FAST / C / 95-142	137.4	136.8	-0.60	0.2	3.0
STD Setting					2.0
Complete cycle					2.0
Positive half cycle	136.4	136.2	-0.20	-0.20	2.0
Negative half cycle	136.4	136.2	-0.20		2.0

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FM-708-SLM-01 Rev.0 Issue date 01/07/15

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Certificate No : 22-ACT-102
Request No : Req-2022-0233

7. Long Term Stability

UUC Setting	Measured UUC (dB)	UNCERTAINTY (± dB)	Acceptance Limit (± dB)
FAST / A / 37-139	114.0	0.1	0.3
STD Setting			
Initial			
Final	114.0	0.0	0.3
Deviated	0.0		

8. Level linearity on the reference level range

UUC Setting	Anticipated REF (dB)	Deviation		UNCERTAINTY (± dB)	Acceptance Limit (± dB)
		UUC (dB)	ERR (dB)		
FAST / A / 37-139	140	140.0	0.0	0.3	1.1
STD dB					1.1
140.00					1.1
139.00	139	139.0	0.0	0.3	1.1
134.00	134	134.0	0.0		1.1
129.00	129	129.0	0.0		1.1
124.00	124	124.0	0.0		1.1
119.00	119	119.0	0.0		1.1
114.00	114	114.0	0.0		1.1
109.00	109	109.0	0.0		1.1
104.00	104	104.0	0.0		1.1
99.00	99	99.0	0.0		1.1
94.00	94	93.9	-0.1		1.1
89.00	89	88.9	-0.1	0.3	1.1
84.00	84	83.9	-0.1		1.1
79.00	79	78.9	-0.1		1.1
74.00	74	73.9	-0.1		1.1
69.00	69	68.9	-0.1		1.1
64.00	64	63.9	-0.1		1.1
59.00	59	58.9	-0.1		1.1
54.00	54	53.9	-0.1		1.1
49.00	49	48.9	-0.1		1.1
44.00	44	44.0	0.0		1.1
39.00	39	39.2	0.2	0.3	1.1
38.00	38	38.3	0.3		1.1

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FM-708-SLM-01 Rev.0 Issue date 01/07/15

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Certificate of Calibration

Customer

Name : UNITED ANALYST AND ENGINEERING CONSULTANT CO.LTD.

Address : 81 Soi Udomsuak 41, Sukhumvit Road, Bangchak, Prakanong, Bangkok 10260

Certificate No : 22-ACT-113

Request No : Req-2022-0330

Unit Under Calibration Details

Measurement item : Sound Level Meter

Manufacturer : LARSON DAVIS

Model : LxT2

Serial Number : 0006616

ID : UAE.EFM.0472564

Resolution : 0.1 dB

Microphone Class : 2

Microphone Model : 375A04

Microphone S/N : 329551

Preamplifier Model : PRMLxT2C

Preamplifier S/N : 073798

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 : 14 February 2022

Calibrated Date : 15 February 2022

Calibration Procedure : In-house method CP-SLM-01 based on IEC 61672-3 : 2013 Electroacoustics - Sound level meters - Part 3: Periodic tests

Location of Calibration : Lab Acoustic

Reference Standard

Instrument	Brand	Model	SN.	Due calibration	Traceability
Standard Microphone	GRAS	40AN	188273	15 September 2022	GRAS
Multifrequency Calibrator	Quest	Quest-cal	EFA000234	14 June 2022	TSI
Audio Generator	Svantek	Svan401	131	18 October 2022	WK Electric

Note

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

Calibrated By : 
Mr. Noppadon Luangart
Calibration Officer

Approved By : 
Mr. Pacit Mahavorn
Calibration Engineer Supervisor

Issue Date : 15 February 2022

Certificate No : 22-ACT-102

Request No : Req-2022-0233

12. Overload indication

UUC Setting	Measured	UNCERTAINTY	Acceptance Limit
FAST / A / 37-139	UUC	(± dB)	(± dB)
STD Setting	(dB)		
Positive one-half cycle	141.7		
Negative one-half cycle	141.7		
Deviated	0.0	0.2	1.5

13. High Level Stability

UUC Setting	Measured	UNCERTAINTY	Acceptance Limit
FAST / A / 37-139	UUC	(± dB)	(± dB)
STD Setting	(dB)		
Initial	138.0		
Final	138.0		
Deviated	0.0	0.1	0.3

End of Certificate

Certificate of Calibration

Customer

Name	: UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.	Certificate No : 22-ACT-100
Address	: 81 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Prakanong, Bangkok 10260	Request No : Req-2022-0234

Unit Under Calibration Details

Measurement item :	: Sound Level Meter	Microphone Class : 2
Manufacturer	: LARSON DAVIS	Microphone Model : 375A04
Model	: LxT2	Microphone S/N : 328669
Serial Number	: 0006617	Preamplifier Model : PM1LxT2C
ID	: UAE.EFM.048/2564	Preamplifier S/N : 071532

Calibration Environment and Details

Temperature	: 23 °C ± 2 °C
Humidity	: 50 %RH ± 20 %RH
Barometric Pressure	: 1013 hPa ± 10 hPa
Received Date	: 31 January 2022
Calibrated Date	: 11 February 2022

Calibration Procedure : In-house method CP-SLM-01 based on IEC 61672-3 : 2013 Electroacoustics - Sound level meters - Part 3: Periodic tests


Location of Calibration : Lab Acoustic

Reference Standard

Instrument	Brand	Model	SN.	Due calibration	Traceability
Standard Microphone	GRAS	40AN	188273	15 September 2022	GRAS
Multifrequency Calibrator	Quest	Quest-cal	EFA000234	14 June 2022	TSI
Audio Generator	Svantek	Svan401	131	18 October 2022	WK Electric

Note

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

Calibrated By : 
Mr. Noppadon Luangart
Calibration Officer

Approved By : Mr. Pacit Mathavorn
Calibration Engineer Supervisor
Issue Date : 11 February 2022

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-SI M-01 Rev. 0 Issue date 01/07/19

เอกสารไม่ควบคุม

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01/07/19

เอกสารไม่ควบคุม

7
date 01/07/19

1. Indication at the calibration check frequency

UUC Setting	Nominal Level (dB)	Before Adjust		Adjust		UNCERTAINTY (± dB)	Acceptance Limit (± dB)
		UUC (dB)	ERR (dB)	UUC (dB)	ERR (dB)		
FAST / A / 37-139							
Calibrator Setting							
1000 Hz 114.00 dB	113.85	113.9	+0.05	113.9	0.05	0.20	0.3

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

2. Self-generated noise, Microphone installed

	Measured	UNCERTAINTY
UUC Setting		
FAST / 37-139		
UUC Weighting		
A	28.9	(\pm dB) 0.10

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

	UUC Setting	Measured	UNCERTAINTY (\pm dB)
	FAST / 37-139		
	UUC Weighting	(dB)	
	A	28.8	0.10
	C	28.4	0.10
	Z	34.3	0.10

4. Acoustic signal test of frequency weightings

UUC Setting	Deviation from various Frequency				UNCERTAINTY (\pm dB)	Acceptance Limit (\pm dB)
	Weighting Response curve					
	A (dB)	C (dB)	Z (dB)			
FAST / 37-139						
STD Setting						
125 Hz	0.0	0.1	0.0	0.50	2.0	
1000 Hz	0.0	0.0	0.0	0.60	1.0	
4000 Hz	0.6	0.6	0.6	0.60	3.0	
8000 Hz	0.5	0.5	0.6	0.70	5.0	

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FM-708-SLM-01 Rev.0 Issue date 01/07/19

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

UUC Setting		Deviation from various Frequency				UNCERTAINTY (± dB)	Acceptance Limit (± dB)
FAST / 37-139	STD Setting	A (dB)	C (dB)	Z (dB)			
	63 Hz	-0.2	0.0	0.0	0.2	2.0	
	125 Hz	-0.1	0.0	0.0		1.5	
	250 Hz	-0.1	0.0	0.0		1.5	
	500 Hz	-0.1	0.0	0.0		1.5	
	1000 Hz	0.0	0.0	0.0		1.0	
	2000 Hz	0.0	0.1	0.0		2.0	
	4000 Hz	0.0	0.0	0.0		3.0	
	8000 Hz	-0.1	0.0	0.0		5	
	16000 Hz	-0.1	-0.1	-0.1	+5, -INF.		

6. Frequency and time weightings at 1kHz

	UUC Setting		STD REF (dB)	Measured		UNCERTAINTY (\pm dB)	Acceptance Limit (\pm dB)
	FAST / 37-139	UUC Weighting		UUC (dB)	ERR (dB)		
	A		114.00	114.0	0.0	0.2	
	C		114.00	114.0	0.0	0.2	
	Z		114.00	114.0	0.0	0.2	

UUC Setting	STD REF (dB)	Measured		UNCERTAINTY (\pm dB)	Acceptance Limit (\pm dB)
		UUC (dB)	ERR (dB)		
UUC Time Response					
Fast	114.00	114.0	0.0		0.1
Slow	114.00	114.0	0.0	0.2	0.1
Leq	114.00	114.0	0.0		0.1

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EM-708-SI M-01 Rev 0 Issue Date 01/07/16

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Certificate No : 22-ACT-100

Request No : Req-2022-0234

9. Level linearity including the level range control

UUC Setting	STD REF (dB)	Measured		UNCERTAINTY (± dB)	Acceptance Limit (± dB)
		UUC (dB)	ERR (dB)		
37-139	43.9	43.6	-0.3	0.3	1.1
	114	114.0	0.0		1.1

10. Tone burst response

UUC Setting	STD Toneburst (ms)	Anticipated Ref (dB)	Measured		UNCERTAINTY (± dB)	Acceptance Limit (± dB)
			UUC (dB)	ERR (dB)		
Fast	200	135.0	134.9	-0.1	0.3	1.0
	2	118.0	117.6	-0.4		+1.0, -2.5
	0.25	109.0	108.7	-0.3		+1.5, -5.0
Slow	200	128.6	128.5	-0.1	0.3	1.0
	2	109.0	108.9	-0.1		+1.0, -5.0
SEL	200	129.0	129.0	0.0	0.3	1.0
	2	109.0	109.1	+0.1		+1.0, -2.5
	0.25	100.0	99.9	-0.1		+1.5, -5.0

11. Peak C Sound level

UUC Setting	Anticipated REF (dB)	Measured		UNCERTAINTY (± dB)	Acceptance Limit (± dB)
		UUC (dB)	ERR (dB)		
FAST / C / 95-142	137.4	136.8	-0.60	0.2	3.0
STD Setting					2.0
Complete cycle					2.0
Positive half cycle	136.4	136.2	-0.20	0.2	2.0
Negative half cycle	136.4	136.2	-0.20		2.0

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FM-708-SLM-01 Rev.0 Issue date 01/07/15

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Certificate No : 22-ACT-100

Request No : Req-2022-0234

7. Long Term Stability

UUC Setting	FAST / A / 37-139	Measured		UNCERTAINTY (± dB)	Acceptance Limit (± dB)
		UUC (dB)	ERR (dB)		
STD Setting	Initial	114.0			
	Final	114.0			
Deviated		0.0	0.1	0.3	

8. Level linearity on the reference level range

UUC Setting	FAST / A / 37-139	STD dB	Anticipated REF (dB)	Deviation		UNCERTAINTY (± dB)	Acceptance Limit (± dB)
				UUC (dB)	ERR (dB)		
				140.00	140.0	0.0	1.1
				139.00	139.0	0.0	1.1
				134.00	134.0	0.0	1.1
				129.00	129.0	0.0	1.1
				124.00	124.0	0.0	1.1
				119.00	119.0	0.0	1.1
				114.00	114.0	0.0	1.1
				109.00	109.0	0.0	1.1
				104.00	104.0	0.0	1.1
				99.00	99.0	0.0	1.1
				94.00	94.0	0.0	1.1
				89.00	89.0	0.0	1.1
				84.00	84.0	0.0	1.1
				79.00	79.0	0.0	1.1
				74.00	74.0	0.0	1.1
				69.00	69.0	0.0	1.1
				64.00	64.0	0.0	1.1
				59.00	59.0	0.0	1.1
				54.00	54.0	0.0	1.1
				49.00	49.0	0.0	1.1
				44.00	44.1	0.1	1.1
				39.00	39.4	0.4	1.1

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