

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)	22P801	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)	22P2722	22 Jul 22	21 Jul 23	-
4	Dial Thermo-Hygrometer	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM ₁₀)	Barigo, Germany	-	Technology Promotion Association (Thailand-Japan)	22H771	5 Apr 22	4 Apr 23	-
5	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Scientific	42i CM08130002	UAE Consultant Co.,Ltd.	07042022	7 Apr 22	6 Apr 23	-
6	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Environmental Instrument	42C 42C-67174-356	UAE Consultant Co.,Ltd.	19042022	19 Apr 22	18 Apr 23	-
7	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Environmental Instrument	42C 42C-76412-383	UAE Consultant Co.,Ltd.	07042022	7 Apr 22	6 Apr 23	-
8	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Environmental Instrument	42C 42C-70971-367	UAE Consultant Co.,Ltd.	19042022	19 Apr 22	18 Apr 23	-
9	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Environmental Instrument	42C 42C-58929-320	UAE Consultant Co.,Ltd.	07042022	7 Apr 22	6 Apr 23	-
10	Standard Gases (Mixture)	Nitrogen Dioxide	Airgas	EB0143262 2015PSIG	Airgas an Air Liquide company	E04NI99E15A01D3	21 Jun 21	21 Jun 24	-
11	Sulphur Dioxide Analyzer	Sulphur Dioxide	Thermo Scientific	43i 1201778111	UAE Consultant Co.,Ltd.	03042022	3 May 22	2 May 23	-
12	Sulphur Dioxide Analyzer	Sulphur Dioxide	Thermo Scientific	43i 1201778113	UAE Consultant Co.,Ltd.	03042022	3 May 22	2 May 23	-

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Ambient									
13	Sulphur Dioxide Analyzer	Sulphur Dioxide	Thermo Scientific	43i 1201778116	UAE Consultant Co.,Ltd.	22042022	22 Apr 22	21 Apr 23	-
14	Sulphur Dioxide Analyzer	Sulphur Dioxide	Thermo Scientific	43i 1182920014	UAE Consultant Co.,Ltd.	08042022	8 Apr 22	7 Apr 23	-
15	Sulphur Dioxide Analyzer	Sulphur Dioxide	Thermo Scientific	43i 1182920015	UAE Consultant Co.,Ltd.	22042022	22 Apr 22	21 Apr 23	-
16	Standard Gases (Mixture)	Sulphur Dioxide	Airgas	EB0143262 2015PSIG	Airgas an Air Liquide company	E04NI99E15A01D3	21 Jun 21	21 Jun 24	-
17	Wind Speed/Wind Direction	WS/AWD	Scarlet Tech Ltd.	WL-21 2111DT0004	Scarlet Tech Ltd.	22022022	22 Feb 22	21 Feb 23	-
18	Wind Speed/Wind Direction	WS/AWD	Scarlet Tech Ltd.	WL-21 2111DT0041	Scarlet Tech Ltd.	25032022	25 Mar 22	24 Mar 23	-
19	Wind Speed/Wind Direction	WS/AWD	Scarlet Tech Ltd.	WL-21 2111DT0052	Scarlet Tech Ltd.	25032022	25 Mar 22	24 Mar 23	-
20	Wind Speed/Wind Direction	WS/AWD	Scarlet Tech Ltd.	WL-21 2111DT0058	Scarlet Tech Ltd.	25032022	25 Mar 22	24 Mar 23	-
21	Wind Speed/Wind Direction	WS/AWD	Scarlet Tech Ltd.	WL-21 2111DT0065	Scarlet Tech Ltd.	25032022	25 Mar 22	24 Mar 23	-
22	Sound Level Calibrator (Acoustic Calibrator)	Calibrate Sound Level Meter	SvanteK	SV35A 73249	Innovative Instrument Co.,Ltd.	22-ACT-406	1 Jul 22	30 Jun 23	-
23	Sound Level Meter	$L_{Aeq} 24\text{ hr}$ $L_{Aeq} 1\text{ hr}$ $L_{Aeq} 5\text{ min}$ $L_{A,dn}$ L_{Amax} L_{A90}	Larson Davis	LxT2 0005394	Innovative Instrument Co.,Ltd.	22-ACT-034	21 Jan 22	20 Jan 23	-
24	Sound Level Meter	$L_{Aeq} 24\text{ hr}$ $L_{Aeq} 1\text{ hr}$ $L_{Aeq} 5\text{ min}$ $L_{A,dn}$ L_{Amax} L_{A90}	Larson Davis	LxT2 0005395	Innovative Instrument Co.,Ltd.	22-ACT-247	1 Apr 22	31 Mar 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									
25	Sound Level Meter	$L_{Aeq} 24\text{ hr}$ $L_{Aeq} 1\text{ hr}$ $L_{Aeq} 5\text{ min}$ $L_{A,dn}$ L_{Amax} L_{A90}	Larson Davis	LxT2 0005396	Innovative Instrument Co.,Ltd.	22-ACT-105	11 Feb 22	10 Feb 23	-

RECALIBRATION
DUE DATE:
June 28, 2022

Certificate of Calibration

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

Run	Vol. Init (m3)	Vol. Final (m3)	ΔVol. (m3)	ΔTime (min)	ΔP (mm Hg)	ΔH (in H2O)
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)	$\sqrt{\Delta H \left(\frac{P_a}{P_{std}} \right) \left(\frac{T_{std}}{T_a} \right)}$ (y-axis)	Va (x-axis)
0.9906	0.7121	1.4106	0.9956
0.9865	0.9975	1.9949	0.9915
0.9844	1.1123	2.2304	0.9894
0.9831	1.1661	2.3393	0.9881
0.9779	1.4030	2.8213	0.9829
QSTD		m= 2.04215 b= -0.04258 r= 1.00000	QA

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= $1/m \left(\sqrt{\Delta H \left(\frac{P_a}{P_{std}} \right) \left(\frac{T_{std}}{T_a} \right)} - b \right)$	Qa= $1/m \left(\sqrt{\Delta H \left(\frac{T_a}{P_a} \right)} - b \right)$

Standard Conditions	
Tstd:	298.15 °K
Pstd:	760 mm Hg
Key	
ΔH:	calibrator manometer reading (in H2O)
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



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. : 22P801
Page : 1 of 2

Equipment : U Tube Manometer
Manufacturer: Dwyer
Model: 1221-36-W/M
Serial No.: -
ID No.: UAE.EFM.178/2561

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.

Condition As-Received: Used Item
Received Date: 03 March 2022
Calibration Date: 12 March 2022

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

Reference: 2203-0131WSC
Ambient Temperature: (23 ± 2) °C
Relative Humidity: (50 ± 15) %
Atmospheric Pressure: 1010 mbar
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-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 Aussarree
Issue Date : 14 March 2022

Approved Signatory : Altapol P.
[] Phalinee Prabpaipal
[] Sura Suwamasri
[x] Altapol Panurach

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B 0282414



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		ΔP (inH ₂ O)	Error (inH ₂ O)
	High-port side (inH ₂ O)	Low-port side (inH ₂ O)		
0.00	0.00	0.00	0.00	0.00
2.00	0.98	-0.94	1.92	-0.08
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	6.02	-5.96	11.98	-0.02
14.00	7.02	-6.96	13.98	-0.02
16.00	8.04	-7.98	16.02	0.02
18.00	9.04	-8.98	18.02	0.02
20.00	10.04	-9.98	20.02	0.02
22.00	11.06	-10.98	22.04	0.04
24.00	12.06	-12.00	24.06	0.06
26.00	13.06	-13.00	26.06	0.06
28.00	14.08	-14.02	28.10	0.10
30.00	15.08	-15.02	30.10	0.10
32.00	16.08	-16.04	32.12	0.12
34.00	17.10	-17.04	34.14	0.14
36.00	17.90	-17.86	35.76	-0.04

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



MSC-TIS-TS17025
CALIBRATION 6008

Certificate of Calibration

Certificate No. : 22P2722
Page : 1 of 2

Equipment : Aneroid Barometer
Manufacturer: Barigo
Model :
Serial No. :
ID No. : UAE.ANV.013/2547
Condition As-Received: Used Item
Received Date: 20 July 2022
Calibration Date: 22 July 2022

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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: 2207-0584WSC
Ambient Temperature: (23 ± 2) °C
Relative Humidity: (50 ± 15) %
Atmospheric Pressure: 1010 mbar
81 Soi Udomsuk 41, Sukhumvit Road, Bangchak,
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-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
Standard Barometer	DP1142	1422505046	MP-0076-22	02 May 2023

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.Scale and conversion factor is 1 kPa = 7.50062 mmHg

5.This result of calibration instrument was in absolute pressure.

6.This instrument was used clean air as pressure media.

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 Aussarree
Issue Date : 25 July 2022

Approved Signatory : Attapol P.
[] Phalinee Prabpalpal
[] Sura Suwanmasri
[x] Attapol Panurach

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Cert.No.: 22P2722
Page: 2 of 2

Result of calibration:- Without adjustment
Function:- Absolute Pressure Measurement
Range: 720 mmHg to 780 mmHg
Scale Interval: 1 mmHg (The Fifth Estimate)

Increasing Pressure	718.46	729.33	739.85	750.22	760.90	772.01	785.89
Applied Pressure (mmHg)	720.0	730.0	740.0	750.0	760.0	770.0	780.0
UUC* Indication (mmHg)	1.54	0.67	0.15	-0.22	-0.90	-2.01	-5.89
Error (mmHg)							

Decreasing Pressure

Applied Pressure (mmHg)	785.90	771.99	760.85	750.17	739.90	729.57	718.62
UUC* Indication (mmHg)	780.0	770.0	760.0	750.0	740.0	730.0	720.0
Error (mmHg)	-5.90	-1.99	-0.85	-0.17	0.10	0.43	1.38

The uncertainty of measurement was ± 0.24 mmHg

* 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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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



MSC-T801/05/1028
CALIBRATION 0008

Certificate of Calibration

Certificate No. : 22H771
Page : 1 of 2

Equipment : Dial Thermo-Hygrometer
Manufacturer: Barigo
Model :
Serial No.:
ID No.: UAE/ANV/003/2548
Condition As-Received: Used Item
Received Date: 30 March 2022
Calibration Date: 01 April 2022 to 05 April 2022
Reference: 2203-1124WSC
Ambient Temperature: (25 ± 3) °C
Relative Humidity: (50 ± 20) %

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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.

81 Soi Udomsuk 41, Sukhumvit Road, Bangchak,
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 Certificate 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 :

[V] Chakrit Waewarajua
[] Pornthippa Tameyaskul
[] Vilporn Tantiyawutti

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B 0285423



Cert. No.: 22H771
Page.: 2 of 2

Result of Calibration:-
Function: Humidity measurement.

Reference Temperature (°C)	Humidity Standard (%R.H.)	UUC* Reading (%R.H.)	Error (%R.H.)	Uncertainty of Measurement (±%R.H.)
25.0	40.1	42	1.9	1.6
25.0	60.0	61	1.0	1.8
25.0	80.0	78	-2.0	2.0

Result of Calibration:-
Function: Temperature measurement.

Reference Temperature (°C)	Temperature Standard (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of Measurement (±°C)
20.02	20.02	20.0	-0.02	0.72
29.98	29.98	30.0	0.02	0.72
35.02	35.02	35.0	-0.02	0.72
40.03	40.03	40.0	-0.03	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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a 1104141

MULTI-POINT GAS TEST REPORT

Test Date : Apr 7, 2022

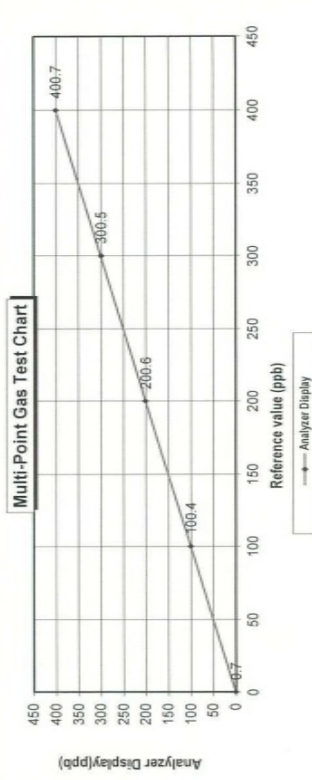
Equipment : Gas Analyzer (NO₂) Model : 421
Manufacturer : Thermo Scientific Serial Number : CM08130002

Standard Gas Concentration
Sulphur Dioxide (SO₂) 44.75 PPM Thermo Scientific
Nitric Oxide (NO) 45.35 PPM 146i
Methane (CH₄) - PPM 1180540071
Carbon Monoxide (CO) 1007
Cylinder No. : CC159599
Expiration Date : Jul 30, 2022

Multi-point gas test data

Level	Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	% Error
Level 1	Zero	0.0	0.70	0.70	0.70
Level 2	20.00%	100.0	100.4	0.40	0.40
Level 3	40.00%	200.0	200.6	0.30	0.30
Level 4	60.00%	300.0	300.5	0.17	0.17
Level 5	80.00%	400.0	400.7	0.17	0.17

Remark : Measuring Range 500.0 ppb
:Acceptable Limit \pm 5%



Calculate by

Sirichit Y.
7 4 15

Approve by

Patthana
8 Apr. 2022

MULTI-POINT GAS TEST REPORT

Test Date : Apr 7, 2022

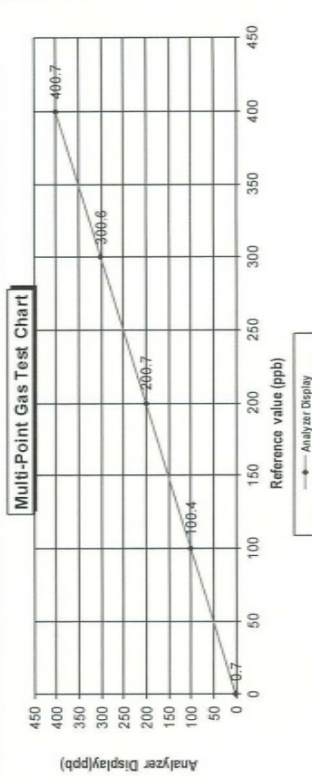
Equipment : Gas Analyzer (NO₂) Model : 42C
Manufacturer : Thermo Environmental Instruments Serial Number : 42C-76412-383

Standard Gas Concentration
Sulphur Dioxide (SO₂) 44.75 PPM Thermo Scientific
Nitric Oxide (NO) 45.35 PPM 146i
Methane (CH₄) - PPM 1180540071
Carbon Monoxide (CO) 1007
Cylinder No. : CC159599
Expiration Date : Jul 30, 2022

Multi-point gas test data

Level	Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	% Error
Level 1	Zero	0.0	0.70	0.70	0.70
Level 2	20.00%	100.0	100.4	0.40	0.40
Level 3	40.00%	200.0	200.7	0.35	0.35
Level 4	60.00%	300.0	300.6	0.20	0.20
Level 5	80.00%	400.0	400.7	0.17	0.17

Remark : Measuring Range 500.0 ppb
:Acceptable Limit \pm 5%



Calculate by

Sirichit Y.
7 4 15

Approve by

Patthana
8 Apr. 2022

MULTI-POINT GAS TEST REPORT

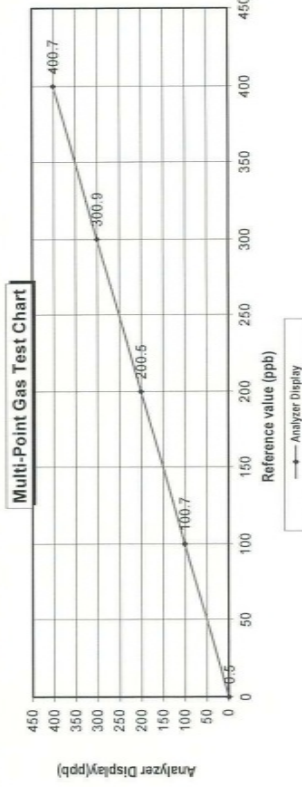
Test Date : Apr 19, 2022

Equipment : Gas Analyzer (NO₂) Model : 42C
Manufacturer : Thermo Environmental Instruments Serial Number : 42C-67174-356

Standard Gas Concentration
Sulphur Dioxide (SO₂) 44.75 PPM Manufacturer : Thermo Scientific
Nitric Oxide (NO) 45.35 PPM Model : 1461
Methane (CH₄) - PPM Serial Number : 1180540071
Carbon Monoxide (CO) 1007
Cylinder No. : CC159599
Expiration Date : Jul 30, 2022

Multi-point gas test data

Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1 Zero 0.0	0.5	0.50	0.50	0.50
Level 2 20.00%	100.7	0.70	0.70	0.70
Level 3 40.00%	200.5	0.50	0.25	0.25
Level 4 60.00%	300.9	0.90	0.30	0.30
Level 5 80.00%	400.7	0.70	0.17	0.17
Remark : Measuring Range 500.0 ppb				
:Acceptable Limit \pm 5%				
Average Difference (%) 0.38				



Calculate by
Srinachar Y.
19/04/2022

Approve by
Srinachar Y.
20 Apr 2022

MULTI-POINT GAS TEST REPORT

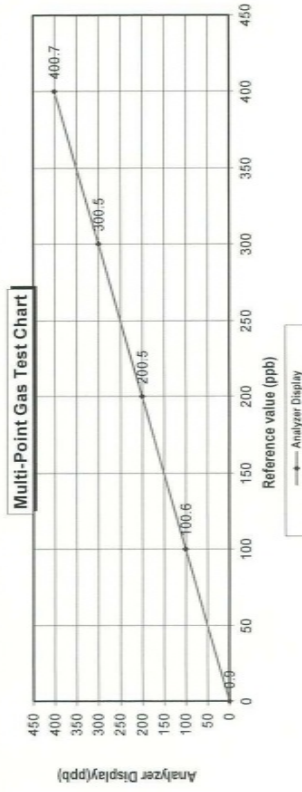
Test Date : Apr 19, 2022

Equipment : Gas Analyzer (NO₂) Model : 42C
Manufacturer : Thermo Environmental Instruments Serial Number : 42C-70971-367

Standard Gas Concentration
Sulphur Dioxide (SO₂) 44.75 PPM Manufacturer : Thermo Scientific
Nitric Oxide (NO) 45.35 PPM Model : 1461
Methane (CH₄) - PPM Serial Number : 1180540071
Carbon Monoxide (CO) 1007
Cylinder No. : CC159599
Expiration Date : Jul 30, 2022

Multi-point gas test data

Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1 Zero 0.0	0.9	0.90	0.90	0.90
Level 2 20.00%	100.6	0.60	0.60	0.60
Level 3 40.00%	200.5	0.50	0.25	0.25
Level 4 60.00%	300.5	0.50	0.17	0.17
Level 5 80.00%	400.7	0.70	0.17	0.17
Remark : Measuring Range 500.0 ppb				
:Acceptable Limit \pm 5%				
Average Difference (%) 0.42				



Calculate by
Srinachar Y.
19/04/2022

Approve by
Srinachar Y.
20 Apr 2022

MULTI-POINT GAS TEST REPORT

Test Date : Apr 7, 2022

Equipment : Gas Analyzer (NO₂) Model : 42C
Manufacturer : Thermo Environmental Instruments Serial Number : 42C-58929-320

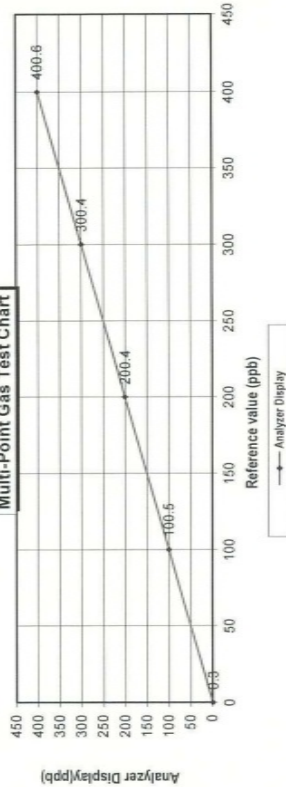
Standard Gas Concentration
Sulphur Dioxide (SO₂) 44.75 PPM Thermo Scientific
Nitric Oxide (NO) 45.35 PPM 1461
Methane (CH₄) - PPM 1180540071
Carbon Monoxide (CO) 1007 PPM
Cylinder No. : CC159599
Expiration Date : Jul 30, 2022

Multi-point gas test data

Level	Reference Value (ppb)	Analyzer Display (ppb)	Difference Error (ppb)	Percent Error (%)	% Error
Level 1	Zero	0.0	0.30	0.30	0.30
Level 2	20.00%	100.0	0.50	0.50	0.50
Level 3	40.00%	200.0	0.20	0.10	0.20
Level 4	60.00%	300.4	0.40	0.13	0.13
Level 5	80.00%	400.6	0.60	0.15	0.15

Remark : Measuring Range
: Acceptable Limit $\pm 5\%$

Multi-Point Gas Test Chart



Calculate by

Sirichai
24/4/2022

Approve by

Sirichai
8/4/2022

CERTIFICATE OF ANALYSIS
Grade of Product: EPA Protocol

Part Number: E04N199E15A01D3 Reference Number: 122-402135187-1
Cylinder Number: E04143252 Cylinder Volume: 144.4 CF
Laboratory: 121 - Durham (SAP) - NC Cylinder Pressure: 2015 PSIG
PGVP Number: B22021 Valve Outlet: 860
Gas Code: CO,NO,NO₂,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 800/R-12/01. This document is a technical document and is not intended for use as a legal document. The cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. This uncertainty is based on the uncertainty of the calibration standards and the uncertainty of the analytical method. All measurements are on a mass basis unless otherwise noted.
Do Not Use This Cylinder Below 100 psig, i.e. 0.7 megapascals.

ANALYTICAL RESULTS

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
NO _x	45.00 PPM	45.95 PPM	G1	$\pm 1.4\%$ NIST Traceable	08/14/2021, 09/21/2021
NITRIC OXIDE	45.00 PPM	45.94 PPM	G1	$\pm 1.4\%$ NIST Traceable	08/14/2021, 09/21/2021
SULFUR DIOXIDE	45.00 PPM	44.68 PPM	G1	$\pm 1.0\%$ NIST Traceable	08/14/2021, 09/21/2021
CARBON MONOXIDE	1000 PPM	984.0 PPM	G1	$\pm 0.7\%$ NIST Traceable	08/14/2021, 09/21/2021
NITROGEN	Balance				06/14/2021

CALIBRATION STANDARDS

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NITRM	20081120	CC708086	40.92 PPM NITRIC OXIDE/NITROGEN	$\pm 1.0\%$	Feb 02, 2025
PRM	12386	D855025	0.91 PPM NITROGEN / NITROGEN	$\pm 2.0\%$	Feb 20, 2025
GMAS	40142383102	CC505581	4.348 PPM NITROGEN DIOXIDE/NITROGEN	± 2.1	Feb 16, 2023
NITRM	18011043	CC473277	49.02 PPM SULFUR DIOXIDE/NITROGEN	$\pm 0.6\%$	Jun 17, 2022
NITRM	14080119	CC434277	990.9 PPM CARBON MONOXIDE/NITROGEN	$\pm 0.6\%$	Nov 15, 2025

The SRM, PRM or RM listed above is only in reference to the GME used in the assay and not part of the analysis.

ANALYTICAL EQUIPMENT

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
Nicoret 6700 AHR0801333 CO	FTIR	Jun 03, 2021
Nicoret 6700 AHR0801333 NO	FTIR	Jun 03, 2021
Nicoret 6700 AHR0801333 NO ₂	FTIR	Jun 03, 2021
Nicoret 6700 AHR0801333 SO ₂	FTIR	Jun 03, 2021

Triad Data Available Upon Request

NOTES: H₂O #5221002807

GROSS WT: 28.40kg

NET WT: 4.73kg



เอกสารไม่ควบคุม

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

Approved for Release

MULTI-POINT GAS TEST REPORT

Test Date : May 3, 2022

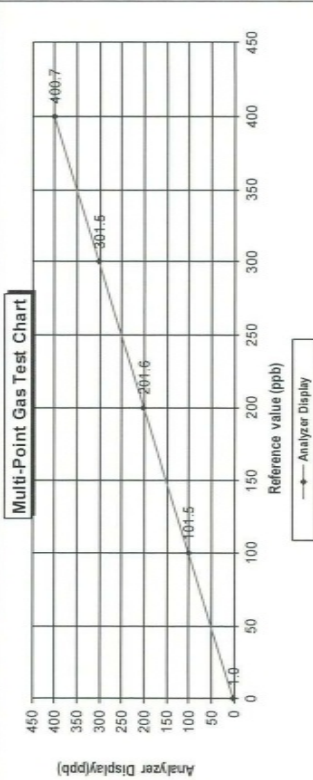
Equipment : Gas Analyzer (SO₂) Model : 43i
Manufacturer : Thermo SCIENTIFIC Serial Number : 1201778111

Standard Gas Concentration
Sulphur Dioxide (SO₂) 44.75 PPM Manufacturer : Thermo SCIENTIFIC
Nitric Oxide (NO) 45.35 PPM Model : 146i
Methane (CH₄) - PPM Serial Number : 1180540071
Carbon Monoxide (CO) 1007
Cylinder No. : CC159599
Expiration Date : Jul 30, 2022

Multi-point gas test data

Level	Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	% Error
Level 1	Zero	0.0	1.00	1.00	1.00
Level 2	20.00%	100.0	101.5	1.48	1.48
Level 3	40.00%	200.0	201.6	0.79	0.79
Level 4	60.00%	300.0	301.5	0.50	0.50
Level 5	80.00%	400.0	400.7	0.17	0.17

Remark : Measuring Range 500.0 ppb
Acceptable Limit \pm 5%



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Approve by

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MULTI-POINT GAS TEST REPORT

Test Date : May 3, 2022

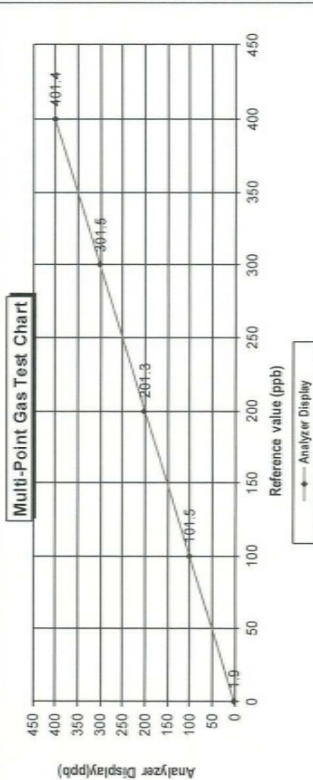
Equipment : Gas Analyzer (SO₂) Model : 43i
Manufacturer : Thermo SCIENTIFIC Serial Number : 1201778113

Standard Gas Concentration
Sulphur Dioxide (SO₂) 44.75 PPM Manufacturer : Thermo SCIENTIFIC
Nitric Oxide (NO) 45.35 PPM Model : 146i
Methane (CH₄) - PPM Serial Number : 1180540071
Carbon Monoxide (CO) 1007
Cylinder No. : CC159599
Expiration Date : Jul 30, 2022

Multi-point gas test data

Level	Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	% Error
Level 1	Zero	0.0	1.90	1.90	1.90
Level 2	20.00%	100.0	101.5	1.48	1.48
Level 3	40.00%	200.0	201.3	0.65	0.65
Level 4	60.00%	300.0	301.5	0.50	0.50
Level 5	80.00%	400.0	401.4	0.35	0.35

Remark : Measuring Range 500.0 ppb
Acceptable Limit \pm 5%



Calculate by

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Approve by

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MULTI-POINT GAS TEST REPORT

Test Date : Apr 22, 2022

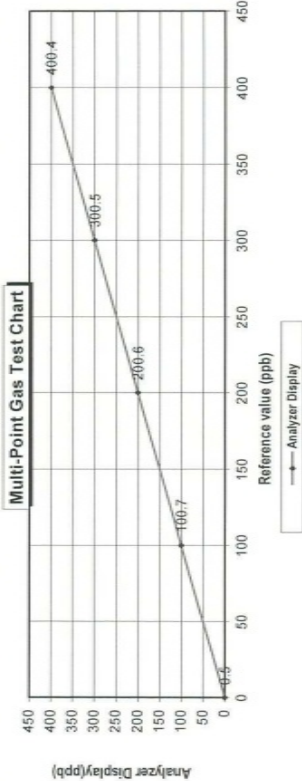
Equipment : Gas Analyzer (SO₂) Model : 431
Manufacturer : Thermo Scientific Serial Number : 1201778116

Standard Gas Concentration
Sulphur Dioxide (SO₂) 44.75 PPM Manufacturer : Thermo Scientific
Nitric Oxide (NO) 45.35 PPM Model : 1461
Methane (CH₄) - PPM Serial Number : 1180540071
Carbon Monoxide (CO) 1007
Cylinder No. : CC159599
Expiration Date : Jul 30, 2022

Multi-point gas test data

Level	Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	0.5	0.50	0.50
Level 2	20.00%	100.0	100.7	0.70	0.70
Level 3	40.00%	200.0	200.6	0.30	0.30
Level 4	60.00%	300.0	300.5	0.17	0.17
Level 5	80.00%	400.0	400.4	0.10	0.10

Remark : Measuring Range 500.0 ppb
Acceptable Limit \pm 5%



Calculate by : Srirach V.
Date : 22 Apr 2022

Approve by : Srirach V.
Date : 22 Apr 2022

MULTI-POINT GAS TEST REPORT

Test Date : Apr 8, 2022

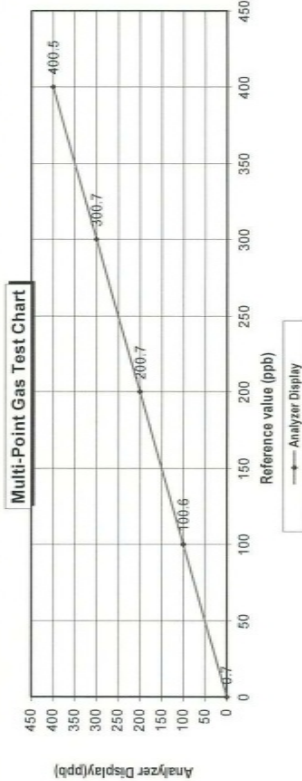
Equipment : Gas Analyzer (SO₂) Model : 431
Manufacturer : Thermo Scientific Serial Number : 1182920014

Standard Gas Concentration
Sulphur Dioxide (SO₂) 44.75 PPM Manufacturer : Thermo Scientific
Nitric Oxide (NO) 45.35 PPM Model : 1461
Methane (CH₄) - PPM Serial Number : 1180540071
Carbon Monoxide (CO) 1007
Cylinder No. : CC159599
Expiration Date : Jul 30, 2022

Multi-point gas test data

Level	Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	0.7	0.70	0.70
Level 2	20.00%	100.0	100.6	0.60	0.60
Level 3	40.00%	200.0	200.7	0.35	0.35
Level 4	60.00%	300.0	300.7	0.23	0.23
Level 5	80.00%	400.0	400.5	0.12	0.12

Remark : Measuring Range 500.0 ppb
Acceptable Limit \pm 5%



Calculate by : Srirach V.
Date : 8 Apr 2022

Approve by : Srirach V.
Date : 8 Apr 2022

MULTI-POINT GAS TEST REPORT

Test Date : Apr 22, 2022

Equipment : Gas Analyzer (SO₂) Model : 431
Manufacturer : Thermo SCIENTIFIC Serial Number : 1182920015

Standard Gas Concentration
Sulphur Dioxide (SO₂) 44.75 PPM
Nitric Oxide (NO) 45.35 PPM
Methane (CH₄) - PPM
Carbon Monoxide (CO) 1007 PPM
Cylinder No. : CC159599
Expiration Date : Jul 30, 2022

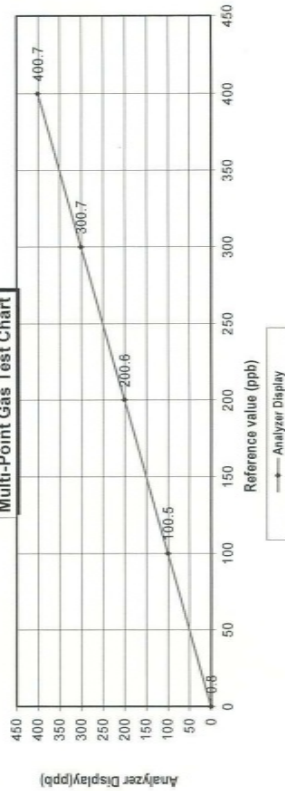
Dilutor Detail
Manufacturer : Thermo SCIENTIFIC
Model : 146i
Serial Number : 1180540071

Multi-point gas test data

Level	Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	0.80	0.80	0.80
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%	400.7	0.70	0.17	0.17

Remark : Measuring Range 500.0 ppb
Acceptable Limit \pm 5%

Multi-Point Gas Test Chart



Calculate by

Signature: [Signature]
Date: 22/ Apr 2022

Approve by

Signature: [Signature]
Date: 22/ Apr 2022



Airgas Specialty Gases
Airgas USA, LLC
930 United Drive
Durham, NC 27713
Airgas.com

CERTIFICATE OF ANALYSIS
Grade of Product: EPA Protocol

Part Number: E04N199E15A01D3
Cylinder Number: E04N199E15A01D3
Laboratory: 121 - Durham (SAP) - NC
PGVP Number: B22021
Gas Code: CO, NO, NO₂, SO₂, BALN
Reference Number: 122-402135187-1
Cylinder Volume: 144.4 CF
Cylinder Pressure: 2015 PSIG
Valve Outlet: 860
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 800/R-12/01. This document describes the procedures used to ensure the accuracy of the calibration standards. The cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. This uncertainty is based on the combined uncertainty of the calibration standards and the analytical method used. The uncertainty is not a measure of the accuracy of the calibration standards. The uncertainty is not a measure of the accuracy of the analytical method used. The uncertainty is not a measure of the accuracy of the calibration standards. The uncertainty is not a measure of the accuracy of the analytical method used.

Do Not Use This Cylinder Below 100 psig, i.e. 0.7 megapascals.

ANALYTICAL RESULTS

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
NOX	45.00 PPM	45.95 PPM	G1	\pm 1.4% NIST Traceable	08/14/2021, 09/21/2021
NITRIC OXIDE	45.00 PPM	45.94 PPM	G1	\pm 1.4% NIST Traceable	08/14/2021, 09/21/2021
SULFUR DIOXIDE	45.00 PPM	44.68 PPM	G1	\pm 1.0% NIST Traceable	08/14/2021, 09/21/2021
CARBON MONOXIDE	1000 PPM	984.0 PPM	G1	\pm 0.7% NIST Traceable	08/14/2021, 09/21/2021
NITROGEN	Balance				

CALIBRATION STANDARDS

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NITRM	20081120	CC708086	40.92 PPM NITRIC OXIDE/NITROGEN	\pm 1.0%	Feb 02, 2025
PRM	12386	DB85025	0.91 PPM NITROGEN / NOXIDE/AR	\pm 2.0%	Feb 20, 2025
GMIS	40142838102	CC505581	4.348 PPM NITROGEN DIOXIDE/NITROGEN	\pm 2.1	Feb 16, 2023
NITRM	18011043	CC473277	49.02 PPM SULFUR DIOXIDE/NITROGEN	\pm 0.6%	Jun 17, 2022
NITRM	14080119	CC434277	990.9 PPM CARBON MONOXIDE/NITROGEN	\pm 0.6%	Nov 15, 2025

The SRM, PRM or RM listed above is only in reference to the GMS used in the assay and not part of the analysis.

ANALYTICAL EQUIPMENT

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
Nicoret 6700 AHR0801333 CO	FTIR	Jun 03, 2021
Nicoret 6700 AHR0801333 NO	FTIR	Jun 03, 2021
Nicoret 6700 AHR0801333 NO ₂	FTIR	Jun 03, 2021
Nicoret 6700 AHR0801333 SO ₂	FTIR	Jun 03, 2021

Triad Data Available Upon Request

NOTES: H₂O #5221002807

GROSS WT: 28.40kg

NET WT: 4.73kg



CERT 3082.01
เอกสารไม่ควบคุม

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

Signature: [Signature]

Approved for Release

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		Actual Value (m/s)	Deviation	Tolerance	Result
Measured Value (m/s)					
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		Actual Value	Deviation	Tolerance	Result
Measured Value					
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	Actual	Deviation	Tolerance	Result
Room Temp	22.1	0.4	21.5-23.5	Pass

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

Environment conditions :

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

Jin Lin

Performed by:

Certified by
Head of Engineering department

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4F-3, No. 347, 2nd Sec., Heping E. Rd., Dean Dist. Taipei City 106, Taiwan

เอกสารไม่ควบคุม

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

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

Inspection	Actual	Deviation	Tolerance	Result
Room Temp	24.8	0.6	23.2-25.2	Pass

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

Environment conditions :

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

Jin Lin

Performed by:

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.: 2111DT0052

Calibration Date: 2022/3/25

Calibration Expiry Date: 2023/3/24

The Result of Calibration

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

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

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

Atmospheric Pressure	Actual	Deviation	Tolerance	Result
Inspection	Value			
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.: 2111DT0058

Calibration Date: 2022/3/25

Calibration Expiry Date: 2023/3/24

The Result of Calibration

Velocity		Actual Value (m/s)	Deviation	Tolerance	Result
Measured Value (m/s)					
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		Actual Value	Deviation	Tolerance	Result
Measured Value					
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	Actual	Deviation	Tolerance	Result
Room Temp	Value			
24.2°C	24.5	0.3	23.2-25.2	Pass

Atmospheric Pressure	Actual	Deviation	Tolerance	Result
Inspection	Value			
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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4F-3, No. 347, 2nd Sec., Heping E. Rd., Dean Dist. Taipei City 106, Taiwan

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 : 22-ACT-034
Request No : Req-2022-0092

Unit Under Calibration Details

Measurement Item : Sound Level Meter
Manufacturer : LARSON DAVIS
Model : LX72
Serial Number : 0005394
ID : UAE.EFM.0312564
Resolution : 0.1 dB
Instrument Status : Used

Microphone Class : 2
Microphone Model : 375A04
Microphone S/N : 329361
Preamplifier Model : PRMLX72C
Preamplifier S/N : 073810

Calibration Environment and Details

Temperature : 23 °C ± 2 °C
Humidity : 50 %RH ± 20 %RH
Barometric Pressure : 1013 hPa ± 10 hPa
Received Date : 14 January 2022
Calibrated Date : 21 January 2022
Calibration Procedure : In-house method CIP-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	S/N	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 :

me
Mr. Noppadon Luangart
Calibration Officer

Approved By :

๗๓๖
Mr. Paet Mathavorn
Calibration Engineer Supervisor
Issue Date : 21 January 2022

Certificate No : 22-ACT-034
Request No : Req-2022-0092

1. Indication at the calibration check frequency

UUC Setting	Nominal Level (dB)	Before Adjust UUC (dB)	ERR (dB)	Adjust UUC (dB)	ERR (dB)	UNCERTAINTY (± dB)	Acceptance Limit (± 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

UUC Setting	Measured (dB)	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 (dB)	UNCERTAINTY (± dB)
FAST / 37-139		
UUC Weighting		
A	27.5	0.10
C	27.0	0.10
Z	31.8	0.10

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

UUC Setting	Deviation from various Frequency Weighting Response curve	UNCERTAINTY (± dB)	Acceptance Limit (± dB)
FAST / 37-139	A C Z	(dB) (dB) (dB)	(± dB)
STD Setting			
125 Hz	0.0 0.1 0.0	0.0 0.50	2.0
1000 Hz	0.0 0.0 0.0	0.0 0.60	1.0
4000 Hz	0.2 0.3 0.2	0.60 0.60	3.0
8000 Hz	-0.3 -0.3 -0.3	0.70 0.70	5.0

Certificate No : 22-ACT-034
Request No : Req-2022-0092

7. Long Term Stability			
UUC Setting	Measured		Acceptance Limit (± dB)
	FAST / A / 37-139	UUC (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	Anticipated		Deviation		Acceptance Limit (± dB)
	FAST / A / 37-139	REF (dB)	UUC (dB)	ERR (dB)	
STD dB					
	139.00	139	139.0	0.0	
	134.00	134	134.0	0.0	
	129.00	129	129.0	0.0	
	124.00	124	124.0	0.0	
	119.00	119	119.0	0.0	
	114.00	114	114.0	0.0	
	109.00	109	109.0	0.0	
	104.00	104	104.0	0.0	
	99.00	99	99.0	0.0	
	94.00	94	93.9	-0.1	
	89.00	89	88.9	-0.1	
	84.00	84	83.9	-0.1	
	79.00	79	78.9	-0.1	
	74.00	74	73.9	-0.1	
	69.00	69	69.0	0.0	
	64.00	64	63.9	-0.1	
	59.00	59	59.0	0.0	
	54.00	54	54.0	0.0	
	49.00	49	49.0	0.0	
	44.00	44	44.1	0.1	
	39.00	39	39.3	0.3	
	38.00	38	38.3	0.3	
	37.00	37	37.5	0.5	

Certificate No : 22-ACT-034
Request No : Req-2022-0092

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)
		Weighting Response curve				
	PAST / 37-139	A (dB)	C (dB)	Z (dB)		
STD Setting						
	63 Hz	-0.2	-0.1	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	-0.1	-0.1	0.0		5
	16000 Hz	-0.1	-0.1	-0.1		+5, -INF.

6. Frequency and time weightings at 1kHz						
UUC Setting		STD		Measured		Acceptance Limit (± dB)
		REF (dB)		UUC (dB)	ERR (dB)	
FAST / 37-139						
UUC Weighting						
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		Measured		Acceptance Limit (± dB)
		REF (dB)		UUC (dB)	ERR (dB)	
UUC Time Response						
Fast		114.00		114.0	0.0	0.1
Slow		114.00		114.0	0.0	0.1
Leq		114.00		114.0	0.0	0.1

12. Overload indication

UUC Setting	Measured	UNCERTAINTY	Acceptance Limit
FAST / A / 37-139	UUC (dB)	(± dB)	(± dB)
STD Setting			
Positive one-half cycle	141.7		
Negative one-half cycle	141.8		
Deviated	-0.1	0.2	1.5

13. High Level Stability

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

End of Certificate

Certificate No : 22-ACT-034

Request No : Req-2022-0092

Page : 5/6

9. Level linearity including the level range control

UUC Setting	STD	Measured	UNCERTAINTY	Acceptance Limit
FAST / A	REF (dB)	UUC (dB)	ERR (dB)	(± dB)
UUC Range				
37-139	42.8	43.0	0.2	1.1
	114	114.0	0.0	1.1

10. Tone burst response

UUC Setting	STD	Anticipated	Measured	UNCERTAINTY	Acceptance Limit
A / 37-139	Toneburst (ms)	Ref (dB)	UUC (dB)	ERR (dB)	(± dB)
UUC Time Response					
Fast	200	135.0	135.0	0.0	1
	2	118.0	117.7	-0.3	+1.0, -2.5
	0.25	109.0	108.8	-0.2	+1.5, -5.0
Slow	200	128.6	128.5	-0.1	1
	2	109.0	108.9	-0.1	+1.0, -5.0
	200	129.0	129.0	0.0	1
SEL	2	109.0	109.1	+0.1	+1.0, -2.5
	0.25	100.0	100.0	0.0	+1.5, -5.0

11. Peak C Sound level

UUC Setting	Anticipated	Measured	UNCERTAINTY	Acceptance Limit
FAST / C / 95-142	REF (dB)	UUC (dB)	ERR (dB)	(± dB)
STD Setting				
Complete cycle	137.4	136.8	-0.60	3.0
Positive half cycle	136.4	136.1	-0.30	2.0
Negative half cycle	136.4	136.2	-0.20	2.0

Certificate of Calibration

Customer		Certificate No : 22-ACT-247
Name	: UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.	Request No : Req-2022-0627
Address	: 81 Soi Udomsak 41, Sukhumvit Road, Bangchak, Prakanong, Bangkok 10260	

Unit Under Calibration Details

Measurement Item :	Sound Level Meter	Microphone Class : 2
Manufacturer	LARSON DAVIS	Microphone Model : 375A04
Model	LxT2	Microphone S/N : 329355
Serial Number	0003395	Preamplifier Model : PRMLxT2C
ID	UAEJFM.032.2564	Preamplifier S/N : 073797
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	: 23 March 2022
Calibration Date	: 1 April 2022
Calibration Procedure	: In-house method CP-SI-M-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	Svanick	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
1 April 2022

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	113.8	-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 (± dB)
UUC Setting		
FAST / 37-139		
UUC Weighting		
A	28.4	0.10

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

	UUC Setting		Measured (dB)	UNCERTAINTY (\pm dB)
	FAST / 37-139	UUC Weighting		
A			28.1	0.10
C			27.7	0.10
Z			32.0	0.10

4. Acoustic signal test of frequency weightings

UUC Setting	Deviation from various Frequency Weighting Response curve				UNCERTAINTY (\pm dB)	Acceptance Limit (\pm dB)
	A (dB)	C (dB)	Z (dB)			
FAST / 37-139						
STD Setting 125 Hz	0.0	0.1	0.1		0.50	2.0
1000 Hz	0.0	0.0	0.0		0.60	1.0
4000 Hz	0.4	0.5	0.5		0.60	3.0
8000 Hz	0.2	0.1	0.3		0.70	5.0

Certificate No : 22-ACT-247
Request No : Req-2022-0627

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	Weighting Response curve		Z (dB)		
		A (dB)	C (dB)			
	63 Hz	-0.2	-0.1	-0.1	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	-0.1	-0.1	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	Measured		UNCERTAINTY (± dB)	Acceptance Limit (± dB)
			UUC	ERR		
			(dB)	(dB)		
FAST / 37-139						
UUC Weighting						
A	114.00	114.00	114.0	0.0		0.2
C	114.00	114.00	114.0	0.0	0.2	0.2
Z	114.00	114.00	114.0	0.0		0.2

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

Certificate No : 22-ACT-247
Request No : Req-2022-0627

7. Long Term Stability

UUC Setting	Measured	UNCERTAINTY (± dB)	Acceptance Limit (± dB)
	UUC	(dB)	(± dB)
FAST / A / 37-139			
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	Anticipated	Deviation		UNCERTAINTY (± dB)	Acceptance Limit (± dB)
		UUC	ERR		
	REF	(dB)	(dB)		
FAST / A / 37-139					
STD dB					
139.00	139	139.0	0.0		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	94.0	0.0		1.1
89.00	89	89.0	0.0		1.1
84.00	84	84.0	0.0	0.3	1.1
79.00	79	79.0	0.0		1.1
74.00	74	74.0	0.0		1.1
69.00	69	69.0	0.0		1.1
64.00	64	64.0	0.0		1.1
59.00	59	59.0	0.0		1.1
54.00	54	54.0	0.0		1.1
49.00	49	49.0	0.0		1.1
44.00	44	44.1	0.1		1.1
39.00	39	39.3	0.3		1.1
38.00	38	38.4	0.4		1.1

Certificate No : 22-ACT-247

Request No : Req-2022-0627

12. Overload indication

UUC Setting	Measured	UNCERTAINTY	Acceptance Limit
FAST / A / 37-139	UUC (dB)	(± dB)	(± dB)
STD Setting			
Positive one-half cycle	142.2		
Negative one-half cycle	142.2		
Deviated	0.0	0.2	1.5

13. High Level Stability

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

End of Certificate

Certificate No : 22-ACT-247

Request No : Req-2022-0627

9. Level linearity including the level range control

UUC Setting	STD	Measured	UNCERTAINTY	Acceptance Limit
FAST / A	REF (dB)	UUC (dB)	ERR (dB)	(± dB)
UUC Range				
	43.4	43.5	0.1	1.1
37-139	114	114.0	0.0	1.1

10. Tone burst response

UUC Setting	STD	Anticipated	Measured	UNCERTAINTY	Acceptance Limit
A / 37-139	Toneburst (ms)	Ref (dB)	UUC (dB)	ERR (dB)	(± dB)
UUC Time Response					
Fast	200	135.0	134.9	-0.1	1.0
	2	118.0	117.8	-0.2	+1.0, -2.5
	0.25	109.0	108.7	-0.3	+1.5, -5.0
Slow	200	128.6	128.4	-0.2	1.0
	2	109.0	108.8	-0.2	+1.0, -5.0
	200	129.0	129.0	0.0	1.0
SEL	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	Measured	UNCERTAINTY	Acceptance Limit
FAST / C / 95-142	REF (dB)	UUC (dB)	ERR (dB)	(± dB)
STD Setting				
Complete cycle	137.4	136.8	-0.60	3.0
Positive half cycle	136.4	136.2	-0.20	2.0
Negative half cycle	136.4	136.2	-0.20	2.0

Certificate No : 22-ACT-105

Request No : Req-2022-0229

1. Indication at the calibration check frequency					
UUC Setting	Nominal Level (dB)	Before Adjust		Adjust	
		UUC (dB)	ERR (dB)	UUC (dB)	ERR (dB)
1000 Hz 114.00 dB	113.85	113.9	+0.05	113.9	0.05
Note : Absolute sensitivity was established by the use of Sound Calibrator Brand SVANTEK, Model SV 35A, SN:58079					Acceptance Limit (± dB)
					0.20
					0.3

2. Self-generated noise, Microphone installed		
UUC Setting	Measured	UNCERTAINTY
FAST / 37-139		
UUC Weighting	(dB)	(± dB)
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	(dB)	(± dB)
A	27.8	0.10
C	27.3	0.10
Z	33.1	0.10

4. Acoustic signal test of frequency weightings (Without Windscreen)					
UUC Setting	Deviation from various Frequency Weighting Response curve	UNCERTAINTY		Acceptance Limit	
		A (dB)	Z (dB)	(± dB)	(± dB)
FAST / 37-139					
STD Setting					
125 Hz	0.1	0.1	0.2	0.50	2.0
1000 Hz	0.0	0.0	0.0	0.60	1.0
4000 Hz	0.6	0.5	0.6	0.60	3.0
8000 Hz	0.1	0.0	0.2	0.70	5.0

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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 : 22-ACT-105

Request No : Req-2022-0229

Unit Under Calibration Details

Measurement item : Sound Level Meter

Manufacturer : LARSON DAVIS

Model : LxT2

Serial Number : 0005396

ID : UAE.EFM.033/2564

Resolution : 0.1 dB

Microphone Class : 2

Microphone Model : 375A04

Microphone S/N : 329330

Preamplifier Model : PRMLxT2C

Preamplifier S/N : 073812

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

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

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Certificate No : 22-ACT-105
Request No : Req-2022-0229

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

UIC Setting		Deviation from various Frequency Weighting Response curve				UNCERTAINTY (± dB)	Acceptance Limit (± dB)
	FAST / 37-139	A (dB)	C (dB)	Z (dB)			
STD Setting							
	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	0.0	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 (\pm dB)	Acceptance Limit (\pm dB)
		UUC (dB)	ERR (dB)		
FAST / 37-139					
UUC Weighting					
A	114.00	114.0	0.0		0.2
C	114.00	114.0	0.0	0.2	0.2
Z	114.00	114.0	0.0		0.2

UUC Settling	STD REF (dB)	Measured		UNCERTAINTY (± dB)	Acceptance Limit (± dB)
		UUC (dB)	ERR (dB)		
UUC Time Response					
Fast	114.00	114.0	0.0	0.2	0.1
Slow	114.00	114.0	0.0		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 01/07/19

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7. Long Term Stability

UIC Setting	Measured		UNCERTAINTY (\pm dB)	Acceptance Limit (\pm dB)
	FAST / A / 37-139	UIC (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		Anticipated		Deviation		UNCERTAINTY (± dB)	Acceptance Limit (± dB)
	FAST / A / 37-139	REF (dB)	UUC (dB)	ERR (dB)			
	STD dB					0.3	
	139.00	139	139.0	0.0			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			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		1.1	
	38.00	38	38.3	0.3		1.1	

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-SI M-01 Rev 0 Issue date 01/07/16

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12. Overload indication

UUC Setting	Measured		UNCERTAINTY (± dB)	Acceptance Limit (± dB)
	FAST / A / 37-139	UUC (dB)		
STD Setting				
Positive one-half cycle		141.7		
Negative one-half cycle		141.8		
Deviated		-0.1	0.2	1.5

13. High Level Stability

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

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

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9. Level linearity including the level range control

UUC Setting	STD	Measured		UNCERTAINTY (± dB)	Acceptance Limit (± dB)
		UUC (dB)	ERR (dB)		
FAST / A	REF (dB)				
UUC Range					
	43.2	42.8	-0.4	0.3	1.1
37-139	114	114.0	0.0		1.1

10. Tone burst response

UUC Setting	STD	Anticipated	Measured		UNCERTAINTY (± dB)	Acceptance Limit (± dB)
			UUC (dB)	ERR (dB)		
A / 37-139	Toneburst (ms)					
UUC Time Response						
	200	135.0	134.9	-0.1		1.0
	2	118.0	117.6	-0.4		+1.0, -2.5
Fast	0.25	109.0	108.7	-0.3		+1.5, -5.0
	200	128.6	128.5	-0.1		1.0
Slow	2	109.0	108.9	-0.1	0.3	+1.0, -5.0
	200	129.0	129.0	0.0		1.0
SEL	2	109.0	108.9	-0.1		+1.0, -2.5
	0.25	100.0	100.0	0.0		+1.5, -5.0

11. Peak C Sound level

UUC Setting	Anticipated	Measured		UNCERTAINTY (± dB)	Acceptance Limit (± dB)
		UUC (dB)	ERR (dB)		
FAST / C / 95-142	REF (dB)				
STD Setting					
Complete cycle	137.4	136.7	-0.70	0.2	3.0
Positive half cycle	136.4	136.2	-0.20		2.0
Negative half cycle	136.4	136.2	-0.20		2.0

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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