

# ภาคผนวก ง

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เอกสารการสอบเทียบเครื่องมือตรวจวิเคราะห์





ALS Laboratory Group (Thailand) Co., Ltd.  
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รายการเครื่องมือที่ใช้ในการตรวจวัด / หมายเหตุ

Sample Name	Parameter	Equipment Name	ID No.	Calibrated Date	Next Cal	Freq. Calibrate (Months)
Illuminance	Illuminance	Lux Meter	NKH_F50086	07-Jan-22	7-Jan-23	12
Illuminance	Illuminance	Lux Meter	NKH_F50086	07-Jan-22	7-Jan-23	12
Water Lab	pH at 25 °C	pH meter	BOK_EN0072	26-Mar-21	24-Sep-22	18
Water Lab	Ammonia Nitrogen	Discrete analyzer	BOK_EN0037	28-Jun-21	28-Jun-22	12
Water Lab	Sulfide	Burette	BOK_EN0171	30-Mar-21	28-Sep-22	18
Water Lab	Sulfide	Chamber (Cold Room)	BOK_EN0167	18-May-21	16-Nov-22	18
Water Lab	Dissolved Oxygen	Burette	BOK_EN0171	30-Mar-21	28-Sep-22	18
Water Lab	Dissolved Oxygen	Chamber (Cold Room)	BOK_EN0167	18-May-21	16-Nov-22	18
Water Lab	Oil & Grease	Electronic Top-Loading Balance	BOK_EN0003	3-Sep-21	3-Sep-22	12
Water Lab	Oil & Grease	Water Bath	BOK_EN0148	31-Jan-22	1-Aug-23	18
Water Lab	Phosphate	Discrete analyzer	BOK_EN0037	28-Jun-21	28-Jun-22	12
Water Lab	Phosphate	Ion Chromatography	BOK_EN0069	12-Jan-22	12-Jan-23	12
Water Lab	Chloride	Ion Chromatography	BOK_EN0069	12-Jan-22	12-Jan-23	12
Water Lab	Total Kjeldahl Nitrogen	Digestion Unit	BOK_EN0023	1-Feb-22	1-Feb-23	12
Water Lab	Total Kjeldahl Nitrogen	Discrete analyzer	BOK_EN0037	28-Jun-21	28-Jun-22	12
Water Lab	Total Suspended Solids	Electronic Top-Loading Balance	BOK_EN0003	3-Sep-21	3-Sep-22	12
Water Lab	Total Suspended Solids	Oven	BOK_EN0073	22-Jul-21	20-Jan-23	18
Water Lab	Total Dissolved Solids 180°C	Electronic Top-Loading Balance	BOK_EN0003	3-Sep-21	3-Sep-22	12
Water Lab	Total Dissolved Solids 180°C	Oven	BOK_EN0073	22-Jul-21	20-Jan-23	18
Water Lab	Conductivity	Conductivity meter	BOK_EN0066	19-Nov-21	20-May-23	18
Water Lab	800 (5 days at 20°C)	DO Meter	BOK_EN0005	19-Jan-21	16-Jul-22	18
Water Lab	800 (5 days at 20°C)	Incubator	BOK_EN0005	4-Oct-21	4-Apr-23	18

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Sample Name	Parameter	Equipment Name	ID No.	Calibrated Date	Next Cal	Freq. Calibrate (Months)
Stack (CEM)	Oxides of Nitrogen	Analyzer, System calibration, Standard gas	-	-	-	-
Stack (CEM)	Sulfur Dioxide	Analyzer, System calibration, Standard gas	-	-	-	-
Stack	Total Suspended Particulate	Console Control Unit	BOK_F50496	4-Jan-22	4-Jul-22	6
Stack	Total Suspended Particulate	Digital Balance	BOK_EN0039	16-Dec-21	16-Dec-22	12
Ambient	Total Suspended Particulate	High Volume	NKH_F50050	-	-	On site Calibration
Ambient	Total Suspended Particulate	High Volume	NKH_F50051	-	-	On site Calibration
Ambient	Total Suspended Particulate	High Volume	NKH_F50049	-	-	On site Calibration
Ambient	Total Suspended Particulate	High Volume	NKH_F50052	-	-	On site Calibration
Ambient	Total Suspended Particulate	Digital Balance	BOK_EN0004	25-Feb-22	25-Feb-23	12
Ambient	Particulate Matter (PM-10)	High Volume	NKH_F50046	-	-	On site Calibration
Ambient	Particulate Matter (PM-10)	High Volume	NKH_F50047	-	-	On site Calibration
Ambient	Particulate Matter (PM-10)	High Volume	NKH_F50048	-	-	On site Calibration
Ambient	Particulate Matter (PM-10)	High Volume	NKH_F50045	-	-	On site Calibration
Ambient	Particulate Matter (PM-10)	Digital Balance	BOK_EN0004	25-Feb-22	25-Feb-23	12
Ambient	Nitrogen Dioxide	NO <sub>x</sub> Analyzer	NKH_F50080	4-Jan-22	4-Jul-22	6
Ambient	Nitrogen Dioxide	NO <sub>x</sub> Analyzer	NKH_F50084	4-Jan-22	4-Jul-22	6
Ambient	Nitrogen Dioxide	NO <sub>x</sub> Analyzer	NKH_F50082	4-Jan-22	4-Jul-22	6
Ambient	Nitrogen Dioxide	NO <sub>x</sub> Analyzer	NKH_F50078	4-Jan-22	4-Jul-22	6
Ambient	Sulfur Dioxide	SO <sub>2</sub> Analyzer	NKH_F50081	4-Jan-22	4-Jul-22	6
Ambient	Sulfur Dioxide	SO <sub>2</sub> Analyzer	NKH_F50085	4-Jan-22	4-Jul-22	6
Ambient	Sulfur Dioxide	SO <sub>2</sub> Analyzer	NKH_F50083	4-Jan-22	4-Jul-22	6
Ambient	Sulfur Dioxide	SO <sub>2</sub> Analyzer	NKH_F50079	4-Jan-22	4-Jul-22	6

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Sample Name	Parameter	Equipment Name	ID No.	Calibrated Date	Next Cal	Freq. Calibrate (Months)
Water Lab	Temperature	pH Meter	BOK_L00031	23-Dec-21	23-Dec-22	12
Water Lab	Calcium	ICP-OES	BOK_L00037	13-Sep-21	12-Mar-23	12
Water Lab	Calcium	Hot Block	BOK_L00054	7-Apr-22	7-Oct-23	18
Water Lab	Calcium	Chamber (Cold Room)	BOK_EN0167	18-May-21	16-Nov-22	18
Water Lab	Magnesium	ICP-OES	BOK_L00037	13-Sep-21	12-Mar-23	12
Water Lab	Magnesium	Hot Block	BOK_L00054	7-Apr-22	7-Oct-23	18
Water Lab	Magnesium	Chamber (Cold Room)	BOK_EN0167	18-May-21	16-Nov-22	18
Water Lab	Sodium	ICP-OES	BOK_L00037	13-Sep-21	12-Mar-23	12
Water Lab	Sodium	Hot Block	BOK_L00054	7-Apr-22	7-Oct-23	18
Water Lab	Sodium	Chamber (Cold Room)	BOK_EN0167	18-May-21	16-Nov-22	18
Water Lab	Chromium	ICP-MS	BOK_L00043	30-Sep-21	29-Mar-23	12
Water Lab	Chromium	Hot Block	BOK_L00054	7-Apr-22	7-Oct-23	18
Water Lab	Chromium	Chamber (Cold Room)	BOK_EN0167	18-May-21	16-Nov-22	18
Water Lab	Manganese	ICP-MS	BOK_L00043	30-Sep-21	29-Mar-23	12
Water Lab	Manganese	Hot Block	BOK_L00054	7-Apr-22	7-Oct-23	18
Water Lab	Manganese	Chamber (Cold Room)	BOK_EN0167	18-May-21	16-Nov-22	18
Water Lab	Copper	ICP-MS	BOK_L00043	30-Sep-21	29-Mar-23	12
Water Lab	Copper	Hot Block	BOK_L00054	7-Apr-22	7-Oct-23	18
Water Lab	Copper	Chamber (Cold Room)	BOK_EN0167	18-May-21	16-Nov-22	18
Water Lab	Zinc	ICP-MS	BOK_L00043	30-Sep-21	29-Mar-23	12
Water Lab	Zinc	Hot Block	BOK_L00054	7-Apr-22	7-Oct-23	18
Water Lab	Zinc	Chamber (Cold Room)	BOK_EN0167	18-May-21	16-Nov-22	18

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Sample Name	Parameter	Equipment Name	ID No.	Calibrated Date	Next Cal	Freq. Calibrate (Months)
Ambient	Wind Speed / Wind Direction	Wind Speed / Wind Direction	NKH_F50054	20-Jul-21	18-Jan-23	18
Ambient	Wind Speed / Wind Direction	Wind Speed / Wind Direction	NKH_F50055	10-Jun-21	9-Dec-22	18
Ambient	Wind Speed / Wind Direction	Wind Speed / Wind Direction	NKH_F50056	24-Feb-21	25-Aug-22	18
Ambient	Wind Speed / Wind Direction	Wind Speed / Wind Direction	NKH_F50057	20-Jul-21	18-Jan-23	18
Ambient	Temperature	Temperature Sensor	NKH_F50054	20-Jul-21	18-Jan-23	18
Ambient	Temperature	Temperature Sensor	NKH_F50055	10-Jun-21	9-Dec-22	18
Ambient	Temperature	Temperature Sensor	NKH_F50056	24-Feb-21	25-Aug-22	18
Ambient	Temperature	Temperature Sensor	NKH_F50053	20-Jul-21	18-Jan-23	18
Noise	Leq 24 hrs	Sound Calibrator	NKH_F50019	20-Aug-21	20-Aug-22	12
Noise	Leq 24 hrs	Sound Level Meter	NKH_F50071	7-Jun-21	7-Jun-22	12
Noise	Leq 24 hrs	Sound Level Meter	NKH_F50070	7-Jun-21	7-Jun-22	12
Noise	Leq 24 hrs	Sound Level Meter	NKH_F50008	14-Jul-21	14-Jul-22	12
Noise	Leq 5 min	Sound Calibrator	NKH_F50019	20-Aug-21	20-Aug-22	12
Noise	Leq 5 min	Sound Level Meter	NKH_F50071	7-Jun-21	7-Jun-22	12
Noise	Leq 5 min	Sound Level Meter	NKH_F50070	7-Jun-21	7-Jun-22	12
Noise	Leq 5 min	Sound Level Meter	NKH_F50008	14-Jul-21	14-Jul-22	12
Noise	Leq 8 hrs	Sound Calibrator	NKH_F50019	20-Aug-21	20-Aug-22	12
Noise	Leq 8 hrs	Sound Level Meter	NKH_F50071	26-Apr-21	26-Apr-22	12
Noise	Leq 8 hrs	Sound Level Meter	NKH_F50072	20-Aug-21	20-Aug-22	12
Noise	Leq 8 hrs	Sound Level Meter	NKH_F50007	27-Apr-21	27-Apr-22	12
Noise	Leq 8 hrs	Sound Level Meter	NKH_F50072	7-Jun-21	7-Jun-22	12
Noise	Leq 8 hrs	Sound Level Meter	NKH_F50071	7-Jun-21	7-Jun-22	12

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Sample Name	Parameter	Equipment Name	ID No.	Calibrated Date	Next Cal	Freq. Calibrate (Months)
Water Lab	SAR	ICP-MS	BOK_L00043	30-Sep-21	29-Mar-23	12
Water Lab	SAR	Hot Block	BOK_L00054	7-Apr-22	7-Oct-23	18
Water Lab	SAR	Chamber (Cold Room)	BOK_EN0167	18-May-21	16-Nov-22	18
Water Lab	Mercury	DLO-CWMS / CWMS	BOK_L00023	6-Jun-22	5-Jun-23	12
Water Lab	Fecal Coliform	Autoclave	BOK_ML0043	1-Dec-21	1-Jun-23	18
Water Lab	Fecal Coliform	Incubator	BOK_ML0010	21-Jan-22	22-Jul-23	18
Water Lab	Fecal Coliform	Hot Air Oven	BOK_ML0013	7-Jun-21	6-Dec-22	18
Water Lab	Fecal Coliform	Water Bath	BOK_ML0056	20-May-22	20-May-23	12

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Sample Name	Parameter	Equipment Name	ID No.	Calibrated Date	Next Cal	Freq. Calibrate (Months)
Noise	Leq 8 hrs	Sound Level Meter	NKH_F50070	7-Jun-21	7-Jun-22	12
Noise	Leq 8 hrs	Sound Level Meter	NKH_F50069	7-Jun-21	7-Jun-22	12
Noise	Leq 8 hrs	Sound Level Meter	NKH_F50007	14-Jul-21	14-Jul-22	12
Noise	Leq 8 hrs	Sound Calibrator	NKH_F50019	20-Aug-21	20-Aug-22	12
Noise	Leq 8 hrs	Sound Level Meter	NKH_F50006	14-Jul-21	14-Jul-22	12
Noise	Leq 8 hrs	Sound Level Meter	NKH_F50072	7-Jun-21	7-Jun-22	12
Noise	Leq 8 hrs	Sound Level Meter	NKH_F50073	7-Jun-21	7-Jun-22	12
Noise	Leq 8 hrs	Sound Level Meter	NKH_F50069	7-Jun-21	7-Jun-22	12
Noise	Leq 8 hrs	Sound Level Meter	NKH_F50027	20-Aug-21	20-Aug-22	12
Noise	Leq 8 hrs	Sound Level Meter	NKH_F50007	14-Jul-21	14-Jul-22	12
Noise	Leq 8 hrs	Sound Level Meter	NKH_F50084	3-May-22	3-May-23	12
Noise	Leq 8 hrs	Sound Level Meter	NKH_F50026	20-Aug-21	20-Aug-22	12
Heat	Heat Stress	Heat Stress Monitor	NKH_F50025	27-Jul-21	27-Jul-22	12
Heat	Heat Stress	Heat Stress Monitor	NKH_F50024	27-Jul-21	27-Jul-22	12
Heat	Heat Stress	Heat Stress Monitor	NKH_F50031	26-Jul-21	26-Jul-22	12
Heat	Heat Stress	Heat Stress Monitor	NKH_F50032	29-Jul-21	29-Jul-22	12
Heat	Heat Stress	Heat Stress Monitor	NKH_F50033	22-Jul-21	22-Jul-22	12
Heat	Heat Stress	Heat Stress Monitor	NKH_F50021	22-Jul-21	22-Jul-22	12
Heat	Heat Stress	Heat Stress Monitor	NKH_F50025	27-Jul-21	27-Jul-22	12
Heat	Heat Stress	Heat Stress Monitor	NKH_F50024	27-Jul-21	27-Jul-22	12
Heat	Heat Stress	Heat Stress Monitor	NKH_F50031	26-Jul-21	26-Jul-22	12
Heat	Heat Stress	Heat Stress Monitor	NKH_F50033	22-Jul-21	22-Jul-22	12

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Lot No. 2244240-1

## SYSTEM CALIBRATION BIAS AND DRIFT DATA

Client : Gulf HRV1 Co., Ltd. Location : Mile HR80 11  
Date : 26 May 22 Test Operator : Nawaphut S.O<sub>2</sub> ANALYZER : 16.08 Span (%) : 25

	O <sub>2</sub> Analyzer Calibration Response	Initial Values System Calibration Response	System Cal Bias (% of Span)	Final Values System Calibration Response	System Cal Bias (% of Span)	Drift (% of Span)
Zero Gas	0.00	0.00	0.00	0.10	0.40	0.40
Upstream Gas	16.05	15.90	0.80	15.90	0.60	0.00

NO<sub>x</sub> ANALYZER : 198.20 Span (ppm) : 200

	NO <sub>x</sub> Analyzer Calibration Response	Initial Values System Calibration Response	System Cal Bias (% of Span)	Final Values System Calibration Response	System Cal Bias (% of Span)	Drift (% of Span)
Zero Gas	0.00	0.30	0.15	0.30	0.15	0.00
Upstream Gas	198.20	157.80	0.20	157.60	0.30	0.10

SO<sub>2</sub> ANALYZER : 161.60 Span (ppm) : 200

	SO <sub>2</sub> Analyzer Calibration Response	Initial Values System Calibration Response	System Cal Bias (% of Span)	Final Values System Calibration Response	System Cal Bias (% of Span)	Drift (% of Span)
Zero Gas	0.00	0.00	0.00	0.00	0.00	0.00
Upstream Gas	161.60	161.20	0.20	161.10	0.25	0.05

Calibrated by

( Mr. Nawaphut Srithepa )

Environmental Field Scientist (2)

FORM NO. : F-06-002 REVISION NO. : 2 ISSUE DATE: 3/10/19

ALS Laboratory Group



## EMISSION TEST RESULT

Client : Gulf HRV1 Co., Ltd. Location : Mile HR80 11  
Date : 26 May 22 Test Operator : Nawaphut S.  
Start Time : 11:01 Finish Time : 11:41  
SO<sub>2</sub> Analyzer Model : TELEDYNE API 100EH Serial No. : 410  
NO<sub>x</sub>/CO<sub>2</sub> Analyzer Model : TELEDYNE API 200EH Serial No. : 426

Time (min)	O <sub>2</sub> (%)	CO <sub>2</sub> (%)	NOx (ppm)	SO <sub>2</sub> (ppm)	CO (ppm)	Remark
11:01	14.83	4.04	15.26	0.11	-	-
11:02	14.84	4.07	15.29	0.11	-	-
11:03	14.83	4.05	15.30	0.11	-	-
11:04	14.82	4.10	15.22	0.15	-	-
11:05	14.76	4.04	15.26	0.14	-	-
11:06	14.74	4.08	15.32	0.17	-	-
11:07	14.74	4.08	15.36	0.17	-	-
11:08	14.75	4.02	15.41	0.18	-	-
11:09	14.76	4.04	15.39	0.10	-	-
11:10	14.76	4.03	15.34	0.10	-	-
11:11	14.78	4.09	15.25	0.10	-	-
11:12	14.77	4.08	15.25	0.05	-	-
11:13	14.78	4.01	15.34	0.04	-	-
11:14	14.79	4.02	15.43	0.08	-	-
11:15	14.76	4.02	15.45	0.08	-	-
11:16	14.79	4.02	15.37	0.07	-	-
11:17	14.84	4.01	15.30	0.15	-	-
11:18	15.05	3.86	15.02	0.09	-	-
11:19	15.15	3.82	14.84	0.10	-	-
11:40	15.16	3.83	14.46	0.10	-	-
11:41	15.19	3.84	14.48	0.11	-	-
Average	14.88	4.01	15.19	0.11	-	-

( Mr. Nawaphut Srithepa )

Environmental Field Scientist (2)

FORM NO. : F-06-002 REVISION NO. : 2 ISSUE DATE: 3/10/19

ALS Laboratory Group



Lot No. 2244241-1

## ANALYZER CALIBRATION DATA

Client : Gulf HRV1 Co., Ltd. Location : Mile HR80 12  
Date : 26 May 22 Test Operator : Nawaphut S.O<sub>2</sub> ANALYZER : 16.08 Span (%) : 25

	Cylinder Value (%)	Initial Analyzers Calibration Response (%)	Final Analyzers Calibration Response (%)	Difference (Percent of Span)
Zero Gas	0.00	0.00	0.10	0.40
Low-Level Gas	8.05	8.00	7.90	0.40
Span Gas	16.08	16.05	15.95	0.60

NO<sub>x</sub> ANALYZER : 198.20 Span (ppm) : 200

	Cylinder Value (ppm)	Initial Analyzers Calibration Response (ppm)	Final Analyzers Calibration Response (ppm)	Difference (Percent of Span)
Zero Gas	0.00	0.00	0.30	0.15
Low-Level Gas	50.32	50.10	50.05	0.05
Span Gas	198.20	158.20	157.60	0.30

SO<sub>2</sub> ANALYZER : 161.60 Span (ppm) : 200

	Cylinder Value (ppm)	Initial Analyzers Calibration Response (ppm)	Final Analyzers Calibration Response (ppm)	Difference (Percent of Span)
Zero Gas	0.00	0.00	0.00	0.00
Low-Level Gas	50.27	50.00	49.90	0.05
Span Gas	161.60	161.00	161.10	0.25

Calibrated by

( Mr. Nawaphut Srithepa )

Environmental Field Scientist (2)

FORM NO. : F-06-002 REVISION NO. : 2 ISSUE DATE: 3/10/19

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Lot No. 2244240-1

## ANALYZER CALIBRATION DATA

Client : Gulf HRV1 Co., Ltd. Location : Mile HR80 11  
Date : 26 May 22 Test Operator : Nawaphut S.O<sub>2</sub> ANALYZER : 16.08 Span (%) : 25

	Cylinder Value (%)	Initial Analyzers Calibration Response (%)	Final Analyzers Calibration Response (%)	Difference (Percent of Span)
Zero Gas	0.00	0.00	0.10	0.40
Low-Level Gas	8.05	8.00	7.90	0.40
Span Gas	16.08	16.05	15.95	0.60

NO<sub>x</sub> ANALYZER : 198.20 Span (ppm) : 200

	Cylinder Value (ppm)	Initial Analyzers Calibration Response (ppm)	Final Analyzers Calibration Response (ppm)	Difference (Percent of Span)
Zero Gas	0.00	0.30	0.30	0.15
Low-Level Gas	50.32	50.10	50.00	0.05
Span Gas	198.20	158.20	157.60	0.30

SO<sub>2</sub> ANALYZER : 161.60 Span (ppm) : 200

	Cylinder Value (ppm)	Initial Analyzers Calibration Response (ppm)	Final Analyzers Calibration Response (ppm)	Difference (Percent of Span)
Zero Gas	0.00	0.00	0.00	0.00
Low-Level Gas	50.27	50.00	49.90	0.05
Span Gas	161.60	161.00	161.10	0.25

Calibrated by

( Mr. Nawaphut Srithepa )

Environmental Field Scientist (2)

FORM NO. : F-06-002 REVISION NO. : 2 ISSUE DATE: 3/10/19

ALS Laboratory Group



## EMISSION TEST RESULT

Client : Gulf HRV1 Co., Ltd. Location : Mile HR80 11  
Date : 26 May 22 Test Operator : Nawaphut S.  
Start Time : 11:00 Finish Time : 11:30  
SO<sub>2</sub> Analyzer Model : TELEDYNE API 100EH Serial No. : 410  
NO<sub>x</sub>/CO<sub>2</sub> Analyzer Model : TELEDYNE API 200EH Serial No. : 426

Time (min)	O <sub>2</sub> (%)	CO <sub>2</sub> (%)	NOx (ppm)	SO <sub>2</sub> (ppm)	CO (ppm)	Remark
11:00	14.83	4.04	15.29	0.17	-	-
11:01	14.86	4.02	15.26	0.15	-	-
11:02	14.85	4.03	15.30	0.15	-	-
11:03	14.87	4.01	15.31	0.12	-	-
11:04	14.85	4.06	15.31	0.08	-	-
11:05	14.84	4.03	15.30	0.05	-	-
11:06	14.82	4.05	15.38	0.08	-	-
11:07	14.83	4.04	15.45	0.07	-	-
11:08	14.85	4.09	15.47	0.04	-	-
11:09	14.85	4.09	15.47	0.04	-	-
11:10	14.84	4.07	15.45	0.02	-	-
11:11	14.84	4.01	15.44	0.02	-	-
11:12	14.84	4.09	15.43	0.04	-	-
11:13	14.83	4.08	15.42	0.05	-	-
11:14	14.84	4.10	15.36	0.04	-	-
11:15	14.84	4.03	15.34	0.06	-	-
11:16	14.85	4.06	15.20	0.07	-	-
11:17	14.85	4.06	15.19	0.07	-	-
11:18	14.83	4.07	15.21	0.08	-	-
11:19	14.84	4.03	15.21	0.09	-	-
11:20	14.84	4.04	15.26	0.08	-	-
Average	14.85	4.08	15.34	0.07	-	-

( Mr. Nawaphut Srithepa )

Environmental Field Scientist (2)

FORM NO. : F-06-002 REVISION NO. : 2 ISSUE DATE: 3/10/19

ALS Laboratory Group



## EMISSION TEST RESULT

Client : Gulf HRV1 Co., Ltd. Location : Mile HR80 11  
Date : 26 May 22 Test Operator : Nawaphut S.  
Start Time : 11:42 Finish Time : 12:02  
SO<sub>2</sub> Analyzer Model : TELEDYNE API 100EH Serial No. : 410  
NO<sub>x</sub>/CO<sub>2</sub> Analyzer Model : TELEDYNE API 200EH Serial No. : 774  
CO/CO<sub>2</sub> Analyzer Model : TELEDYNE API 200EH Serial No. : 426

Time (min)	O <sub>2</sub> (%)	CO <sub>2</sub> (%)	NOx (ppm)	SO <sub>2</sub> (ppm)	CO (ppm)	Remark
11:42	15.19	3.80	14.42	0.14	-	-
11:43	15.18	3.78	14.39	0.13	-	-
11:44	15.19	3.78	14.36	0.13	-	-
11:45	15.19	3.80	14.42	0.14	-	-
11:46	15.20	3.80	14.41	0.15	-	-
11:47	15.20	3.77	14.40	0.15	-	-
11:48	15.21	3.81	14.41	0.13	-	-
11:49	15.18	3.78	14.42	0.15	-	-
11:50	15.18	3.78	14.39	0.16	-	-
11:51	15.20	3.85	14.42	0.17	-	-
11:52	15.20	3.78	14.39	0.17	-	-
11:53	15.21	3.80	14.38	0.17	-	-
11:54	15.21	3.74	14.42	0.18	-	-
11:55	15.21	3.78	14.47	0.20	-	-
11:56	15.22	3.78	14.36	0.22	-	-
11:57	15.21	3.75	14.32	0.25	-	-
11:58	15.23	3.78	14.31	0.26	-	-
11:59	15.22	3.72	14.47	0.25	-	-
12:00	15.28	3.77	14.44	0.23	-	-
12:01	15.24	3.75	14.45	0.23	-	-
12:02	15.23	3.76	14.54	0.26	-	-
Average	15.21	3.78	14.41	0.19	-	-

( Mr. Nawaphut Srithepa )

Environmental Field Scientist (2)

FORM NO. : F-06-002 REVISION NO. : 2 ISSUE DATE: 3/10/19

ALS Laboratory Group





## EMISSION TEST RESULT

Client	Gulf HRV1 Co., Ltd.	Run #	1
Date	28 May 22	Location	Mesa HRBQ 12
Start Time	15:42	Test Operator	Naveghat S.
SO <sub>2</sub> Analyzer Model	TELEDYNE API 100EH	Finish Time	16:03
NO <sub>x</sub> /CO <sub>2</sub> Analyzer Model	TELEDYNE API 200EH	Serial No.	410
CO/CO <sub>2</sub> Analyzer Model	TELEDYNE API 300EH	Serial No.	774
		Serial No.	428

Time (min)	O <sub>2</sub> (%)	CO <sub>2</sub> (%)	NO <sub>x</sub> (ppm)	SO <sub>2</sub> (ppm)	CO (ppm)	Remark
13:45	15.13	3.85	19.52	0.07	-	
13:46	15.14	3.83	20.12	0.04	-	
13:47	15.15	3.85	20.30	0.05	-	
13:48	15.21	3.77	20.27	0.04	-	
13:49	15.19	3.84	20.18	0.06	-	
13:50	15.15	3.88	20.10	0.08	-	
13:51	15.13	3.84	20.55	0.05	-	
13:52	15.15	3.85	20.49	0.07	-	
13:53	15.13	3.88	20.59	0.06	-	
13:54	15.12	3.86	20.70	0.07	-	
13:55	15.12	3.87	20.50	0.07	-	
13:56	15.13	3.83	20.85	0.09	-	
13:57	15.14	3.85	20.67	0.05	-	
13:58	15.14	3.85	20.51	0.03	-	
13:59	15.12	3.84	20.10	0.06	-	
14:00	15.20	3.83	20.24	0.03	-	
14:01	15.13	3.87	20.27	0.05	-	
14:02	15.12	3.81	20.46	0.05	-	
14:03	15.13	3.85	20.64	0.05	-	
14:04	15.14	3.82	20.10	0.06	-	
14:05	15.14	3.83	20.74	0.05	-	
Average	15.14	3.84	20.48	0.05	-	

(Mr. Naveghat S. Shetye)

Environmental Field Scientist (2)

FORM NO. : F-06-002 REVISION NO. : 2 ISSUE DATE: 3/30/19

ALS Laboratory Group



## EMISSION TEST RESULT

Client	Gulf HRV1 Co., Ltd.	Run #	5
Date	28 May 22	Location	Mesa HRBQ 12
Start Time	14:27	Test Operator	Naveghat S.
SO <sub>2</sub> Analyzer Model	TELEDYNE API 100EH	Finish Time	14:47
NO <sub>x</sub> /CO <sub>2</sub> Analyzer Model	TELEDYNE API 200EH	Serial No.	410
CO/CO <sub>2</sub> Analyzer Model	TELEDYNE API 300EH	Serial No.	774
		Serial No.	428

Time (min)	O <sub>2</sub> (%)	CO <sub>2</sub> (%)	NO <sub>x</sub> (ppm)	SO <sub>2</sub> (ppm)	CO (ppm)	Remark
14:27	15.14	3.85	20.04	0.03	-	
14:28	15.15	3.83	20.11	0.00	-	
14:29	15.14	3.84	20.20	0.00	-	
14:30	15.15	3.81	20.20	0.00	-	
14:31	15.16	3.81	20.17	0.02	-	
14:32	15.16	3.81	20.05	0.02	-	
14:33	15.17	3.88	19.98	0.02	-	
14:34	15.17	3.83	19.90	0.03	-	
14:35	15.17	3.83	20.03	0.05	-	
14:36	15.18	3.81	20.05	0.02	-	
14:37	15.18	3.77	19.98	0.03	-	
14:38	15.18	3.79	19.91	0.03	-	
14:39	15.19	3.77	19.84	0.03	-	
14:40	15.23	3.83	19.72	0.02	-	
14:41	15.18	3.85	19.63	0.04	-	
14:42	15.15	3.75	19.29	0.03	-	
14:43	15.14	3.80	19.35	0.07	-	
14:44	15.16	3.81	19.72	0.03	-	
14:45	15.17	3.80	20.02	0.04	-	
14:46	15.17	3.83	19.91	0.03	-	
14:47	15.17	3.85	19.84	0.07	-	
Average	15.17	3.81	19.91	0.03	-	

(Mr. Naveghat S. Shetye)

Environmental Field Scientist (2)

FORM NO. : F-06-002 REVISION NO. : 2 ISSUE DATE: 3/30/19

ALS Laboratory Group



## SYSTEM CALIBRATION BIAS AND DRIFT DATA

Client	Gulf HRV1 Co., Ltd.	Location	Mesa HRBQ 11
Date	28 May 22	Test Operator	Naveghat S.

O <sub>2</sub> ANALYZER		Span (%)	25
Cylinder Conc. (%)	18.08		

	O <sub>2</sub> Analyzer Calibration Response	Initial Values System Calibration Response	System Calibration Response	System Calibration Response	System Calibration Response	Drift (% of Span)
Zero Gas	0.00	0.00	0.00	0.10	0.44	0.40
Upscale Gas	18.05	18.90	0.60	18.90	0.60	0.00

CO ANALYZER		Span (ppm)	200
Cylinder Conc. (ppm)	187.80		

	CO Analyzer Calibration Response	Initial Values System Calibration Response	System Calibration Response	System Calibration Response	System Calibration Response	Drift (% of Span)
Zero Gas	0.00	0.00	0.00	0.00	0.00	0.00
Upscale Gas	187.50	187.30	0.10	187.30	0.10	0.00

Calibrated by

(Mr. Naveghat S. Shetye)

Environmental Field Scientist (2)

FORM NO. : F-06-002 REVISION NO. : 2 ISSUE DATE: 3/30/19

ALS Laboratory Group



## SYSTEM CALIBRATION BIAS AND DRIFT DATA

Client	Gulf HRV1 Co., Ltd.	Location	Mesa HRBQ 12
Date	28 May 22	Test Operator	Naveghat S.

O <sub>2</sub> ANALYZER		Span (%)	25
Cylinder Conc. (%)	18.08		

	O <sub>2</sub> Analyzer Calibration Response	Initial Values System Calibration Response	System Calibration Response	System Calibration Response	System Calibration Response	Drift (% of Span)
Zero Gas	0.00	0.00	0.00	0.10	0.40	0.40
Upscale Gas	18.05	18.90	0.60	18.90	0.60	0.00

NO <sub>x</sub> ANALYZER		Span (ppm)	200
Cylinder Conc. (ppm)	198.20		

	NO <sub>x</sub> Analyzer Calibration Response	Initial Values System Calibration Response	System Calibration Response	System Calibration Response	System Calibration Response	Drift (% of Span)
Zero Gas	0.00	0.30	0.15	0.30	0.15	0.00
Upscale Gas	198.20	197.80	0.20	197.60	0.30	0.10

SO <sub>2</sub> ANALYZER		Span (ppm)	200
Cylinder Conc. (ppm)	191.80		

	SO <sub>2</sub> Analyzer Calibration Response	Initial Values System Calibration Response	System Calibration Response	System Calibration Response	System Calibration Response	Drift (% of Span)
Zero Gas	0.00	0.00	0.00	0.00	0.00	0.00
Upscale Gas	191.60	191.20	0.20	191.10	0.25	0.05

Calibrated by

(Mr. Naveghat S. Shetye)

Environmental Field Scientist (2)

FORM NO. : F-06-002 REVISION NO. : 2 ISSUE DATE: 3/30/19

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## EMISSION TEST RESULT

Client	Gulf HRV1 Co., Ltd.	Run #	2
Date	28 May 22	Location	Mesa HRBQ 12
Start Time	14:08	Test Operator	Naveghat S.
SO <sub>2</sub> Analyzer Model	TELEDYNE API 100EH	Finish Time	14:28
NO <sub>x</sub> /CO <sub>2</sub> Analyzer Model	TELEDYNE API 200EH	Serial No.	410
CO/CO <sub>2</sub> Analyzer Model	TELEDYNE API 300EH	Serial No.	774
		Serial No.	428

Time (min)	O <sub>2</sub> (%)	CO <sub>2</sub> (%)	NO <sub>x</sub> (ppm)	SO <sub>2</sub> (ppm)	CO (ppm)	Remark
14:05	15.14	3.83	20.79	0.01	-	
14:07	15.14	3.85	20.80	0.01	-	
14:08	15.14	3.82	20.71	0.03	-	
14:09	15.15	3.84	20.57	0.01	-	
14:10	15.15	3.83	20.39	0.00	-	
14:11	15.15	3.84	20.25	0.01	-	
14:12	15.16	3.82	20.15	0.02	-	
14:13	15.18	3.77	20.11	0.00	-	
14:14	15.18	3.84	20.18	0.02	-	
14:15	15.15	3.86	20.18	0.04	-	
14:16	15.14	3.81	20.19	0.03	-	
14:17	15.14	3.81	20.15	0.01	-	
14:18	15.14	3.84	20.16	0.05	-	
14:19	15.15	3.85	20.10	0.01	-	
14:20	15.15	3.82	20.06	0.01	-	
14:21	15.15	3.81	20.01	0.00	-	
14:22	15.15	3.79	20.05	0.02	-	
14:23	15.16	3.81	19.98	0.00	-	
14:24	15.16	3.82	19.88	0.03	-	
14:25	15.18	3.78	19.83	0.01	-	
14:26	15.18	3.81	19.80	0.02	-	
Average	15.15	3.82	20.21	0.02	-	

(Mr. Naveghat S. Shetye)

Environmental Field Scientist (2)

FORM NO. : F-06-002 REVISION NO. : 2 ISSUE DATE: 3/30/19

ALS Laboratory Group



## ANALYZER CALIBRATION DATA

Client	Gulf HRV1 Co., Ltd.	Location	Mesa HRBQ 11
Date	28 May 22	Test Operator	Naveghat S.

O <sub>2</sub> ANALYZER		Serial No.	774
Model	TELEDYNE API 200EH		
Span (%)	25		

	Cylinder Value (%)	Initial Analyzers Calibration Response (%)	Final Analyzers Calibration Response (%)	Difference (Percent of Span)
Zero Gas	0.00	0.00	0.10	0.40
Low-Level Gas	8.00	8.00	7.90	0.40
Span Gas	18.05	18.05	18.90	0.60

CO ANALYZER		Serial No.	428
Model	TELEDYNE API 300EH		
Span (ppm)	200		

	Cylinder Value (ppm)	Initial Analyzers Calibration Response (ppm)	Final Analyzers Calibration Response (ppm)	Difference (Percent of Span)
Zero Gas	0.00	0.00	0.00	0.00
Low-Level Gas	49.99	50.00	50.00	0.00
Span Gas	187.50	187.50	187.30	0.10

Calibrated by

(Mr. Naveghat S. Shetye)

Environmental Field Scientist (2)

FORM NO. : F-06-002 REVISION NO. : 2 ISSUE DATE: 3/30/19

ALS Laboratory Group





### EMISSION TEST RESULT

Client	Gulf NRVY Co., Ltd.	Run #	2
Date	26 May 22	Location	Mae HRBG 11
Start Time	11:01	Test Operator	Navephat S.
SO <sub>2</sub> Analyzer Model	TELEDYNE API 100BH	Finish Time	11:41
NO <sub>x</sub> /CO <sub>2</sub> Analyzer Model	TELEDYNE API 200BH	Serial No.	410
CO/CO <sub>2</sub> Analyzer Model	TELEDYNE API 300BH	Serial No.	774
		Serial No.	426

Time (min)	O <sub>2</sub> (%)	CO <sub>2</sub> (%)	HCx (ppm)	SO <sub>2</sub> (ppm)	CO (ppm)	Remark
11:21	14.83	4.94	-	-	0.55	
11:22	14.84	4.97	-	-	0.55	
11:23	14.83	4.95	-	-	0.56	
11:24	14.82	4.92	-	-	0.52	
11:25	14.79	4.94	-	-	0.46	
11:26	14.74	4.98	-	-	0.53	
11:27	14.74	4.98	-	-	0.47	
11:28	14.75	4.99	-	-	0.41	
11:29	14.76	4.94	-	-	0.38	
11:30	14.76	4.93	-	-	0.39	
11:31	14.78	4.99	-	-	0.37	
11:32	14.77	4.98	-	-	0.33	
11:33	14.78	4.97	-	-	0.35	
11:34	14.79	4.92	-	-	0.30	
11:35	14.79	4.92	-	-	0.30	
11:36	14.79	4.92	-	-	0.31	
11:37	14.84	4.91	-	-	0.17	
11:38	15.05	3.98	-	-	0.16	
11:39	15.10	3.82	-	-	0.16	
11:40	15.10	3.82	-	-	0.09	
11:41	15.10	3.84	-	-	0.06	
Average	14.88	4.91	-	-	0.38	

*Navephat S.*  
(Mr.Navephat Sathiyas)  
Environmental Field Scientist (2)



### ANALYZER CALIBRATION DATA

Client	Gulf NRVY Co., Ltd.	Location	Mae HRBG 12
Date	26 May 22	Test Operator	Navephat S.
Start Time	11:01	Finish Time	11:41
SO <sub>2</sub> Analyzer Model	TELEDYNE API 200BH	Serial No.	774
Span (%)	25		

	Cylinder Value (%)	Initial Analyzers Calibration Response (%)	Final Analyzers Calibration Response (%)	Difference (Percent of Span)
Zero Gas	0.00	0.00	0.10	0.40
Low-Level Gas	8.05	8.00	7.90	0.45
Span Gas	15.06	15.05	15.90	0.65

CO ANALYZER		Serial No.	426
Model	TELEDYNE API 300BH		
Span (ppm)	200		

	Cylinder Value (ppm)	Initial Analyzers Calibration Response (ppm)	Final Analyzers Calibration Response (ppm)	Difference (Percent of Span)
Zero Gas	0.00	0.00	0.00	0.00
Low-Level Gas	49.99	50.00	50.00	0.00
Span Gas	197.50	197.50	197.30	0.10

Calibrated by  
*Navephat S.*  
(Mr.Navephat Sathiyas)  
Environmental Field Scientist (2)  
FORM NO. F 06-062 REVISION NO. 2 ISSUE DATE: 3/06/19  
ALS Laboratory Group



### EMISSION TEST RESULT

Client	Gulf NRVY Co., Ltd.	Run #	1
Date	26 May 22	Location	Mae HRBG 12
Start Time	11:01	Test Operator	Navephat S.
SO <sub>2</sub> Analyzer Model	TELEDYNE API 100BH	Finish Time	11:40
NO <sub>x</sub> /CO <sub>2</sub> Analyzer Model	TELEDYNE API 200BH	Serial No.	410
CO/CO <sub>2</sub> Analyzer Model	TELEDYNE API 300BH	Serial No.	774
		Serial No.	426

Time (min)	O <sub>2</sub> (%)	CO <sub>2</sub> (%)	HCx (ppm)	SO <sub>2</sub> (ppm)	CO (ppm)	Remark
13:41	15.13	3.86	-	-	0.60	
13:42	15.14	3.83	-	-	0.55	
13:47	15.15	3.85	-	-	0.66	
13:48	15.21	3.77	-	-	0.77	
13:49	15.16	3.81	-	-	0.61	
13:50	15.13	3.88	-	-	0.93	
13:51	15.13	3.84	-	-	0.87	
13:52	15.13	3.86	-	-	0.92	
13:53	15.13	3.88	-	-	0.95	
13:54	15.12	3.86	-	-	0.91	
13:55	15.12	3.87	-	-	0.84	
13:59	15.13	3.83	-	-	0.71	
13:57	15.14	3.85	-	-	0.74	
13:58	15.14	3.85	-	-	0.48	
13:59	15.15	3.84	-	-	0.54	
14:00	15.20	3.83	-	-	0.58	
14:01	15.13	3.87	-	-	0.65	
14:02	15.12	3.81	-	-	0.84	
14:03	15.13	3.85	-	-	0.55	
14:04	15.14	3.82	-	-	0.69	
14:05	15.14	3.83	-	-	0.57	
Average	15.14	3.84	-	-	0.72	

*Navephat S.*  
(Mr.Navephat Sathiyas)  
Environmental Field Scientist (2)



### EMISSION TEST RESULT

Client	Gulf NRVY Co., Ltd.	Run #	1
Date	26 May 22	Location	Mae HRBG 11
Start Time	11:02	Test Operator	Navephat S.
SO <sub>2</sub> Analyzer Model	TELEDYNE API 100BH	Finish Time	11:39
NO <sub>x</sub> /CO <sub>2</sub> Analyzer Model	TELEDYNE API 200BH	Serial No.	410
CO/CO <sub>2</sub> Analyzer Model	TELEDYNE API 300BH	Serial No.	774
		Serial No.	426

Time (min)	O <sub>2</sub> (%)	CO <sub>2</sub> (%)	HCx (ppm)	SO <sub>2</sub> (ppm)	CO (ppm)	Remark
11:00	14.83	4.94	-	-	1.30	
11:01	14.86	4.92	-	-	1.30	
11:02	14.85	4.93	-	-	1.21	
11:03	14.87	4.91	-	-	1.13	
11:04	14.85	4.98	-	-	1.06	
11:05	14.84	4.93	-	-	1.06	
11:06	14.82	4.99	-	-	1.09	
11:07	14.83	4.94	-	-	1.07	
11:08	14.83	4.99	-	-	0.98	
11:09	14.85	4.99	-	-	0.95	
11:10	14.84	4.97	-	-	0.86	
11:11	14.84	4.97	-	-	0.85	
11:12	14.84	4.98	-	-	0.83	
11:13	14.83	4.98	-	-	0.83	
11:14	14.85	4.95	-	-	0.80	
11:15	14.84	4.93	-	-	0.75	
11:16	14.85	4.96	-	-	0.72	
11:17	14.85	4.95	-	-	0.65	
11:18	14.83	4.97	-	-	0.67	
11:19	14.85	4.93	-	-	0.61	
11:20	14.84	4.94	-	-	0.57	
Average	14.88	4.95	-	-	0.82	

*Navephat S.*  
(Mr.Navephat Sathiyas)  
Environmental Field Scientist (2)



### EMISSION TEST RESULT

Client	Gulf NRVY Co., Ltd.	Run #	3
Date	26 May 22	Location	Mae HRBG 11
Start Time	11:42	Test Operator	Navephat S.
SO <sub>2</sub> Analyzer Model	TELEDYNE API 100BH	Finish Time	12:02
NO <sub>x</sub> /CO <sub>2</sub> Analyzer Model	TELEDYNE API 200BH	Serial No.	410
CO/CO <sub>2</sub> Analyzer Model	TELEDYNE API 300BH	Serial No.	774
		Serial No.	426

Time (min)	O <sub>2</sub> (%)	CO <sub>2</sub> (%)	HCx (ppm)	SO <sub>2</sub> (ppm)	CO (ppm)	Remark
11:42	15.19	3.80	-	-	0.58	
11:43	15.18	3.78	-	-	0.60	
11:44	15.19	3.79	-	-	0.66	
11:45	15.19	3.80	-	-	0.63	
11:46	15.20	3.80	-	-	0.60	
11:47	15.20	3.77	-	-	0.60	
11:48	15.21	3.81	-	-	0.59	
11:49	15.18	3.78	-	-	0.64	
11:50	15.18	3.78	-	-	0.56	
11:51	15.20	3.88	-	-	0.11	
11:52	15.20	3.79	-	-	0.12	
11:53	15.21	3.80	-	-	0.18	
11:54	15.21	3.74	-	-	0.17	
11:55	15.21	3.78	-	-	0.25	
11:56	15.22	3.78	-	-	0.22	
11:57	15.21	3.75	-	-	0.27	
11:58	15.23	3.78	-	-	0.29	
11:59	15.22	3.72	-	-	0.25	
12:00	15.25	3.77	-	-	0.31	
12:01	15.24	3.75	-	-	0.33	
12:02	15.23	3.79	-	-	0.28	
Average	15.21	3.78	-	-	0.18	

*Navephat S.*  
(Mr.Navephat Sathiyas)  
Environmental Field Scientist (2)



### SYSTEM CALIBRATION BIAS AND DRIFT DATA

Client	Gulf NRVY Co., Ltd.	Location	Mae HRBG 12
Date	26 May 22	Test Operator	Navephat S.
Start Time	11:01	Finish Time	11:41
SO <sub>2</sub> Analyzer Model	TELEDYNE API 100BH	Serial No.	410
NO <sub>x</sub> /CO <sub>2</sub> Analyzer Model	TELEDYNE API 200BH	Serial No.	774
CO/CO <sub>2</sub> Analyzer Model	TELEDYNE API 300BH	Serial No.	426

	O <sub>2</sub> Analyzer Calibration Response	Initial Values System Calibration Response	System Cal Bias (% of Span)	Final Values System Calibration Response	System Cal Bias (% of Span)	Drift (% of Span)
Zero Gas	0.00	0.00	0.00	0.10	0.40	0.40
Upstate Gas	15.05	15.30	0.60	15.30	0.60	0.00

CO ANALYZER		Serial No.	426
Cylinder Conc. (ppm)	167.20		
Span (ppm)	200		

	CO Analyzer Calibration Response	Initial Values System Calibration Response	System Cal Bias (% of Span)	Final Values System Calibration Response	System Cal Bias (% of Span)	Drift (% of Span)
Zero Gas	0.00	0.00	0.00	0.00	0.00	0.00
Upstate Gas	157.50	157.30	0.10	157.30	0.10	0.00

Calibrated by  
*Navephat S.*  
(Mr.Navephat Sathiyas)  
Environmental Field Scientist (2)





### EMISSION TEST RESULT

Client	Out HRYI Co., Ltd.	Run #	3
Date	26 May 22	Location	Site 1000 12
Start Time	1427	Test Operator	Narephat S.
CO <sub>2</sub> Analyzer Model	TELEDYNE API 100SH	Field No.	410
NO <sub>x</sub> /CO <sub>2</sub> Analyzer Model	TELEDYNE API 200SH	Serial No.	774
CO/CO <sub>2</sub> Analyzer Model	TELEDYNE API 800SH	Serial No.	426

Time (min)	CO <sub>2</sub> (%)	CO <sub>2</sub> (%)	NO <sub>x</sub> (ppm)	NO <sub>x</sub> (ppm)	CO (ppm)	Remark
14:27	15.14	3.80	-	-	8.15	
14:28	15.15	3.83	-	-	8.32	
14:29	15.15	3.84	-	-	8.29	
14:30	15.15	3.81	-	-	8.19	
14:31	15.16	3.81	-	-	8.25	
14:32	15.16	3.81	-	-	8.12	
14:33	15.17	3.88	-	-	8.10	
14:34	15.17	3.83	-	-	8.12	
14:35	15.17	3.83	-	-	8.06	
14:36	15.18	3.81	-	-	8.01	
14:37	15.18	3.77	-	-	8.05	
14:38	15.18	3.79	-	-	7.98	
14:39	15.19	3.77	-	-	8.03	
14:40	15.23	3.83	-	-	8.05	
14:41	15.18	3.85	-	-	8.31	
14:42	15.16	3.78	-	-	7.95	
14:43	15.14	3.81	-	-	8.10	
14:44	15.17	3.80	-	-	8.31	
14:45	15.17	3.80	-	-	8.21	
14:46	15.17	3.83	-	-	8.15	
14:47	15.17	3.80	-	-	8.20	
Average	15.17	3.81	ND/ND	ND/ND	8.08	

(Mr. Narephat S. Sathya)

Environmental Field Scientist (2)

FORM NO. F-06-02 REVISION NO. 2 ISSUE DATE: 2019/10

ALS Laboratory Group



### CERTIFICATE OF ANALYSIS

Grade of Product: EPA Protocol

Part Number: 0240000340003 Reference Number: 100-4017541321-1  
Cylinder Number: 0240000340003 Cylinder Pressure: 2412 CF  
Laboratory: 124 - Pharmaceuticals - PA Value Outlet: 860  
POVP Number: A10205 Certification Date: Mar 28, 2022  
Gas Code: CO NO NOX SO2 SULFUR

Registration Date: Mar 28, 2022

ANALYTICAL RESULTS

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Acceptance Criteria
CO	100.00 ppm	100.00 ppm	01	± 0.1% (100.00 ppm)	100.00 ppm ± 0.10 ppm
NO	100.00 ppm	100.00 ppm	01	± 0.1% (100.00 ppm)	100.00 ppm ± 0.10 ppm
NO2	100.00 ppm	100.00 ppm	01	± 0.1% (100.00 ppm)	100.00 ppm ± 0.10 ppm

Type	Lot ID	Cylinder No.	Concentration	Uncertainty	Expiration Date
CO	100.0000	0240000340003	100.00 ppm	± 0.1%	Mar 28, 2022
NO	100.0000	0240000340003	100.00 ppm	± 0.1%	Mar 28, 2022
NO2	100.0000	0240000340003	100.00 ppm	± 0.1%	Mar 28, 2022

Equipment/Model	Lot ID	Calibration No.	Concentration	Uncertainty	Expiration Date
CO	100.0000	0240000340003	100.00 ppm	± 0.1%	Mar 28, 2022
NO	100.0000	0240000340003	100.00 ppm	± 0.1%	Mar 28, 2022
NO2	100.0000	0240000340003	100.00 ppm	± 0.1%	Mar 28, 2022

Trace Data Available Upon Request  
NOTES: Gross Weight: 47.7 kg, Net Weight: 7.8 kg



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Page 1 of 100-4017541321-1



### EMISSION TEST RESULT

Client	Out HRYI Co., Ltd.	Run #	2
Date	26 May 22	Location	Site 1000 12
Start Time	1429	Test Operator	Narephat S.
CO <sub>2</sub> Analyzer Model	TELEDYNE API 100SH	Field No.	410
NO <sub>x</sub> /CO <sub>2</sub> Analyzer Model	TELEDYNE API 200SH	Serial No.	774
CO/CO <sub>2</sub> Analyzer Model	TELEDYNE API 800SH	Serial No.	426

Time (min)	CO <sub>2</sub> (%)	CO <sub>2</sub> (%)	NO <sub>x</sub> (ppm)	NO <sub>x</sub> (ppm)	CO (ppm)	Remark
14:09	15.14	3.83	-	-	8.47	
14:10	15.14	3.85	-	-	8.54	
14:11	15.14	3.82	-	-	8.52	
14:12	15.15	3.84	-	-	8.33	
14:13	15.15	3.83	-	-	8.32	
14:14	15.15	3.84	-	-	8.24	
14:15	15.16	3.82	-	-	8.24	
14:16	15.16	3.84	-	-	8.32	
14:17	15.14	3.81	-	-	8.41	
14:18	15.14	3.84	-	-	8.28	
14:19	15.15	3.85	-	-	8.19	
14:20	15.15	3.82	-	-	8.27	
14:21	15.15	3.81	-	-	8.34	
14:22	15.15	3.81	-	-	8.23	
14:23	15.15	3.81	-	-	8.31	
14:24	15.16	3.82	-	-	8.55	
14:25	15.15	3.82	-	-	8.35	
14:26	15.15	3.81	-	-	8.10	
Average	15.15	3.82	-	-	8.28	

(Mr. Narephat S. Sathya)

Environmental Field Scientist (2)

FORM NO. F-06-02 REVISION NO. 2 ISSUE DATE: 2019/10

ALS Laboratory Group



### CERTIFICATE OF ANALYSIS

Grade of Product: EPA Protocol

Part Number: 0240000340003 Reference Number: 100-4017541321-1  
Cylinder Number: 0240000340003 Cylinder Pressure: 2412 CF  
Laboratory: 124 - Pharmaceuticals - PA Value Outlet: 860  
POVP Number: A10205 Certification Date: Mar 28, 2022  
Gas Code: CO NO NOX SO2 SULFUR

Registration Date: Mar 28, 2022

ANALYTICAL RESULTS

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Acceptance Criteria
CO	100.00 ppm	100.00 ppm	01	± 0.1% (100.00 ppm)	100.00 ppm ± 0.10 ppm
NO	100.00 ppm	100.00 ppm	01	± 0.1% (100.00 ppm)	100.00 ppm ± 0.10 ppm
NO2	100.00 ppm	100.00 ppm	01	± 0.1% (100.00 ppm)	100.00 ppm ± 0.10 ppm

Type	Lot ID	Cylinder No.	Concentration	Uncertainty	Expiration Date
CO	100.0000	0240000340003	100.00 ppm	± 0.1%	Mar 28, 2022
NO	100.0000	0240000340003	100.00 ppm	± 0.1%	Mar 28, 2022
NO2	100.0000	0240000340003	100.00 ppm	± 0.1%	Mar 28, 2022

Equipment/Model	Lot ID	Calibration No.	Concentration	Uncertainty	Expiration Date
CO	100.0000	0240000340003	100.00 ppm	± 0.1%	Mar 28, 2022
NO	100.0000	0240000340003	100.00 ppm	± 0.1%	Mar 28, 2022
NO2	100.0000	0240000340003	100.00 ppm	± 0.1%	Mar 28, 2022

Trace Data Available Upon Request  
NOTES: Gross Weight: 47.7 kg, Net Weight: 7.8 kg



Approved for Release

Page 1 of 100-4017541321-1







**PENTA CALIBRATION**  
PENTA CALIBRATION CO., LTD.  
88/119 The Corner 33 Village International Road  
Bangkok, Thailand 10110  
Tel: +66 (0) 2058-4771  
www.pentacal.com

## Certificate of Calibration

Report to Certificate of Calibration: PTC001181

Certificate No.: PTC001181 Page: 1 of 2

Equipment: Digital Balance Condition: Normal

Manufacturer: Ohaus Serial No.: 30300000

Model: N11111111111111111111

Type of Service: Single Interval

Calibrated: ALS Laboratory Group (Thailand) Co., Ltd.  
104 Prathumwan 40, Prathumwan Rd.,  
Klongkum Prathumwan, Klongkum Sub District, Bangkok 10110

Environment Condition: Temperature: 23.4 °C ± 0.4 °C  
Humidity: 58.1 %RH ± 0.7 %RH  
Air density: 1.19 kg/m³

Calibration Place: ALS Laboratory Group (Thailand) Co., Ltd.  
104 Prathumwan 40, Prathumwan Rd.,  
Klongkum Prathumwan, Klongkum Sub District, Bangkok 10110

The Method used: In house method, PTC-001181, based on Balance eq. 19

Traceability: The certificate is traceable to the SI Unit through Thai Calibration Service Co., Ltd.  
MCO-0000 Accreditation No.: Calibration 0149

Date Received: December 16, 2021

Calibration Date: December 16, 2021

Next Date: December 16, 2022

Calibration By: Mr. Nattawat Jantapan

Approved By: Mr. Nattawat Jantapan  
Laboratory Manager

This certificate is issued to the user of the equipment according to the International System of Units (SI). A certificate of calibration is not a guarantee of accuracy. The user is responsible for the accuracy of the results. The user is responsible for the accuracy of the results. The user is responsible for the accuracy of the results.

**ALS**

## High Volume Air Sampler Calibration Worksheet

Project Site: Gulf NRV1 Co., Ltd. Barometric Pressure (mm Hg): 743

Calibrate Location: กรุงเทพมหานคร Barometric Pressure (mm Hg): 743

Calibrate Date: 23-May-22 Temperature (°C): 33

CalibrationSheet No.: C-230522-NKH-F50050 High Volume ID: NKH-F50050

Calibrator ID: NKH-F50044 High Volume S/N: 5853

Calibrator Model: TE-5028A Calibrator Slope: 1.64919

Calibrator S/N: 3681 Calibrator Intercept: -0.06996

Test No.	Delta H <sub>2</sub> O (inch)	Q <sub>air</sub> (m³/min)	I: Chart (CFM)	Linear Regression
1	2.2	0.9475	40	Slope: 33.4705
2	3.0	1.0947	44	Intercept: 7.6898
3	4.2	1.2825	50	Correlation Coefficient: 0.9973
4	5.0	1.3929	54	
5	6.2	1.5431	60	

Calibrated by: Sangtawan N. (Mr. Sangtawan Natasat) Field Scientist (1)

Approved by: N. Jantapan (Mr. Noppong Jantapan) Enviro Field Coordinator Scientist (3)

FORM NO.: F-06-073 REVISION NO.: ISSUE DATE: 14/03/16

**ALS**

## High Volume Air Sampler Calibration Worksheet

Project Site: Gulf NRV1 Co., Ltd. Barometric Pressure (mm Hg): 743

Calibrate Location: กรุงเทพมหานคร Barometric Pressure (mm Hg): 743

Calibrate Date: 23-May-22 Temperature (°C): 33

CalibrationSheet No.: C-230522-NKH-F50049 High Volume ID: NKH-F50049

Calibrator ID: NKH-F50044 High Volume S/N: 5852

Calibrator Model: TE-5028A Calibrator Slope: 1.64919

Calibrator S/N: 3681 Calibrator Intercept: -0.06996

Test No.	Delta H <sub>2</sub> O (inch)	Q <sub>air</sub> (m³/min)	I: Chart (CFM)	Linear Regression
1	2.4	0.9865	40	Slope: 35.3682
2	3.0	1.0947	44	Intercept: 5.0375
3	4.2	1.2825	50	Correlation Coefficient: 0.9991
4	5.0	1.3929	54	
5	6.2	1.5431	60	

Calibrated by: Sangtawan N. (Mr. Sangtawan Natasat) Field Scientist (1)

Approved by: N. Jantapan (Mr. Noppong Jantapan) Enviro Field Coordinator Scientist (3)

FORM NO.: F-06-073 REVISION NO.: ISSUE DATE: 14/03/16

**ALS**

## PROBE NOZZLE DIAMETER CALIBRATION DATA SHEET

Calibration Date: 4 Jan 22 Nozzle Set ID.: BKK-F50602

Calibration Sheet No.: C-040122-228-2-32-07 Verier Caliper ID.: BKK-F50626

Nozzle ID #	Nozzle Diameter (cm)			Hi - Lo ΔD	(D <sub>1</sub> + D <sub>2</sub> + D <sub>3</sub> ) / 3
	D <sub>1</sub>	D <sub>2</sub>	D <sub>3</sub>		
1	0.315	0.315	0.315	0.000	0.315
2	0.475	0.475	0.475	0.000	0.475
3	0.635	0.635	0.635	0.000	0.635
4	0.790	0.790	0.790	0.000	0.790
5	0.950	0.950	0.950	0.000	0.950
6	1.110	1.110	1.110	0.000	1.110
7	1.270	1.270	1.270	0.000	1.270

Where:  
D<sub>1</sub>, D<sub>2</sub>, D<sub>3</sub> = Three different nozzle diameters at 60 degrees to each other, each measured the nearest 0.025 mm.  
ΔD = Maximum distance between any two diameters, must be ≤ 0.100 mm.  
D<sub>avg</sub> = (D<sub>1</sub> + D<sub>2</sub> + D<sub>3</sub>) / 3

Calibrated by: Chawatt (Mr. Chawatt Wongchan) Field Scientist (2)

Approved by: Mr. Samart Roo-ngan Field Specialist (1)

FORM NO.: F-06-073 REVISION NO.: ISSUE DATE: 14/03/16

**PENTA CALIBRATION**  
PENTA CALIBRATION CO., LTD.  
88/119 The Corner 33 Village International Road  
Bangkok, Thailand 10110  
Tel: +66 (0) 2058-4771  
www.pentacal.com

## Report to Certificate of Calibration: PTC001181

Certificate No.: PTC001181 Page: 2 of 2

### Measurement Results:

Without Adjustment

Function Calibration: Internal Calibration

Source Error: Weight to be 10.00 ± 0.01 or 10.00 ± 0.01

Repeatability Test: Weight to be 10.00 ± 0.01 or 10.00 ± 0.01

Dispersion of the standard deviation of weighing balance: Repeatability: 0.0001 g

Measured test value (g)	Standard Deviation
10.0000	0.0001

Error of indication: From nominal value, Repeatability: 0.0001 g

Nominal Value (g)	Conventional Mass (g)	Indication (g)	Correction of Reading (g)	Uncertainty (g)	k
0	0.0000	0.0000	0.0000	0.00010	0.97
0.01	0.0100	0.0100	0.0000	0.00010	0.99
0.02	0.0200	0.0200	0.0000	0.00010	0.97
0.05	0.0500	0.0500	0.0000	0.00010	0.99
0.1	0.1000	0.1000	0.0000	0.00010	0.99
0.2	0.2000	0.2000	0.0000	0.00010	0.99
0.5	0.5000	0.5000	0.0000	0.00010	0.99
1	1.0000	1.0000	0.0000	0.00010	0.99
2	2.0000	2.0000	0.0000	0.00010	0.99
5	5.0000	5.0000	0.0000	0.00010	0.99
10	10.0000	10.0000	0.0000	0.00010	0.99
20	20.0000	20.0000	0.0000	0.00010	0.99
50	50.0000	50.0000	0.0000	0.00010	0.99
100	100.0000	100.0000	0.0000	0.00010	0.99
200	200.0000	200.0000	0.0000	0.00010	0.99

Note: Weight of actual: 10.0000 g

The End of Certificate

**ALS**

## High Volume Air Sampler Calibration Worksheet

Project Site: Gulf NRV1 Co., Ltd. Barometric Pressure (mm Hg): 743

Calibrate Location: กรุงเทพมหานคร Barometric Pressure (mm Hg): 743

Calibrate Date: 23-May-22 Temperature (°C): 33

CalibrationSheet No.: C-230522-NKH-F50051 High Volume ID: NKH-F50051

Calibrator ID: NKH-F50044 High Volume S/N: 5854

Calibrator Model: TE-5028A Calibrator Slope: 1.64919

Calibrator S/N: 3681 Calibrator Intercept: -0.06996

Test No.	Delta H <sub>2</sub> O (inch)	Q <sub>air</sub> (m³/min)	I: Chart (CFM)	Linear Regression
1	2.4	0.9865	40	Slope: 35.3682
2	3.0	1.0947	44	Intercept: 5.0375
3	4.2	1.2825	50	Correlation Coefficient: 0.9991
4	5.0	1.3929	54	
5	6.2	1.5431	60	

Calibrated by: Sangtawan N. (Mr. Sangtawan Natasat) Field Scientist (1)

Approved by: N. Jantapan (Mr. Noppong Jantapan) Enviro Field Coordinator Scientist (3)

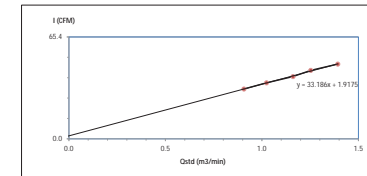
FORM NO.: F-06-073 REVISION NO.: ISSUE DATE: 14/03/16






Project Site:	Gulf NREY Co Ltd	Barometric Pressure (mm Hg)	743
Calibration Location:	22.994333; 93.999999	Temperature (°C)	33
Calibration Date:	22-May-22	High Volume ID:	NHJ_F50047
Calibration Sheet No:	C-230522-NHJ_F50047	High Volume Model:	TE_5020VX
Calibrator ID:	NHJ_F50046	High Volume S/N:	5848
Calibrator Model:	TE_5020SA	Calibrator Slope:	1.64919
Calibrator S/N:	3681	Calibrator Intercept:	-0.06996

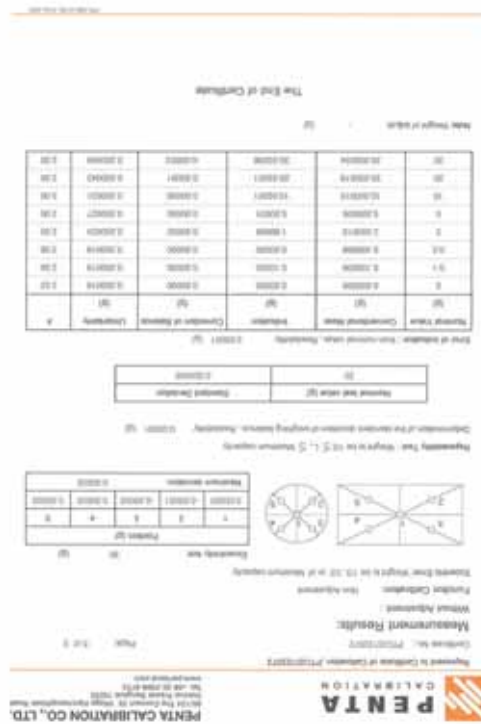
Test No.	Delta H <sub>2</sub> O (inch)	Q <sub>avg</sub> (m <sup>3</sup> /min)	I : Chart (CFM)	Linear Regression
1	2.0	0.9067	32	Slope : 33.1862 Intercept : 1.9175 Correlation Coefficient : 0.998
2	2.6	1.0240	36	
3	3.4	1.1609	40	
4	4.0	1.2533	44	
5	5.0	1.3929	48	



Calibrated by Sangtawan N  
( Mr.Sangtawan Natasat )  
Field Scientist(1)

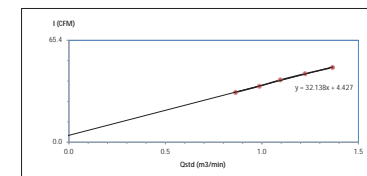
Approved by :   
(Mr. Noppong Juntarup)  
Enviro Field Coordinator Scientist (3

FORM NO.: F 06-074 REVISION NO.: - ISSUE DATE: 14/03/16



Project Site:	Gulf NREI Co Ltd	Barometric Pressure (mm Hg):	743
Calibrate Location:	Tsitsiriki Promenade	Temperature (°C):	33
Calibrate Date:	23 May 22	High Volume ID:	NKH-F50046
Calibration/Shot No.:	C-230522-NKH-F50046	High Volume Model:	TE-50095
Calibrator ID:	NKH-F50044	High Volume S/N:	5847
Calibrator Model:	TE-5028A	Calibrator Slope:	1.64919
Calibrator S/N:	3681	Calibrator Intercept:	-0.06996

Test No.	Delta H <sub>2</sub> O (inch)	Q <sub>out</sub> (m <sup>3</sup> /min)	I : Chart (CFM)	Linear Regression	
1	1.8	0.8637	32	Slope :	32.1377
2	2.4	0.9865	36	Intercept :	4.4270
3	3.0	1.0947	40	Correlation Coefficient :	0.999
4	3.8	1.2233	44		
5	4.8	1.3662	48		



Calibrated by Sangtawan N  
( Mr.Sangtawan Natasat )

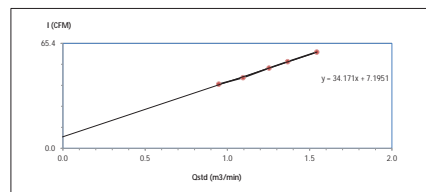
Approved by : \_\_\_\_\_  
(Mr. Noppong Juntarapan)  
Enviro Field Coordinator Scientist (3)

FORM NO.: F 06-074 REVISION NO.: - ISSUE DATE: 14/03/16




Project Site:	Gul/NSVI Co., Ltd.	Barometric Pressure (mm Hg):	743
Calibrate Location:	5a-2nd floor, 5a-2	Temperature (°C):	23
Calibrate Date:	23-May-22	High Volume ID:	NKH-F30052
Calibration Sheet No.:	C-200522-NKH-F30052	High Volume Model:	TE-5170D
Calibrator ID:	NKH-F30044	High Volume S/N:	5855
Calibrator Model:	TE-5028A	Calibrator Slope:	1.64919
Calibrator S/N:	3461	Calibrator Intercept:	-0.06996

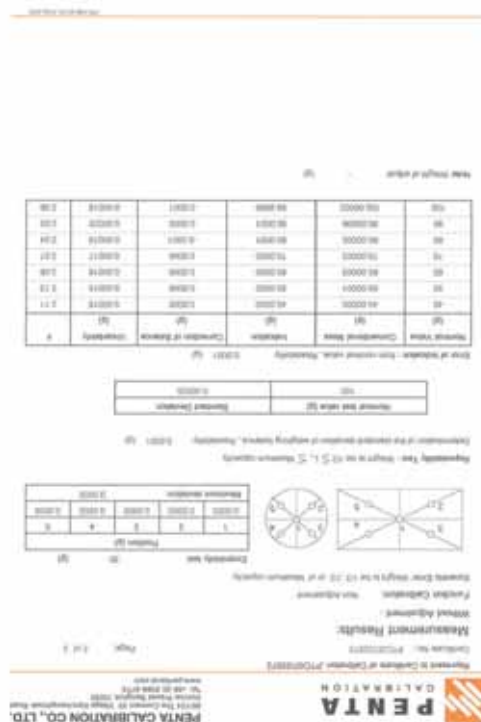
Test No.	Delta H <sub>2</sub> O (inch)	Q <sub>del</sub> (m <sup>3</sup> /min)	I: Chart (CFM)	Linear Regression	
1	2.2	0.9475	40	Slope :	34.1709
2	3.0	1.0947	44	Intercept :	7.1951
3	4.0	1.2533	50	Correlation Coefficient :	0.9989
4	4.8	1.3662	54		
5	6.2	1.5431	60		



Calibrated by Sangtawan N.  
(Mr.Sangtawan Natasat )  
Field Scientist(1)

Approved by :   
(Mr. Noppong Juntarupan)  
Enviro Field Coordinator Scientist (3)

FORM NO.: F 06-073 REVISION NO.: - ISSUE DATE: 14/03/16



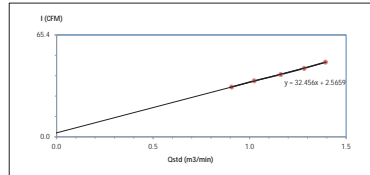




### High Volume Air Sampler Calibration Worksheet

Project Site : Gulf NRT-1 Co., Ltd. Barometric Pressure (mm Hg) : 743  
Calibrate Location : 56 Tachin Road, Bangkok, Thailand Temperature (°C) : 33  
Calibrate Date : 23-May-22 High Volume ID : NKH\_F30045  
Calibration Sheet No. : C-230522-NKH-F30045 High Volume Model : TE-5009X  
Calibrator ID : NKH\_F30044 High Volume S/N : 5846  
Calibrator Model : TE-5026A Calibrator Slope : 1.64919  
Calibrator S/N : 3681 Calibrator Intercept : -0.00996

Test No.	Delta H <sub>2</sub> O (inch)	Q <sub>sp</sub> (m <sup>3</sup> /min)	I : Chart (CFM)	Linear Regression
1	2.6	0.9667	32	Slope : 32.4559
2	2.6	1.0248	36	Intercept : 2.5659
3	3.4	1.1689	40	Correlation Coefficient : 0.9994
4	4.2	1.2825	44	
5	5.0	1.3929	48	



Calibrated by :   
( Mr. Sangtawan Natasat )  
Field Scientist (1)

Approved by :   
( Mr. Noppong Jintanont )  
Enviro Field Coordinator Scientist (3)

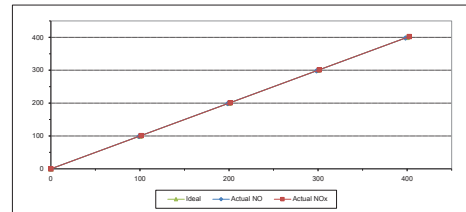
FORM NO. : F 06-074 REVISION NO. : ISSUE DATE : 14/03/16



### MULTIPOINT CALIBRATION REPORT

Calibration Date : 4-Jan-22 Equipment Name : NOx Analyzer  
Manufacturer : HORIBA Model : APNA-370  
Serial No. : GESG2AB Equipment ID : NKH\_F80084  
Calibrator Manufacturer : Teledyne API Model : 700  
Serial No. : 947  
Std. Gas Concentration (PPM) : 51.33 Cylinder No. : LL38633  
Cylinder Pressure (psi) : 1200 Certified By : Algas Inc.  
Certified Date : 18-Mar-14 Expired Date : 18-Mar-22

CALIBRATION RESULTS							
Point	Ideal	Actual NO	Error NO	%Error NO	Actual NOx	Error NOx	%Error NOx
ZERO	0.00	0.10	0.10	0.10	0.10	0.10	0.10
1	100.00	99.00	-1.00	-1.00	101.30	1.30	1.30
2	200.00	198.50	-1.50	-0.75	201.30	1.30	0.65
3	300.00	298.40	-1.60	-0.53	301.40	1.40	0.47
4	400.00	398.20	-1.80	-0.45	402.50	2.50	0.63
AVERAGE (%)				-0.63			0.63



Calibrated By :   
( Mr. Jirawut Sakam )  
Field Environmental Scientist (3)

Approved By :   
( Mr. Sarayuth Jitranont )  
Assistant General Manager

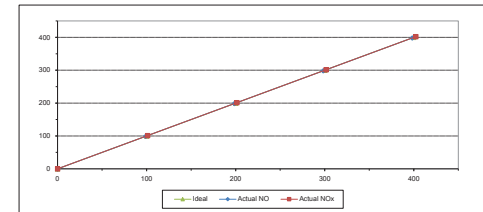
ALS Laboratory Group  
FORM NO. : F 06-056 REVISION NO. : ISSUE DATE : 02/04/12



### MULTIPOINT CALIBRATION REPORT

Calibration Date : 4-Jan-22 Equipment Name : NOx Analyzer  
Manufacturer : HORIBA Model : APNA-370  
Serial No. : RZTHDXTY Equipment ID : NKH\_F80078  
Calibrator Manufacturer : Teledyne API Model : 700  
Serial No. : 947  
Std. Gas Concentration (PPM) : 51.33 Cylinder No. : LL38633  
Cylinder Pressure (psi) : 1200 Certified By : Algas Inc.  
Certified Date : 18-Mar-14 Expired Date : 18-Mar-22

CALIBRATION RESULTS							
Point	Ideal	Actual NO	Error NO	%Error NO	Actual NOx	Error NOx	%Error NOx
ZERO	0.00	0.10	0.10	0.10	0.10	0.10	0.10
1	100.00	99.00	-1.00	-1.00	101.20	1.20	1.20
2	200.00	198.50	-1.50	-0.75	201.50	1.50	0.75
3	300.00	298.40	-1.60	-0.53	301.50	1.50	0.50
4	400.00	398.30	-1.70	-0.42	402.30	2.30	0.58
AVERAGE (%)				-0.62			0.63



Calibrated By :   
( Mr. Jirawut Sakam )  
Field Environmental Scientist (3)

Approved By :   
( Mr. Sarayuth Jitranont )  
Assistant General Manager

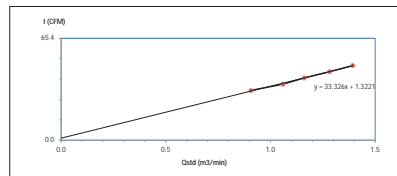
ALS Laboratory Group  
FORM NO. : F 06-056 REVISION NO. : ISSUE DATE : 02/04/12



### High Volume Air Sampler Calibration Worksheet

Project Site : Gulf NRT-1 Co., Ltd. Barometric Pressure (mm Hg) : 743  
Calibrate Location : 56 Tachin Road, Bangkok, Thailand Temperature (°C) : 33  
Calibrate Date : 23-May-22 High Volume ID : NKH\_F30048  
Calibration Sheet No. : C-230522-NKH-F30048 High Volume Model : TE-5009X  
Calibrator ID : NKH\_F30044 High Volume S/N : 5849  
Calibrator Model : TE-5026A Calibrator Slope : 1.64919  
Calibrator S/N : 3681 Calibrator Intercept : -0.00996

Test No.	Delta H <sub>2</sub> O (inch)	Q <sub>sp</sub> (m <sup>3</sup> /min)	I : Chart (CFM)	Linear Regression
1	2.6	0.9667	32	Slope : 33.3261
2	2.8	1.0660	36	Intercept : 1.3221
3	3.4	1.1689	40	Correlation Coefficient : 0.9978
4	4.2	1.2825	44	
5	5.0	1.3929	48	



Calibrated by :   
( Mr. Sangtawan Natasat )  
Field Scientist (1)

Approved by :   
( Mr. Noppong Jintanont )  
Enviro Field Coordinator Scientist (3)

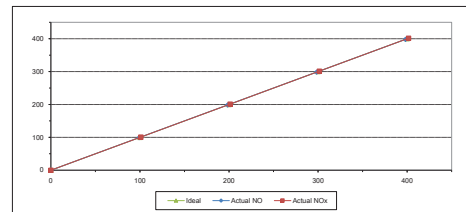
FORM NO. : F 06-074 REVISION NO. : ISSUE DATE : 14/03/16



### MULTIPOINT CALIBRATION REPORT

Calibration Date : 4-Jan-22 Equipment Name : NOx Analyzer  
Manufacturer : HORIBA Model : APNA-370  
Serial No. : RCWXYMBS Equipment ID : NKH\_F80080  
Calibrator Manufacturer : Teledyne API Model : 700  
Serial No. : 947  
Std. Gas Concentration (PPM) : 51.33 Cylinder No. : LL38633  
Cylinder Pressure (psi) : 1200 Certified By : Algas Inc.  
Certified Date : 18-Mar-14 Expired Date : 18-Mar-22

CALIBRATION RESULTS							
Point	Ideal	Actual NO	Error NO	%Error NO	Actual NOx	Error NOx	%Error NOx
ZERO	0.00	0.10	0.10	0.10	0.10	0.10	0.10
1	100.00	99.20	-0.80	-0.80	101.00	1.00	1.00
2	200.00	198.50	-1.50	-0.75	201.30	1.30	0.65
3	300.00	298.50	-1.50	-0.50	301.50	1.50	0.50
4	400.00	398.20	-1.80	-0.45	401.60	1.60	0.40
AVERAGE (%)				-0.48			0.53



Calibrated By :   
( Mr. Jirawut Sakam )  
Field Environmental Scientist (3)

Approved By :   
( Mr. Sarayuth Jitranont )  
Assistant General Manager

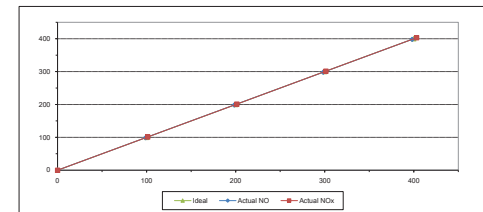
ALS Laboratory Group  
FORM NO. : F 06-056 REVISION NO. : ISSUE DATE : 02/04/12



### MULTIPOINT CALIBRATION REPORT

Calibration Date : 4-Jan-22 Equipment Name : NOx Analyzer  
Manufacturer : HORIBA Model : APNA-370  
Serial No. : MB83MPX3 Equipment ID : NKH\_F80082  
Calibrator Manufacturer : Teledyne API Model : 700  
Serial No. : 947  
Std. Gas Concentration (PPM) : 51.33 Cylinder No. : LL38633  
Cylinder Pressure (psi) : 1200 Certified By : Algas Inc.  
Certified Date : 18-Mar-14 Expired Date : 18-Mar-22

CALIBRATION RESULTS							
Point	Ideal	Actual NO	Error NO	%Error NO	Actual NOx	Error NOx	%Error NOx
ZERO	0.00	0.10	0.10	0.10	0.10	0.10	0.10
1	100.00	99.00	-1.00	-1.00	101.30	1.30	1.30
2	200.00	198.50	-1.50	-0.75	201.30	1.30	0.65
3	300.00	298.40	-1.60	-0.53	301.40	1.40	0.47
4	400.00	398.20	-1.80	-0.45	403.20	3.20	0.80
AVERAGE (%)				-0.53			0.68



Calibrated By :   
( Mr. Jirawut Sakam )  
Field Environmental Scientist (3)

Approved By :   
( Mr. Sarayuth Jitranont )  
Assistant General Manager

ALS Laboratory Group  
FORM NO. : F 06-056 REVISION NO. : ISSUE DATE : 02/04/12











## CERTIFICATE OF CALIBRATION

Certificate No: WD-02000201  
Page 1 of 2 pages

Measurement Item : Wind direction sensor with data logger.

Manufacturer : Data logger: Novolynx.  
: Wind direction sensor: Novolynx.

Model/Type : Data logger: 110-WD-250L-N.  
: Wind direction sensor: WD-007.

Serial Number : Data logger: A5490.  
: Wind direction sensor: WSD-009.

ID No : Data logger: NHH\_F50055.  
: Cup anemometer: -

Customer : AJS laboratory group (Thailand) Co.,Ltd.  
104 Phatthanakan 40, Phatthanakan Rd, Khwaeng Suan Luang, Khet Suan Luang, Bangkok 10250 Thailand.

Environmental Condition:  
The measurement was carried out in an ambient temperature of (23±3)°C, and relative humidity of (40±10)%.

Measurement Method:  
The wind direction sensor calibration according to comparison method with reference angle measurement electronic theodolite and line laser is used for axis control. The measurement were taken at 45° intervals in clockwise and counter-clockwise directions.

Note: The UUC was warmed up for 1 hour prior to the calibration being performed.

Traceability:  
The measurement results are traceable to the international system of units (SI) through Certificate No: CC563-07-0045, Certificate No: NWS63/0044.

Measurement Date : Jun 10, 2021.  
Issued Date : Jun 10, 2021.

Performed by  
☒ Mr. Sorawit Thachalad  
☐ Miss Orathai Wisetwittaya

Approved Signature: *Orathai Wisetwittaya*  
Mr. Parinya Booncharoen  
Technical Support  
and Calibration Manager

THIS CERTIFICATE REPORT MAY NOT BE REPRODUCED EXCEPT IN FULL UNLESS PERMISSION FOR REPRODUCTION HAS BEEN OBTAINED IN WRITING FROM THE LABORATORY.

## CERTIFICATE OF CALIBRATION

Certificate No: GL-043-44  
Page 1 of 2

Equipment Name : Data Logger with Temperature Sensor  
Manufacturer : Novolynx  
Model : 110-WD-250L-N  
Serial No. : A5490  
ID No. : NHH\_F50055

Customer Name : AJS laboratory group (Thailand) Co.,Ltd.  
Address : 104 Phatthanakan 40, Phatthanakan Rd., Khwaeng Suan Luang, Khet Suan Luang, Bangkok 10250 Thailand.

Received date : 04 June 2021  
Calibration date : 11 June 2021.  
Issue date : 11 June 2021.

Reference Used During Calibration  
1. Standard Temperature Probe Model : ITS-100 A500.  
Serial No. : 667682-09, Due date : 25 Mar 2022  
2. Digital Temperature Indicator Model : DTI-1000-A MK II, Serial No. : 671407-00591 Due date : 20 May 2021

Calibration Condition  
Temperature : (23±3)°C  
Relative Humidity : (55±15)%

Calibration Procedure  
The temperature calibration was done by In-House calibration method as WI-CL-001, according to comparison method with standard digital temperature indicator and standard temperature probe. The temperature scale use was based on ITS-90.

Traceability  
The measurement results are traceable to the international system of units (SI) through National Institute of Metrology Thailand (NIMT) Certificate number : IT-0039-23, Certificate number : ER-0073-20

Calibrated by  
☐ Mr. Sorawit Thachalad  
☒ Miss Orathai Wisetwittaya

Approved Signature: *Orathai Wisetwittaya*  
Mr. Parinya Booncharoen  
Technical Support  
and Calibration Manager

THIS CERTIFICATE MAY NOT BE REPRODUCED EXCEPT IN FULL UNLESS PERMISSION FOR REPRODUCTION HAS BEEN OBTAINED IN WRITING FROM THE LABORATORY.

## CALIBRATION REPORT

Calibration No : RH-G1062021  
Page 1 of 1 Pages

Measurement Item : Relative humidity with data logger.

Manufacturer : Data logger: Novolynx.  
: Relative humidity sensor: Novolynx.

Model/Type : Data logger: 110-WD-250L-N.  
: Relative humidity sensor: HMP60.

Serial Number : Data logger: A5490.  
: Relative humidity sensor: R3440767.

ID No : Data logger: NHH\_F50055.  
: Relative humidity sensor: -

Customer : AJS laboratory group (Thailand) Co., Ltd.  
104 Phatthanakan 40, Phatthanakan Rd, Khwaeng Suan Luang, Khet Suan Luang, Bangkok 10250 Thailand.

Environmental Condition:  
The measurement was carried out in an ambient temperature of (25±3)°C, and relative humidity of (50±10)%.

Measurement Method:  
The relative humidity with display, Unit Under Calibration (UUC) was calibrated by comparison method with the equilibrium of standard salt solution CH<sub>3</sub>COOK, Potassium Acetate, Mg(NO<sub>3</sub>)<sub>2</sub> Magnesium Nitrate, KCl Potassium Chloride to determine the errors.

Measurement Date : Jun 10, 2021  
Issued Date : Jun 11, 2021

Measurement Results:  
The results of calibration are reported in table below.

Standard salt solution	Standard (RH%)	UUC Reading	Error
CH <sub>3</sub> COOK Potassium Acetate	22.51	24.6	2.1
Mg(NO <sub>3</sub> ) <sub>2</sub> Magnesium Nitrate	52.89	54.2	1.3
KCl Potassium Chloride	84.34	85.2	0.9

Performed by  
☒ Mr. Sorawit Thachalad  
☐ Miss Orathai Wisetwittaya

Approved Signature: *Orathai Wisetwittaya*  
Mr. Parinya Booncharoen  
Technical Support  
and Calibration Manager

THIS CALIBRATION REPORT MAY NOT BE REPRODUCED EXCEPT IN FULL UNLESS PERMISSION FOR REPRODUCTION HAS BEEN OBTAINED IN WRITING FROM THE LABORATORY.

Continuation of Certificate of Calibration Number

Certificate No: WD-02000201  
Page 2 of 2 Pages

Result of calibration: ☒ Without adjustment ☐ With adjustment  
Calibration in the range of 1 - 16 m/s at a calibration interval of 1 m/s.  
The results of calibration and associated measurement uncertainties are reported in the table below.

V <sub>app</sub> Reading m/s	V <sub>acc</sub> Reading m/s	Error m/s	Uncertainty (%)
2.063	1.9	-0.2	2.9
4.080	4.0	-0.1	1.8
5.99	6.0	0.0	1.06
7.99	8.0	0.0	0.85
10.01	10.2	0.2	0.83
11.99	12.1	0.1	0.83
14.02	14.3	0.3	0.43
16.02	16.4	0.4	0.52
18.03	18.4	0.4	0.45
19.99	19.2	-0.8	0.61
11.00	11.2	0.2	0.61
8.99	9.1	0.1	0.77
6.99	7.0	0.0	1.02
4.168	4.1	-0.1	0.90
2.998	3.0	0.0	1.8
1.032	0.9	-0.2	7.1

UUC\*: Unit Under Calibration  
The reported expanded uncertainty is based on standard uncertainty multiplied by a coverage factor k=2 providing a level of confidence of approximately 95%.

### Appendix 1: Instrumentations

NO	Sensor	Manufacturer	Model/Type	Calibration Date	Certificate Report Number	Range
1	Flat plate	ISO 9001	66302145	July 18, 2020	WW-0035-20	0 - 30 m/s
2	Position Universal Pressure Meter	Digital	2042000	July 18, 2020	MM-0035-20	0 - 30 m/s
3	Air velocity transducer (flat wind)	TSI INC.	8450-12	July 20, 2020	MM-0036A-20	0 - 5 m/s
4	Temperature	Digital	DSH-50P	March 30, 2021	GL-027-04	30 - 70°C
5	Relative humidity	Digital	DSH-50P	March 30, 2021	RH-01020201	0 - 100 %RH
6	Atmospheric pressure	Digital	DSH-50P	March 30, 2021	BP-01030201	800 - 1100 hPa
7	Wind tunnel	GRONK	MP3000	-	-	0 - 50 Hz

\*\*\*End of certificate of calibration\*\*\*

Continuation of Certificate of Calibration Number

Certificate No: WD-02000201  
Page 2 of 2 pages

Result of calibration: ☐ Without adjustment ☒ With adjustment  
Calibration in the range of 0 - 360° at a calibration interval of 45°.

The results of calibration and associated measurement uncertainties are reported in table below.

NO	Turning Direction	Nominal Angle (°)	Standard Reading (°)	UUC* Reading (°)	Error (°)	Uncertainty (°)
1		0/360	360	359	-1	3.0
2		45	45	39	-6	3.0
3		90	90	85	-5	3.0
4		135	135	131	-4	3.0
5		180	180	178	-2	3.0
6		225	225	227	2	3.0
7		270	270	274	4	3.0
8		315	315	319	4	3.0
9		0/360	360	359	-1	3.0
10		45	45	39	-6	3.0
11		90	90	85	-5	3.0
12		135	135	131	-4	3.0
13		180	180	178	-2	3.0
14		225	225	227	2	3.0
15		270	270	274	4	3.0
16		315	315	319	4	3.0

UUC\*: Unit Under Calibration The reported expanded uncertainty is based on standard uncertainty multiplied by a coverage factor k=2 providing a level of confidence of approximately 95%.

\*\*\*End of Certificate of Calibration\*\*\*

Result of Calibration: ☒ Without Adjustment ☐ With Adjustment  
Calibration Range: 20°C - 40°C

Function:

This equipment was connected with temperature sensor Model : HMP60 S/N : R3440767

Dimension : Diameter 12mm, Length 80 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
60	20.050	19.8	-0.2	0.19
60	24.877	24.5	-0.4	0.25
60	29.860	29.6	-0.3	0.32
60	34.840	34.4	-0.4	0.19
60	39.822	39.3	-0.5	0.47

UUC\*: Unit Under Calibration  
The reported expanded uncertainty is based on standard uncertainty multiplied by a coverage factor k=2 providing a level of confidence of approximately 95%.

★ End of Certificate ★













83/14-15/7/35-36, Soi Petchkasem 7/1, Petchkasem Rd.  
Wattana, Bangkok/Bangkok 10000 Thailand  
Tel: 0661 02-660812913 Fax: 0661 02-6608060 www.janet.com

## CALIBRATION REPORT

Calibration No.: 010001001  
Page 1 of 1 Page

Measurement Item: Digital multimeter with 400V range

Manufacturer: (Data input: Name)  
Manufacturer: (Data input: Name)

Model/Type: (Data input: Model/Type)  
(Data input: Model/Type)

Serial Number: (Data input: Serial Number)  
(Data input: Serial Number)

IP No.: (Data input: IP No.)  
(Data input: IP No.)

Material: (Data input: Material)  
(Data input: Material)

Measurement Condition: (Data input: Measurement Condition)  
(Data input: Measurement Condition)

Measurement Method: (Data input: Measurement Method)  
(Data input: Measurement Method)

Measurement Date: (Data input: Measurement Date)  
Issue Date: (Data input: Issue Date)

Measurement Result: (Data input: Measurement Result)

Measurement Item	Standard Value	Measured Value	Error	Uncertainty
Resistance (200Ω)	200.0	200.0	0.0	0.0
Resistance (100Ω)	100.0	100.0	0.0	0.0
Resistance (50Ω)	50.0	50.0	0.0	0.0
Resistance (25Ω)	25.0	25.0	0.0	0.0



Reviewed by: (Data input: Reviewed by)  
(Data input: Reviewed by)

Approved Signature: (Data input: Approved Signature)  
(Data input: Approved Signature)

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Wattana, Bangkok/Bangkok 10000 Thailand  
Tel: 0661 02-660812913 Fax: 0661 02-6608060 www.janet.com

Calibration of Digital multimeter

Calibration No.: 010001001  
Page 1 of 1 Page

Result of Calibration: (Data input: Result of Calibration)  
(Data input: Result of Calibration)

Measurement Item	Standard Value	Measured Value	Error	Uncertainty
Resistance (200Ω)	200.0	200.0	0.0	0.0
Resistance (100Ω)	100.0	100.0	0.0	0.0
Resistance (50Ω)	50.0	50.0	0.0	0.0
Resistance (25Ω)	25.0	25.0	0.0	0.0
Resistance (10Ω)	10.0	10.0	0.0	0.0
Resistance (5Ω)	5.0	5.0	0.0	0.0
Resistance (2Ω)	2.0	2.0	0.0	0.0
Resistance (1Ω)	1.0	1.0	0.0	0.0



Result of calibration report

## SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

Continuation of Calibration Certificate

Cert. No.: ACC0101  
Job No.: VC04AC001  
Page: 1 of 3

Calibration Procedure: CP-AC-01

Calibration Method:

This equipment was calibrated by hand on 01-09-2021. The result of calibration was measured using the reference instrument.

Condition of this result of calibration:

1. Reference Instrument:

Instrument	Model	Serial No.	Cert. No.	Due Date
Reference Instrument	10110B	MT1202142	CP-0011-01	01-09-21
Digital Multimeter	1040A	MT1202144	CP-0011-02	01-09-21
Digital Multimeter	1040A	10110B	CP-0011-03	01-09-21
Digital Multimeter	1040A	MT1202144	CP-0011-04	01-09-21
Programmable Instrument	1047-070	62100114	1001-07714C	01-09-21
Condition Multimeter	4180	2077001	AA-1000-11	01-09-21
Measuring Amplifier	NA-420A	10400001	AA-1000-12	01-09-21
Audio Analyzer	AVS-100A	V-10000001	CP-0011-05	01-09-21

2. This result of calibration was found accurate to within 0.01% and place of calibration for this calibration was only.

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

3.1 National Institute of Metrology (NIM)

3.2 Thailand Institute of Scientific and Technological Research (TISTR)

01-09-2021-01-09-2021

T. Petchkasem



83/14-15/7/35-36, Soi Petchkasem 7/1, Petchkasem Rd.  
Wattana, Bangkok/Bangkok 10000 Thailand  
Tel: 0661 02-660812913 Fax: 0661 02-6608060 www.janet.com

Calibration No.: 010001001  
Page 1 of 1 Page

Result of Calibration: (Data input: Result of Calibration)  
(Data input: Result of Calibration)

Calibration Range: (Data input: Calibration Range)

Condition: (Data input: Condition)

This equipment was calibrated with temperature sensor (Model: 104070, Serial: 010001001)

Dimension: (Data input: Dimension)

Measurement Item	Standard Value	Measured Value	Error	Uncertainty
Resistance (200Ω)	200.0	200.0	0.0	0.0
Resistance (100Ω)	100.0	100.0	0.0	0.0
Resistance (50Ω)	50.0	50.0	0.0	0.0
Resistance (25Ω)	25.0	25.0	0.0	0.0
Resistance (10Ω)	10.0	10.0	0.0	0.0
Resistance (5Ω)	5.0	5.0	0.0	0.0
Resistance (2Ω)	2.0	2.0	0.0	0.0
Resistance (1Ω)	1.0	1.0	0.0	0.0

0101 (Data input: Condition)  
The reported accuracy is based on standard uncertainty calculated by a coverage factor (k=2) providing a level of confidence of approximately 95%.

End of Certificate



Reviewed by: (Data input: Reviewed by)  
(Data input: Reviewed by)

Approved Signature: (Data input: Approved Signature)  
(Data input: Approved Signature)

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## CALIBRATION REPORT

Calibration No.: 010001001  
Page 1 of 1 Page

Measurement Item: (Data input: Measurement Item)

Manufacturer: (Data input: Manufacturer)

Model/Type: (Data input: Model/Type)

Serial Number: (Data input: Serial Number)

IP No.: (Data input: IP No.)

Material: (Data input: Material)

Measurement Condition: (Data input: Measurement Condition)

Measurement Method: (Data input: Measurement Method)

Measurement Date: (Data input: Measurement Date)

Issue Date: (Data input: Issue Date)

Measurement Result: (Data input: Measurement Result)

Measurement Condition: (Data input: Measurement Condition)

Measurement Method: (Data input: Measurement Method)

Measurement Date: (Data input: Measurement Date)

Issue Date: (Data input: Issue Date)

Measurement Result: (Data input: Measurement Result)

Measurement Condition: (Data input: Measurement Condition)

Measurement Method: (Data input: Measurement Method)

Measurement Date: (Data input: Measurement Date)

Issue Date: (Data input: Issue Date)

Measurement Result: (Data input: Measurement Result)

Measurement Condition: (Data input: Measurement Condition)

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Measurement Date: (Data input: Measurement Date)

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Measurement Result: (Data input: Measurement Result)

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Issue Date: (Data input: Issue Date)

Measurement Result: (Data input: Measurement Result)

Measurement Condition: (Data input: Measurement Condition)

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Issue Date: (Data input: Issue Date)

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Measurement Result: (Data input: Measurement Result)

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Issue Date: (Data input: Issue Date)

Measurement Result: (Data input: Measurement Result)

Measurement Condition: (Data input: Measurement Condition)

Measurement Method: (Data input: Measurement Method)

Measurement Date: (Data input: Measurement Date)

Issue Date: (Data input: Issue Date)

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Measurement Date: (Data input: Measurement Date)

Issue Date: (Data input: Issue Date)

Measurement Result: (Data input: Measurement Result)

Measurement Condition: (Data input: Measurement Condition)

Measurement Method: (Data input: Measurement Method)

Measurement Date: (Data input: Measurement Date)



# SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

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



Cert. No. : ACL21050  
Pages : 1 of 8

## Calibration Certificate

Equipment : SOUND LEVEL METER  
Manufacturer : RION  
Model : NL-02 / Microphone UC-52 / Pre-amplifier NH-24  
Serial No. : 00799777 / 187363 / 01328  
ID No. : \*

Condition As Found : GOOD

Customer : ALS LABORATORY GROUP (THAILAND) CO., LTD.  
104 PIATTHANAKAN 40, PIATTHANAKAN ROAD,  
KHWAENG PIATTHANAKAN, KHET SUAN LUANG,  
BANGKOK, 10250 THAILAND.

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

Received Date : 07 JUNE 2021  
Calibration Date : 07-08 JUNE 2021  
Date of Issue : 09 JUNE 2021

Calibrated by : Nathakorn Poutpisan

Approved by : *T. Petchur*  
( Thanakul Petchur )

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

QF-TS12-04-04-020664

# SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

## Continuation of Calibration Certificate

Cert. No. : ACL21050  
Job No. : VC64AC0044  
Pages : 3 of 8

## Summary of Measurement Result :

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

QF-TS12-04-04-020664

# SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

## Continuation of Calibration Certificate

Cert. No. : ACL21050  
Job No. : VC64AC0044  
Pages : 5 of 8

## 4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

## 5. Frequency and time weightings at 1 kHz

### 5.1 Frequency weightings at 1 kHz

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

### 5.2 Time weighting at 1 kHz

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

## 6. Long - term stability

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

QF-TS12-04-04-020664

# SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

## Continuation of Calibration Certificate

Cert. No. : ACL21050  
Job No. : VC64AC0044  
Pages : 3 of 3

## Result of calibration :

### 1. Sound pressure level

Specified sound pressure level (dB)	Measured value (dB)	Deviated value (dB)	Uncertainty (dB)	Reference Limit (dB)
94	94.08	0.08	0.14	0.40

### 2. Frequency

Specified Frequency (Hz)	Measured value (Hz)	Deviated value (Hz)	Uncertainty (Hz)	Reference Limit (Hz)
1000	1002.3	0.2	0.3	3.0

### 3. Total distortion

Measured value (%)	Uncertainty (%)	Reference Limit (%)
1.12	0.40	3.0

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

End of Calibration Certificate

QF-TS12-04-04-020664

# SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

## Continuation of Calibration Certificate

Cert. No. : ACL21050  
Job No. : VC64AC0044  
Pages : 2 of 8

Calibration Procedure : CP-AC-01

## Calibration Method :

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

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

## Condition of this result of calibration :

### 1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0012-21	10-Feb-22
Waveform Generator	33511B	MY52302742	EF-0011-21	10-Feb-22
Digital Multimeter	33461A	MY52320104	EEL-BP_05/0264	10-Feb-22
Digital Multimeter	33461A	MY52320076	EEL-BP_03/0264	08-Feb-22
Digital Multimeter	33461A	MY52320116	EEL-BP_04/0264	10-Feb-22
Programmable Attenuator	MAT-1070	62100114	1500-07774E	08-Mar-22
Condenser Microphone	4180	2977900	AA-1008-21	05-Feb-22
Measuring Amplifier	NA-42KAI	34560495	AA-3003-21	16-Feb-22

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

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

3.1 National Institute of Metrology (Thailand).

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

QF-TS12-04-04-020664

# SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

## Continuation of Calibration Certificate

Cert. No. : ACL21050  
Job No. : VC64AC0044  
Pages : 4 of 8

## Result of calibration :

### 1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limit (dB)
93.9 (93.96)	93.9	0.0	±0.3

### 2. Self-generated noise

#### 2.1 Normal test

Measured Value (dB)
14.6

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

Frequency Weighting	Measured value (dB)
A - weight	11.6
C - weight	17.7
Flat	23.4

### 3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.1	0.2	0.2	±1.5
1000	0.1	0.0	0.0	±1.0
8000	1.1	1.2	1.2	±5.0

QF-TS12-04-04-020664



Cert. No. : ACL21050  
Job No. : VC64AC0044  
Pages : 7 of 8

## 8. Level linearity including the level range control

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

## 9. Tone burst response

Time Weighting	Tone duration, T <sub>b</sub> (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	108.0	108.0	0.0	1.5; -5.0
	2	8	117.0	117.0	0.0	1.0; -2.5
	200	800	134.0	134.1	0.1	±1.0
Slow	2	8	108.0	108.0	0.0	1.5; -5.0
	200	800	127.6	127.6	0.0	±1.0
	0.25	1	99.0	98.9	-0.1	1.5; -5.0
SEL	2	8	108.0	108.0	0.0	1.0; -2.5
	200	800	128.0	128.1	0.1	±1.0

## 10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, L <sub>peak</sub> (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
One	136.4	136.2	-0.2	±3.0

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

QP-TS12-04-04-020664

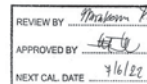
T. Petchur

451-451/7 Sithiporn Rd., Bangbunru, Bangkok 10700 THAILAND.  
Tel: 0-2435-8800 Fax: 0-2433-1679 e-mail: cal-center@sithiporn.com http://www.sithiporn.comCert. No. : ACL21049  
Pages : 1 of 8

## Calibration Certificate

Equipment : SOUND LEVEL METER  
Manufacturer : RION  
Model : NL-42 / Microphone UC-52 / Preamplifier NH-24  
Serial No. : 00709776 / 187362 / 01327  
ID No. : 451-0000

Condition As Found : GOOD

Customer : ALS LABORATORY GROUP (THAILAND) CO., LTD.  
104 PHATTHANAKAN 40, PHATTHANAKAN ROAD,  
KHUANG PHATTHANAKAN, KHET SUAN LUANG,  
BANGKOK, 10250 THAILAND.Location :  
Ambient Temperature : ( 23.0 ± 3 ) °C  
Pressure : ( 101.3 ± 3 ) kPa  
Relative Humidity : ( 50.0 ± 20 ) %Received Date : 07 JUNE 2021  
Calibration Date : 07-08 JUNE 2021  
Date of Issue : 09 JUNE 2021

Calibrated by : Nathakorn Pitsupaisan

Approved by : T. Petchur  
( Thankul Petchurai )

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

QP-TS12-04-04-020664

Cert. No. : ACL21049  
Job No. : VC64AC0044  
Pages : 3 of 8

## Summary of Measurement Result :

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

QP-TS12-04-04-020664

T. Petchur

Cert. No. : ACL21050  
Job No. : VC64AC0044  
Pages : 6 of 8

## 7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	±1.1
136.0	136.0	0.0	±1.1
135.0	135.0	0.0	±1.1
134.0	134.0	0.0	±1.1
133.0	133.0	0.0	±1.1
132.0	132.0	0.0	±1.1
131.0	131.0	0.0	±1.1
129.0	129.0	0.0	±1.1
124.0	124.0	0.0	±1.1
119.0	119.1	0.1	±1.1
114.0	114.0	0.0	±1.1
109.0	109.0	0.0	±1.1
104.0	104.1	0.1	±1.1
99.0	99.0	0.0	±1.1
94.0	94.0	0.0	±1.1
89.0	89.0	0.0	±1.1
84.0	84.0	0.0	±1.1
79.0	79.0	0.0	±1.1
74.0	74.0	0.0	±1.1
69.0	69.0	0.0	±1.1
64.0	64.0	0.0	±1.1
59.0	59.0	0.0	±1.1
54.0	54.0	0.0	±1.1
49.0	49.0	0.0	±1.1
44.0	44.0	0.0	±1.1
39.0	38.9	-0.1	±1.1
34.0	34.0	0.0	±1.1
30.0	29.9	-0.1	±1.1
29.0	28.9	-0.1	±1.1
28.0	27.9	-0.1	±1.1
27.0	26.9	-0.1	±1.1
26.0	25.9	-0.1	±1.1
25.0	24.9	-0.1	±1.1

QP-TS12-04-04-020664

T. Petchur

Cert. No. : ACL21050  
Job No. : VC64AC0044  
Pages : 8 of 8

## 11. Overload indication

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

## 12. High level stability

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

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

End of Calibration Certificate

QP-TS12-04-04-020664

T. Petchur

Cert. No. : ACL21049  
Job No. : VC64AC0044  
Pages : 2 of 8

Calibration Procedure : CP-AC-01

## Calibration Method :

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

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

## Condition of this result of calibration :

## 1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EP-0013-21	10-Feb-22
Waveform Generator	33511B	MY52302742	EP-0011-21	10-Feb-22
Digital Multimeter	33461A	MY53220104	EEL-BP_050264	08-Feb-22
Digital Multimeter	33461A	MY53220076	EEL-BP_030264	08-Feb-22
Digital Multimeter	33461A	MY53220116	EEL-BP_040264	08-Feb-22
Programmable Attenuator	MAT-1070	62100114	1500-07774E	08-Mar-22
Condenser Microphone	4180	2977900	AA-1008-21	05-Feb-22
Measuring Amplifier	NA-42KAI	34560495	AA-3003-21	16-Feb-22

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

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

3.1 National Institute of Metrology (Thailand).

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

QP-TS12-04-04-020664

T. Petchur



## Continuation of Calibration Certificate

Cert. No. : ACL21049  
Job No. : VC64AC0044  
Pages : 5 of 8

## 4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

## 5. Frequency and time weightings at 1 kHz

## 5.1 Frequency weightings at 1 kHz

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

## 5.2 Time weighting at 1 kHz

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

## 6. Long-term stability

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

QP-TS12-04-04-020664

## Continuation of Calibration Certificate

Cert. No. : ACL21049  
Job No. : VC64AC0044  
Pages : 7 of 8

## 8. Level linearity including the level range control

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

## 9. Tone burst response

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

## 10. Peak C sound level

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

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

QP-TS12-04-04-020664

45/141/141 Sukhumvit Rd., Bangkok, Bangkok 10110 THAILAND  
Tel: 02-2613-8888 Fax: 02-2613-8879 e-mail: sithiporn@thiporn.com Web: www.sithiporn.comCert. No. : ACL31077  
Page : 1 of 8

## Calibration Certificate

Equipment : SOUND LEVEL METER  
Manufacturer : KEM  
Model : MC-42 Microphone VC-02 / Preampifier 500-20  
Serial No. : 90471124 / 100971 / 2018  
ID No. : K001\_F10000

Condition As Found : OKKD

Customer : A/S LABORATORY GROUP (THAI) ASSOCIATES, LTD.  
104 PHATTHANAKAN 40, PHATTHANAKAN ROAD,  
KHUAEANG PHATTHANAKAN, KHUET SUAN LUANG,  
BANGKOK, 10110 THAILAND

Location : -  
Ambient Temperature : ( 25.0 ± 0.3 ) °C  
Pressure : ( 101.3 ± 0.3 ) kPa  
Relative Humidity : ( 60.0 ± 30.0 ) %

Received Date : 11 JULY 2021  
Calibration Date : 14-16 JULY 2021  
Date of Issue : 20 JULY 2021

Calibrated by : Haddasorn Pongpattana

Approved by : T. Petcha

This certificate is issued in accordance with the requirements of ISO/IEC 17025 standard, and may be reproduced  
after time in full, except with the prior written approval of the Head of Calibration Laboratory.

QP-TS12-04-04-020664

## Continuation of Calibration Certificate

Cert. No. : ACL21049  
Job No. : VC64AC0044  
Pages : 4 of 8

## Result of calibration:

## 1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limit (dB)
93.9 (93.96)	93.9	0.0	±0.3

## 2. Self-generated noise

## 2.1 Normal test

Measured Value (dB)
14.6

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

Frequency Weighting	Measured value (dB)
A-weight	11.6
C-weight	17.4
Flat	23.2

## 3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.2	0.2	0.2	±1.5
1000	0.1	0.1	0.1	±1.0
8000	1.3	1.4	1.4	±5.0

QP-TS12-04-04-020664

## Continuation of Calibration Certificate

Cert. No. : ACL21049  
Job No. : VC64AC0044  
Pages : 6 of 8

## 7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	±1.1
136.0	136.0	0.0	±1.1
135.0	135.0	0.0	±1.1
134.0	134.0	0.0	±1.1
133.0	133.0	0.0	±1.1
132.0	132.0	0.0	±1.1
131.0	131.0	0.0	±1.1
129.0	129.0	0.0	±1.1
124.0	124.0	0.0	±1.1
119.0	119.0	0.0	±1.1
114.0	114.0	0.0	±1.1
109.0	109.0	0.0	±1.1
104.0	104.0	0.0	±1.1
99.0	99.0	0.0	±1.1
94.0	94.0	0.0	±1.1
89.0	89.0	0.0	±1.1
84.0	84.0	0.0	±1.1
79.0	79.0	0.0	±1.1
74.0	74.0	0.0	±1.1
69.0	69.0	0.0	±1.1
64.0	64.0	0.0	±1.1
59.0	59.0	0.0	±1.1
54.0	53.9	-0.1	±1.1
49.0	49.0	0.0	±1.1
44.0	43.9	-0.1	±1.1
39.0	38.9	-0.1	±1.1
34.0	33.9	-0.1	±1.1
30.0	29.9	-0.1	±1.1
29.0	28.9	-0.1	±1.1
28.0	27.9	-0.1	±1.1
27.0	26.9	-0.1	±1.1
26.0	25.9	-0.1	±1.1
25.0	24.8	-0.2	±1.1

QP-TS12-04-04-020664

## Continuation of Calibration Certificate

Cert. No. : ACL21049  
Job No. : VC64AC0044  
Pages : 8 of 8

## 11. Overload indication

Measured value (dB)		Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	Negative one-half cycle	0.0	±1.5
89.7	89.7	0.0	±1.5

## 12. High level stability

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

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

End of Calibration Certificate

QP-TS12-04-04-020664



## Continuation of Calibration Certificate

Cert. No. : ACL21073  
Job No. : VCMAC0001  
Page : 3 of 8

## Summary of Measurement Results:

Parameter	Pass	Fail	Uncertainty (dB)	Maximum-permitted uncertainty (dB)
1. Absolute sensitivity	✓	-	0.2	N/A
2. Self-generated noise	✓	-	0.2	N/A
3. Acoustical signal tests of frequency weightings				
3.1 Flat	✓	-	0.3	0.5
1000 Hz	✓	-	0.3	0.6
1000 Hz	✓	-	0.3	0.7
4. Electrical signal tests of frequency weightings				
Flat 10 Hz to 4 kHz	✓	-	0.3	0.6
Flat > 4 kHz to 10 kHz	✓	-	0.3	0.7
Flat > 10 kHz to 20 kHz	-	-	-	1.0
5. Frequency and time weightings at 1 kHz	✓	-	0.2	0.2
6. Long-term stability	✓	-	0.1	0.1
7. Level linearity on the reference level range	✓	-	0.2	0.3
8. Level linearity including the level range control	✓	-	0.2	0.3
9. Time base response	✓	-	0.2	0.3
10. Peak C-weight level	✓	-	0.2	0.25
11. Operational indicators	✓	-	0.2	0.25
12. High level stability	✓	-	0.1	0.1

QP-1012-04-04-02004

~ R.L.S.

## Continuation of Calibration Certificate

Cert. No. : ACL21073  
Job No. : VCMAC0001  
Page : 3 of 8

## 4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	F-weight	A-weight	C-weight
50	0.0	-0.1	0.0	+2.0
125	0.0	-0.1	0.0	+1.5
250	0.0	-0.1	0.0	+1.5
500	0.0	-0.1	0.0	+1.5
1000	0.0	-0.1	0.0	+1.0
2000	0.0	-0.1	-0.1	+2.0
4000	-0.1	-0.1	-0.1	+3.0
8000	-0.1	-0.1	-0.1	+5.0

## 5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A-weight	84.0	0.0	-
C-weight	84.0	0.0	+0.2
Flat	84.0	0.0	+0.2

5.2 Time weighting at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	84.0	0.0	-
Slow	84.0	0.0	+0.1
Imp	84.0	0.0	+0.1

## 6. Long-term stability

Frequency Weighting	SLM Display at Initial (dB)	SLM Display at Final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A-weight	84.0	84.1	0.1	+0.2

QP-1012-04-04-02004

~ R.L.S.

## Continuation of Calibration Certificate

Cert. No. : ACL21073  
Job No. : VCMAC0001  
Page : 7 of 8

## 8. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Sum	94.0	94.0	0.0	+1.1

## 9. Time base response

Time Weighting	Time base duration, T <sub>0</sub> (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.22	1	109.0	107.9	-0.1	1.0; +0.8
	2	8	117.0	116.0	-0.1	1.0; +0.2
	200	600	134.0	134.0	0.0	+0.0
Slow	2	8	109.0	107.9	-0.1	1.0; +0.0
	200	600	127.0	127.0	-0.1	+0.0
	0.22	1	99.0	98.0	-0.1	1.0; +0.0
SEL	2	8	109.0	107.9	-0.1	1.0; +0.1
	200	600	129.0	129.0	0.0	+0.0

## 10. Peak C-weight level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, Leq (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	113.0	113.0	0.0	-
One	110.4	110.3	-0.1	+0.0

Number of cycle in test signal	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	113.0	113.0	0.0	-
Positive half cycle	110.4	110.1	-0.3	+2.0
Negative half cycle	110.4	110.1	-0.3	+2.0

QP-1012-04-04-02004

~ R.L.S.

## Continuation of Calibration Certificate

Cert. No. : ACL21073  
Job No. : VCMAC0001  
Page : 1 of 8

## Calibration Procedure : CPAC-01

## Calibration Method :

This equipment was calibrated by based on IEC-61672-1 (2012) standard for sound level meter (SLM).

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

For test results of each item were made by observation of each instrument display and also with SLM's display.

## Condition of this result of calibration :

## 1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Exp. Date
Wireless Generator	3321A	MY10017026	EP-0812-21	19-Feb-22
Wireless Generator	3311B	MY12002742	EP-0811-21	19-Feb-22
Digital Multimeter	33401A	MY13221010	EP1-201-08/004	19-Feb-22
Digital Multimeter	33401A	MY13220876	EP1-201-08/004	19-Feb-22
Digital Multimeter	33401A	MY13220116	EP1-201-08/004	19-Feb-22
Programmable Attenuator	SA-7-1070	42380114	(30047754)	06-Mar-22
Condenser Microphone	4100	2077901	AA-1008-21	10-Feb-22
Integrating Amplifier	NA-42R1	3400401	AA-0011-21	10-Feb-22

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

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

3.1 National Institute of Standards (NIST).

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

QP-1012-04-04-02004

~ R.L.S.

## Continuation of Calibration Certificate

Cert. No. : ACL21073  
Job No. : VCMAC0001  
Page : 4 of 8

## Result of calibration :

## 1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limits (dB)
93.0 (90.0)	93.0	0.0	+0.2

## 2. Self-generated noise

## 2.1 Normal test

Measured Value (dB)
11.9

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

Frequency Weighting	Measured value (dB)
A-weight	11.1
C-weight	10.1
Flat	11.0

## 3. Acoustical signal tests of frequency weightings

Mean free field accuracy response at a level of 94 dB

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	F-weight	A-weight	Acceptance Limits
125	0.2	0.2	-0.2	+1.0
1000	0.0	0.0	0.0	+1.0
8000	-1.1	-0.0	-1.0	+0.0

QP-1012-04-04-02004

~ R.L.S.

## Continuation of Calibration Certificate

Cert. No. : ACL21073  
Job No. : VCMAC0001  
Page : 6 of 8

## 5. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
117.0	117.0	0.0	+1.1
116.0	116.0	0.0	+1.1
115.0	115.1	0.1	+1.1
114.0	114.1	0.1	+1.1
113.0	113.0	0.0	+1.1
112.0	112.0	0.0	+1.1
111.0	111.0	0.0	+1.1
110.0	110.0	0.0	+1.1
109.0	109.1	0.1	+1.1
108.0	108.1	0.1	+1.1
107.0	107.0	0.0	+1.1
106.0	106.0	0.0	+1.1
105.0	105.0	0.0	+1.1
104.0	104.0	0.0	+1.1
103.0	103.0	0.0	+1.1
102.0	102.0	0.0	+1.1
101.0	101.0	0.0	+1.1
100.0	100.0	0.0	+1.1
99.0	99.0	0.0	+1.1
98.0	98.0	0.0	+1.1
97.0	97.0	0.0	+1.1
96.0	96.0	0.0	+1.1
95.0	95.0	0.0	+1.1
94.0	94.0	0.0	+1.1
93.0	93.0	0.0	+1.1
92.0	92.0	0.0	+1.1
91.0	91.0	0.0	+1.1
90.0	90.0	0.0	+1.1
89.0	89.0	0.0	+1.1
88.0	88.0	0.0	+1.1
87.0	87.0	0.0	+1.1
86.0	86.0	0.0	+1.1
85.0	85.0	0.0	+1.1
84.0	84.0	0.0	+1.1
83.0	83.0	0.0	+1.1
82.0	82.0	0.0	+1.1
81.0	81.0	0.0	+1.1
80.0	80.0	0.0	+1.1
79.0	79.0	0.0	+1.1
78.0	78.0	0.0	+1.1
77.0	77.0	0.0	+1.1
76.0	76.0	0.0	+1.1
75.0	75.0	0.0	+1.1

QP-1012-04-04-02004

~ R.L.S.









## Calibration Certificate

Equipment : SOUND LEVEL METER  
Manufacturer : 3036  
Model : 90-42 Microphone X1-02 / Preamplifier N1-24  
Serial No. : 4112049 / 17219 / 74024  
ID No. : NMR 59607

Condition As Found : GOOD

Customer : AIA LABORATORY GROUP (THAILAND) CO., LTD.  
384 PHU THIANAKAN RD., PHU THIANAKAN RUMI,  
KHWANG PHU THIANAKAN, KHUET MUAN LUANG,  
KANDOK, 10259 THAILAND

Location :  
Ambient Temperature : ( 24.0 ± 0.3 ) °C  
Pressure : ( 1013.0 ± 0.3 ) hPa  
Relative Humidity : ( 50.0 ± 20 ) %

Received Date : 18 AUGUST 2021  
Calibration Date : 20-24 AUGUST 2021  
Date of Issue : 25 AUGUST 2021

REVIEW BY : *[Signature]*  
APPROVED BY : *[Signature]*  
NEXT CAL. DATE : 18/8/22

Calibrated by : *[Signature]*  
Sithiporn Proprietary

Approved by : *[Signature]*  
( *[Signature]* )  
Sithiporn Proprietary

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QP-17121-04-00-020004

## Continuation of Calibration Certificate

### Summary of Measurement Results

Parameter	Pass	Fail	Criteria (dB)	Maximum-permitted uncertainty of measurement (dB)
1. Absolute sensitivity	✓	-	-0.2	±0.5
2. Self-generated noise	✓	-	-0.2	±0.5
3. Acoustical signal tests of frequency weightings				
3.1 125 Hz	✓	-	-0.2	±0.6
3.2 1000 Hz	✓	-	-0.2	±0.6
3.3 5000 Hz	✓	-	-0.2	±0.7
4. Electrical signal tests of frequency weightings				
4.1 10 Hz to 4 kHz	✓	-	-0.2	±0.6
4.2 4 kHz to 10 kHz	✓	-	-0.2	±0.7
4.3 10 kHz to 20 kHz	-	-	-	±1.0
5. Frequency and time weightings at 1 kHz				
5.1 Long-term stability	✓	-	-0.1	±0.2
5.2 Level linearity on the reference level range	✓	-	-0.2	±0.2
5.3 Level linearity including the level range control	✓	-	-0.2	±0.2
5.4 Time-constant response	✓	-	-0.2	±0.2
5.5 Peak-C sound level	✓	-	-0.2	±0.2
5.6 Overload indication	✓	-	-0.2	±0.2
5.7 High-level stability	✓	-	-0.1	±0.2

QP-17121-04-00-020004

## Continuation of Calibration Certificate

### 4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.0	-0.1	-0.1	±0.2
250	0.0	0.0	0.0	±0.2
500	0.0	0.0	0.0	±0.2
1000	0.0	0.0	0.0	±0.2
2000	0.0	0.0	0.0	±0.2
4000	0.0	0.0	0.0	±0.2
5000	0.0	0.1	-0.1	±0.2

### 5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviation Value (dB)	Acceptance Limits (dB)
Fast	94.0	0.0	±0.2
Slow	94.0	0.0	±0.2
Imp	94.0	0.0	±0.2

### 6. Long-term stability

Frequency Weighting	10.00 Display at Initial (dB)	10.00 Display at Final (dB)	Deviation Value (dB)	Acceptance Limits (dB)
A-weight	94.0	94.0	0.0	±0.2

QP-17121-04-00-020004



Certificate No. : 01870021

## Calibration Report

Function : 11. High-Level Stability  
High-level stability over 1 minute, with steady 1 kHz signal, 1 dB below upper boundary.

Time Period to Apply Signal (min)	Reference SPL (dB)	Second SPL at Conclusion of Time Period (dB)	Deviation value (dB)	Acceptance limits (dB)
1	124.0	123.0	-1.0	±0.5

### Uncertainty of measurement

Function	Uncertainty (dB)	Maximum-permitted uncertainty of measurement (dB)
11. Indication at the calibration check frequency	0.30	Not applicable
12. Self-generated noise	0.10	Not applicable
13. Acoustical signal tests of frequency weightings	0.30	0.65 (125 to 4000) 0.70 (5000 to 10000)
14. Electrical signal tests of frequency weightings	0.20	0.20
15. Frequency and time weighting at 1 kHz	0.30	0.20
16. Long-term stability	0.10	0.10
17. Level linearity on the reference level range	0.20	0.20
18. Time-constant response	0.20	0.20
19. Peak-C sound level	0.20	0.20
20. Overload indication	0.20	±0.25
21. High-level stability	0.10	0.10

Remarks : 1. The acceptance limit is for the deviation value.  
2. Acceptance limits was 0.5 dB (125 to 4000) (dB)

-- End of Report --

## Continuation of Calibration Certificate

Calibration Procedures : CP-AC-01

### Calibration Method

This equipment was calibrated by hand on DEC 41875-1 (2012) Standard for sound level meter (SLM).  
The SLM had been to Acoustical and Electrical signal tests of frequency weighting with Acoustic chamber and Reference  
Standard Instruments.

For test results of each item were made by observation of each Instrument display and also with SLM's display.

### Condition of this result of calibration

1. Reference Standard Instruments

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	53210A	5424807676	53-0002-01	16-Feb-22
Waveform Generator	532110	5425202742	53-0003-01	16-Feb-22
Digital Multimeter	33881A	5425202056	53-0004-01	16-Feb-22
Digital Multimeter	33881A	1995702	53-0005-01	16-Feb-22
Digital Multimeter	23461A	4251224116	53-0006-01	16-Feb-22
Programmable Attenuator	5441-1070	42100114	1000-077000	06-Apr-22
Customer Microphone	4030	2077000	AA-0000-01	09-Feb-22
Measuring Amplifier	NA-428A1	34500401	AA-0000-01	16-Feb-22

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

3. This certificate is issued to the institutional system of unit maintained at :

3.1 National Institute of Metrology (Thailand)

3.2 Thailand Institute of Scientific and Technological Research (TRIST)

## Continuation of Calibration Certificate

### Result of calibration

#### 1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation Value (dB)	Acceptance Limits (dB)
93.0 (93.0-94.0)	93.0	0.0	±0.5

#### 2. Self-generated noise

2.1 Thermal test

Measured Value (dB)
17.2

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

Frequency Weighting	Measured value (dB)
A-weight	22.6
C-weight	20.0
Flat	21.7

#### 3. Acoustical signal tests of frequency weightings

More than field acoustic response at a level of 94 dB

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			Acceptance Limits
	Flac	C-weight	A-weight	
125	0.2	0.1	0.3	±1.2
5000	0.0	0.0	0.0	±1.0
10000	-0.4	-0.2	-0.5	±0.9









Certificate No.: 0181021

### Calibration Report

#### 7.1 Level Linearity on the reference level range, Lower (dB)

Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
94.0	94.0	0.0	+1.0
89.0	89.0	0.0	+1.0
84.0	84.0	0.0	+1.0
79.0	79.0	0.0	+1.0
74.0	74.0	0.0	+1.0
69.0	69.0	0.0	+1.0
64.0	64.0	0.0	+1.0

#### Function : B. Tone burst response

Time Weighting	Time burst duration, T <sub>b</sub> (ms)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
Fast	0.25	129.0	0.0	+1.0
	0.25	129.9	-0.1	+1.0
Slow	0.25	129.9	-0.1	+1.0
	0.25	129.0	0.0	+1.0
LAE	0.25	129.0	0.0	+1.0
	0.25	129.9	-0.1	+1.0

#### Function : B. Peak C sound level

Number of cycles in test signal	Anticipated Value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
Complete cycle	129.4	129.3	-0.1	+1.0
Positive half cycle	129.4	129.2	-0.2	+1.0
Negative half cycle	129.4	129.0	-0.4	+1.0

#### Function : 10. Overload indication

Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
Positive one-half cycle 129.6	0.0	+1.0
Negative one-half cycle 129.6	0.0	+1.0



Cert. No.: ACL21051  
Pages : 1 of 8

## Calibration Certificate

Equipment : SOUND LEVEL METER  
Manufacturer : RION  
Model : NL-42 / Microphone UC-52 / Preamplifier NH-24  
Serial No.: 00709778 / 187364 / 01329  
ID No.: -

Condition As Found : GOOD

Customer : ALS LABORATORY GROUP (THAILAND) CO., LTD.  
104 PHATTHANAKAN 40, PHATTHANAKAN ROAD,  
KHWAENG PHATTHANAKAN, KHET SUAN LUANG,  
BANGKOK, 10250 THAILAND.

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

Received Date : 07 JUNE 2021  
Calibration Date : 07-08 JUNE 2021  
Date of Issue : 09 JUNE 2021

Calibrated by : Nuthakorn Pimpaisan

Approved by : T. Petchum  
( Thankul Petchum )

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QF-TS12-04-04-020664

### Continuation of Calibration Certificate

Cert. No.: ACL21051  
Job No.: VC64AC0044  
Pages : 3 of 8

#### Summary of Measurement Result :

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

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T. Petchum



Certificate No.: 0181021

### Calibration Report

#### 5.3 Time weighting at 1 kHz

Time Weighting	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
Fast	94.0	0.0	+1.0
Slow	94.0	0.0	+1.0
LAE	94.0	0.0	+1.0

#### Function : C. Long-Term Stability

Long-term stability over 30 minutes, with steady 1 kHz signal at reference level.

Time Period to Apply Signal (min)	Reference SPL at Conclusion of Time Period (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
30	94.0	94.0	0.0	+0.3

#### Function : F. Level Linearity on the reference level range, Upper

Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
104.0	104.0	0.0	+1.0
99.0	99.0	0.0	+1.0
94.0	94.0	0.0	+1.0
89.0	89.0	0.0	+1.0
84.0	84.0	0.0	+1.0
79.0	79.0	0.0	+1.0
74.0	74.0	0.0	+1.0
69.0	69.0	0.0	+1.0
64.0	64.0	0.0	+1.0
59.0	59.0	0.0	+1.0
54.0	54.0	0.0	+1.0
49.0	49.0	0.0	+1.0
44.0	44.0	0.0	+1.0
39.0	39.0	0.0	+1.0
34.0	34.0	0.0	+1.0
29.0	29.0	0.0	+1.0
24.0	24.0	0.0	+1.0
19.0	19.0	0.0	+1.0
14.0	14.0	0.0	+1.0
9.0	9.0	0.0	+1.0

#### 7.2 Level Linearity on the reference level range, Lower

Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
89.0	89.0	0.0	+1.0
84.0	84.0	0.0	+1.0
79.0	79.0	0.0	+1.0
74.0	74.0	0.0	+1.0
69.0	69.0	0.0	+1.0
64.0	64.0	0.0	+1.0
59.0	59.0	0.0	+1.0



Certificate No.: 0181021

### Calibration Report

#### Function : 11. High-Level Stability

High-level stability over 5 minutes, with steady 1 kHz signal, 1 dB below upper boundary.

Time Period to Apply Signal (min)	Reference SPL at Conclusion of Time Period (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
5	129.0	129.0	0.0	+0.3

#### Uncertainty of measurement

Function	Uncertainty (dB)	Maximum-permitted uncertainty of measurement (dB)
1) Indication at the calibration check frequency	0.30	Not applicable
2) Self-generated noise	0.10	Not applicable
3) Acoustical signal tests of frequency weightings	0.30	0.40 (125 Hz to 1 kHz) 0.70 (above 1 kHz)
4) Electrical signal tests of frequency weightings	0.30	0.30
5) Frequency and time weightings at 1 kHz	0.30	0.30
6) Long-term stability	0.10	0.10
7) Level linearity on the reference level range	0.30	0.30
8) Tone burst response	0.30	0.30
9) Peak C sound level	0.30	0.30
10) Overload indication	0.30	0.25
11) High-level stability	0.10	0.10

Remarks : 1. The acceptance limit is for the deviated value.

2. Acceptance limits was 0.3 dB (TS 0.019 (244) 0.1)

-- End of Report --

### Continuation of Calibration Certificate

Cert. No.: ACL21051  
Job No.: VC64AC0044  
Pages : 2 of 8

Calibration Procedure : CP-AC-01

#### Calibration Method :

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

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

#### Condition of this result of calibration :

##### 1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EP-0012-21	10-Feb-22
Waveform Generator	33511B	MY52302742	EP-0011-21	10-Feb-22
Digital Multimeter	33461A	MY53220104	EEL-BP. 050064	10-Feb-22
Digital Multimeter	33461A	MY53220076	EEL-BP. 030264	08-Feb-22
Digital Multimeter	33461A	MY53220116	EEL-BP. 040264	10-Feb-22
Programmable Attenuator	MAT-1070	62100114	1500-07774E	08-Mar-22
Condenser Microphone	4180	2977900	AA-1008-21	05-Feb-22
Measuring Amplifier	NA-42KAI	34560495	AA-3003-21	16-Feb-22

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

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

3.1 National Institute of Metrology (Thailand).

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

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T. Petchum



Continuation of Calibration Certificate

Cert. No. : ACL21051  
Job No. : VC64AC0044  
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long-term stability

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

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Continuation of Calibration Certificate

Cert. No. : ACL21051  
Job No. : VC64AC0044  
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8. Level linearity including the level range control

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

9. Tone burst response

Time Weighting	Tone burst duration, T <sub>b</sub> (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	108.0	107.9	-0.1	1.5 ; -5.0
	2	8	117.0	116.9	-0.1	1.0 ; -2.5
	200	800	134.0	134.0	0.0	±1.0
Slow	2	8	108.0	107.9	-0.1	1.5 ; -5.0
	200	800	127.6	127.5	-0.1	±1.0
	0.25	1	99.0	98.8	-0.2	1.5 ; -5.0
SEL	2	8	108.0	107.9	-0.1	1.0 ; -2.5
	200	800	128.0	128.0	0.0	±1.0

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, L <sub>peak</sub> (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
One	136.4	136.3	-0.1	±3.0

Number of cycle in test signal	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	132.9	-0.1	-
Positive half cycle	135.4	135.1	-0.3	±2.0
Negative half cycle	135.4	135.1	-0.3	±2.0

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

Cert. No. : ACL21051  
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER  
Manufacturer : RION  
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24  
Serial No.: 00709777 / 187363 / 01328  
ID No.: 10000000000000000000

Condition As Found : GOOD

Customer : ALS LABORATORY GROUP (THAILAND) CO., LTD.  
104 PHATTANAKAN 40, PHATTANAKAN ROAD,  
KHWAENG PHATTANAKAN, KHET SUAN LUANG,  
BANGKOK, 10250 THAILAND.

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

Received Date : 07 JUNE 2021  
Calibration Date : 07-08 JUNE 2021  
Date of Issue : 09 JUNE 2021

Calibrated by : Nathakorn Pisutpaian

Approved by :  
( Thanakul Petchurai )

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

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Continuation of Calibration Certificate

Cert. No. : ACL21051  
Job No. : VC64AC0044  
Pages : 4 of 8

Result of calibration :

1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limit (dB)
93.9 (93.96)	93.9	0.0	±0.3

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
13.8

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

Frequency Weighting	Measured value (dB)
A-weight	9.9
C-weight	16.5
Flat	22.2

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.3	0.4	0.4	±1.5
1000	0.0	0.0	0.0	±1.0
8000	-0.4	-0.2	-0.3	±5.0

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Continuation of Calibration Certificate

Cert. No. : ACL21051  
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7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	±1.1
136.0	136.0	0.0	±1.1
135.0	135.0	0.0	±1.1
134.0	134.1	0.1	±1.1
133.0	133.0	0.0	±1.1
132.0	132.0	0.0	±1.1
131.0	131.0	0.0	±1.1
129.0	129.0	0.0	±1.1
124.0	124.0	0.0	±1.1
119.0	119.0	0.0	±1.1
114.0	114.0	0.0	±1.1
109.0	109.0	0.0	±1.1
104.0	104.1	0.1	±1.1
99.0	99.0	0.0	±1.1
94.0	94.0	0.0	±1.1
89.0	89.0	0.0	±1.1
84.0	84.0	0.0	±1.1
79.0	79.0	0.0	±1.1
74.0	74.0	0.0	±1.1
69.0	69.0	0.0	±1.1
64.0	64.0	0.0	±1.1
59.0	59.0	0.0	±1.1
54.0	54.0	0.0	±1.1
49.0	49.0	0.0	±1.1
44.0	44.0	0.0	±1.1
39.0	39.0	0.0	±1.1
34.0	34.0	0.0	±1.1
30.0	29.9	-0.1	±1.1
29.0	29.0	0.0	±1.1
28.0	27.9	-0.1	±1.1
27.0	26.9	-0.1	±1.1
26.0	26.0	0.0	±1.1
25.0	25.0	0.0	±1.1

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Continuation of Calibration Certificate

Cert. No. : ACL21051  
Job No. : VC64AC0044  
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11. Overload indication

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

12. High level stability

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

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

End of Calibration Certificate

QP-TS12-04-04-020664



## Continuation of Calibration Certificate

Cert. No. : ACL21050  
Job No. : VC64AC0044  
Pages : 3 of 8

## Summary of Measurement Result :

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

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✓ RT

## Continuation of Calibration Certificate

Cert. No. : ACL21050  
Job No. : VC64AC0044  
Pages : 5 of 8

## 4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

## 5. Frequency and time weightings at 1 kHz

## 5.1 Frequency weightings at 1 kHz

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

## 5.2 Time weighting at 1 kHz

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

## 6. Long - term stability

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

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✓ RT

## Continuation of Calibration Certificate

Cert. No. : ACL21050  
Job No. : VC64AC0044  
Pages : 7 of 8

## 8. Level linearity including the level range control

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

## 9. Tone burst response

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

## 10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, Lepen (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
One	136.4	136.2	-0.2	±3.0

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

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✓ RT

## Continuation of Calibration Certificate

Cert. No. : ACL21050  
Job No. : VC64AC0044  
Pages : 2 of 8

Calibration Procedure : CP-AC-01

## Calibration Method :

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

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

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

## Condition of this result of calibration :

## 1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EP-0012-21	10-Feb-22
Waveform Generator	33511B	MY52302742	EP-0011-21	10-Feb-22
Digital Multimeter	33461A	MY53220104	EEL-BP_05-0264	10-Feb-22
Digital Multimeter	33461A	MY53220076	EEL-BP_03-0264	08-Feb-22
Digital Multimeter	33461A	MY53220116	EEL-BP_04-0264	10-Feb-22
Programmable Attenuator	MAT-1070	62100114	1500-07774E	08-Mar-22
Condenser Microphone	4180	2977900	AA-1008-21	05-Feb-22
Measuring Amplifier	NA-42KAI	34560495	AA-3003-21	16-Feb-22

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

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

3.1 National Institute of Metrology (Thailand).

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

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✓ RT

## Continuation of Calibration Certificate

Cert. No. : ACL21050  
Job No. : VC64AC0044  
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## Result of calibration :

## 1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limit (dB)
93.9 (93.96)	93.9	0.0	±0.3

## 2. Self-generated noise

## 2.1 Normal test

Measured Value (dB)
14.6

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

Frequency Weighting	Measured value (dB)
A - weight	11.6
C - weight	17.7
Flat	23.4

## 3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.1	0.2	0.2	±1.5
1000	0.1	0.0	0.0	±1.0
8000	1.1	1.2	1.2	±5.0

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✓ RT

## Continuation of Calibration Certificate

Cert. No. : ACL21050  
Job No. : VC64AC0044  
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## 7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	±1.1
136.0	136.0	0.0	±1.1
135.0	135.0	0.0	±1.1
134.0	134.0	0.0	±1.1
133.0	133.0	0.0	±1.1
132.0	132.0	0.0	±1.1
131.0	131.0	0.0	±1.1
129.0	129.0	0.0	±1.1
124.0	124.0	0.0	±1.1
119.0	119.1	0.1	±1.1
114.0	114.0	0.0	±1.1
109.0	109.0	0.0	±1.1
104.0	104.1	0.1	±1.1
99.0	99.0	0.0	±1.1
94.0	94.0	0.0	±1.1
89.0	89.0	0.0	±1.1
84.0	84.0	0.0	±1.1
79.0	79.0	0.0	±1.1
74.0	74.0	0.0	±1.1
69.0	69.0	0.0	±1.1
64.0	64.0	0.0	±1.1
59.0	59.0	0.0	±1.1
54.0	54.0	0.0	±1.1
49.0	49.0	0.0	±1.1
44.0	44.0	0.0	±1.1
39.0	38.9	-0.1	±1.1
34.0	34.0	0.0	±1.1
30.0	29.9	-0.1	±1.1
29.0	28.9	-0.1	±1.1
28.0	27.9	-0.1	±1.1
27.0	26.9	-0.1	±1.1
26.0	25.9	-0.1	±1.1
25.0	24.9	-0.1	±1.1

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✓ RT



SITHIPORN ASSOCIATES CO.,LTD.  
CALIBRATION LABORATORY

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Cert. No. : ACL21049  
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER  
Manufacturer : RION  
Model : NL-02/ Microphone UC-52 / Pre-amplifier NH-24  
Serial No. : 00709776 / 187362 / 01327  
ID No. : 1

Condition As Found : GOOD

Customer : ALS LABORATORY GROUP (THAILAND) CO., LTD.  
104 PHATTHANAKAN 40, PHATTHANAKAN ROAD,  
KHWAENG PHATTHANAKAN, KHET SUAN LUANG,  
BANGKOK, 10250 THAILAND.

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

Received Date : 07 JUNE 2021  
Calibration Date : 07-08 JUNE 2021  
Date of Issue : 09 JUNE 2021

Calibrated by : Nathakorn Pisuapaisan

Approved by : *T. Petchurai*  
( Thanakul Petchurai )

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

QP-TS12-04-04-020664

SITHIPORN ASSOCIATES CO.,LTD.  
CALIBRATION LABORATORY

Continuation of Calibration Certificate

Cert. No. : ACL21049  
Job No. : VC64AC0044  
Pages : 3 of 8

Summary of Measurement Result :

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

QP-TS12-04-04-020664

SITHIPORN ASSOCIATES CO.,LTD.  
CALIBRATION LABORATORY

Continuation of Calibration Certificate

Cert. No. : ACL21049  
Job No. : VC64AC0044  
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long-term stability

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

QP-TS12-04-04-020664

SITHIPORN ASSOCIATES CO.,LTD.  
CALIBRATION LABORATORY

Continuation of Calibration Certificate

Cert. No. : ACL21050  
Job No. : VC64AC0044  
Pages : 8 of 8

11. Overload indication

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

12. High level stability

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

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

End of Calibration Certificate

QP-TS12-04-04-020664

SITHIPORN ASSOCIATES CO.,LTD.  
CALIBRATION LABORATORY

Continuation of Calibration Certificate

Cert. No. : ACL21049  
Job No. : VC64AC0044  
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

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

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

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0012-21	10-Feb-22
Waveform Generator	33511B	MY52302742	EF-0011-21	10-Feb-22
Digital Multimeter	33461A	MY53220104	EEL-BP_05/0264	10-Feb-22
Digital Multimeter	33461A	MY53220076	EEL-BP_03/0264	08-Feb-22
Digital Multimeter	33461A	MY53220116	EEL-BP_04/0264	10-Feb-22
Programmable Attenuator	MAT-1070	62100114	1500-07774E	08-Mar-22
Condenser Microphone	4180	2977900	AA-1008-21	05-Feb-22
Measuring Amplifier	NA-42KA1	34560495	AA-3003-21	16-Feb-22

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

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

- 3.1 National Institute of Metrology (Thailand).
- 3.2 Thailand Institute of Scientific and Technological Research (TISTR).

QP-TS12-04-04-020664

SITHIPORN ASSOCIATES CO.,LTD.  
CALIBRATION LABORATORY

Continuation of Calibration Certificate

Cert. No. : ACL21049  
Job No. : VC64AC0044  
Pages : 4 of 8

Result of calibration :

1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limit (dB)
93.9 (93.96)	93.9	0.0	±0.3

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
14.6

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

Frequency Weighting	Measured value (dB)
A-weight	11.6
C-weight	17.4
Flat	23.2

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.2	0.2	0.2	±1.5
1000	0.1	0.1	0.1	±1.0
8000	1.3	1.4	1.4	±5.0

QP-TS12-04-04-020664



## Continuation of Calibration Certificate

Cert. No. : ACL21049  
Job No. : VC64AC0044  
Pages : 7 of 8

## 8. Level linearity including the level range control

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

## 9. Tone burst response

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

## 10. Peak C sound level

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

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

QF-TS12-04-04-020664

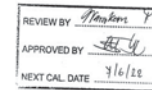
T. Petchum.

451-451/1 Sindhorn Rd., Bangbunru, Bangkok Bangkok 10700 THAILAND.  
Tel:0-2435-8800 Fax:0-2433-1679 e-mail:cal-center@sithiporn.com http://www.sithiporn.comCert. No. : ACL21048  
Job No. : VC64AC0044  
Pages : 1 of 8

## Calibration Certificate

Equipment : SOUND LEVEL METER  
Manufacturer : RION  
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24  
Serial No. : 00709775 / 187361 / 01326  
ID No. : -

Condition As Found : GOOD

Customer : ALS LABORATORY GROUP (THAILAND) CO., LTD.  
104 PHATTHANAKAN 46, PHATTHANAKAN ROAD,  
KHUWAENG PHATTHANAKAN, KHET SUAN LUANG,  
BANGKOK, 10250 THAILAND.Location : -  
Ambient Temperature : ( 23.0 ± 3 ) °C  
Pressure : ( 101.3 ± 3 ) kPa  
Relative Humidity : ( 50.0 ± 20 ) %Received Date : 07 JUNE 2021  
Calibration Date : 07-08 JUNE 2021  
Date of Issue : 09 JUNE 2021

Calibrated by : Natthakorn Pitsupisarn

Approved by : T. Petchum.  
( Thanakul Petchum )

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

QF-TS12-04-04-020664

## Continuation of Calibration Certificate

Cert. No. : ACL21049  
Job No. : VC64AC0044  
Pages : 6 of 8

## 7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	±1.1
136.0	136.0	0.0	±1.1
135.0	135.0	0.0	±1.1
134.0	134.0	0.0	±1.1
133.0	133.0	0.0	±1.1
132.0	132.0	0.0	±1.1
131.0	131.0	0.0	±1.1
129.0	129.0	0.0	±1.1
124.0	124.0	0.0	±1.1
119.0	119.0	0.0	±1.1
114.0	114.0	0.0	±1.1
109.0	109.0	0.0	±1.1
104.0	104.0	0.0	±1.1
99.0	99.0	0.0	±1.1
94.0	94.0	0.0	±1.1
89.0	89.0	0.0	±1.1
84.0	84.0	0.0	±1.1
79.0	79.0	0.0	±1.1
74.0	74.0	0.0	±1.1
69.0	69.0	0.0	±1.1
64.0	64.0	0.0	±1.1
59.0	59.0	0.0	±1.1
54.0	53.9	-0.1	±1.1
49.0	49.0	0.0	±1.1
44.0	43.9	-0.1	±1.1
39.0	38.9	-0.1	±1.1
34.0	33.9	-0.1	±1.1
30.0	29.9	-0.1	±1.1
29.0	28.9	-0.1	±1.1
28.0	27.9	-0.1	±1.1
27.0	26.9	-0.1	±1.1
26.0	25.9	-0.1	±1.1
25.0	24.8	-0.2	±1.1

QF-TS12-04-04-020664

T. Petchum.

## Continuation of Calibration Certificate

Cert. No. : ACL21049  
Job No. : VC64AC0044  
Pages : 8 of 8

## 11. Overload indication

Measured value (dB)		Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	Negative one-half cycle	137.0	±1.5
89.7	89.7		

## 12. High level stability

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

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

End of Calibration Certificate

QF-TS12-04-04-020664

T. Petchum.

## Continuation of Calibration Certificate

Cert. No. : ACL21048  
Job No. : VC64AC0044  
Pages : 3 of 8

## Summary of Measurement Result :

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

QF-TS12-04-04-020664

T. Petchum.

## Continuation of Calibration Certificate

Cert. No. : ACL21048  
Job No. : VC64AC0044  
Pages : 2 of 8

Calibration Procedure : CP-AC-01

## Calibration Method :

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

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

## Condition of this result of calibration :

## 1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EP-0012-21	10-Feb-22
Waveform Generator	33511B	MY52302742	EP-0011-21	10-Feb-22
Digital Multimeter	33461A	MY53220104	EEL-BP. 050264	10-Feb-22
Digital Multimeter	33461A	MY53220076	EEL-BP. 050264	08-Feb-22
Digital Multimeter	33461A	MY53220116	EEL-BP. 040264	10-Feb-22
Programmable Attenuator	MAT-1070	62100114	1500-077746	08-Mar-22
Condenser Microphone	4180	2977990	AA-1008-21	05-Feb-22
Measuring Amplifier	NA-42KAI	34560495	AA-3003-21	16-Feb-22

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

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

3.1 National Institute of Metrology (Thailand).

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

QF-TS12-04-04-020664

T. Petchum.



4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long-term stability

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

QP-TS12-04-04-020664

8. Level linearity including the level range control

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

9. Tone burst response

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

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, L <sub>peak</sub> (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
One	136.4	135.8	-0.6	±3.0

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

QP-TS12-04-04-020664



Calibration Certificate

Equipment : SLM301 LEVEL METER  
Manufacturer : KROHNE  
Model : 96-42 Microphone SK-02 (Pneumatic 90138)  
Serial No. : 0407210 / 14262 / 2294  
ID No. : KROHNE

Condition As Found : GOOD

Customer : SITHIPORN ASSOCIATES CO.,LTD.  
104 PHATTANAKARN RD. PHATTANAKARN ROAD,  
KHWAENG PHATTANAKARN KHUET MUANG LUANG,  
BANGKOK, 10700 THAILAND

Location :  
Ambient Temperature : ( 23.0 ± 3 ) °C  
Pressure : ( 101.3 ± 3 ) kPa  
Relative Humidity : ( 60.0 ± 30 ) %  
Received Date : 18 JULY 2021  
Calibration Date : 19 JULY 2021  
Date of Issue : 20 JULY 2021



Calibrated by : Thaisara Pongprapai

Approved by : T. Pongprapai  
( Thaisara Pongprapai )

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

QP-TS12-04-04-020664

Result of calibration :

1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limit (dB)
93.9 (93.96)	93.9	0.0	±0.3

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
14.2

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

Frequency Weighting	Measured value (dB)
A-weight	10.8
C-weight	17.0
Flat	22.8

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.1	0.1	0.1	±1.5
1000	-0.1	-0.1	-0.1	±1.0
8000	-0.2	-0.1	-0.1	±5.0

QP-TS12-04-04-020664

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	±1.1
136.0	136.0	0.0	±1.1
135.0	135.0	0.0	±1.1
134.0	134.0	0.0	±1.1
133.0	133.0	0.0	±1.1
132.0	132.0	0.0	±1.1
131.0	131.0	0.0	±1.1
129.0	129.0	0.0	±1.1
124.0	124.0	0.0	±1.1
119.0	119.0	0.0	±1.1
114.0	114.0	0.0	±1.1
109.0	109.0	0.0	±1.1
104.0	104.0	0.0	±1.1
99.0	99.0	0.0	±1.1
94.0	94.0	0.0	±1.1
89.0	89.0	0.0	±1.1
84.0	84.0	0.0	±1.1
79.0	79.0	0.0	±1.1
74.0	74.0	0.0	±1.1
69.0	69.0	0.0	±1.1
64.0	64.0	0.0	±1.1
59.0	59.0	0.0	±1.1
54.0	54.0	0.0	±1.1
49.0	49.0	0.0	±1.1
44.0	44.0	0.0	±1.1
39.0	39.0	0.0	±1.1
34.0	33.9	-0.1	±1.1
30.0	29.9	-0.1	±1.1
29.0	28.9	-0.1	±1.1
28.0	28.0	0.0	±1.1
27.0	26.9	-0.1	±1.1
26.0	25.9	-0.1	±1.1
25.0	24.9	-0.1	±1.1

QP-TS12-04-04-020664

11. Overload indication

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

12. High level stability

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

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

End of Calibration Certificate

QP-TS12-04-04-020664



## Continuation of Calibration Certificate

Cert. No. : ACL20072  
Job No. : VCMAC0003  
Page : 3 of 8

## Summary of Measurement Results:

Parameter	Pre	Post	Uncertainty (dB)	Maximum permitted uncertainty (dB)
1. Absolute sensitivity	✓	✓	0.2	N/A
2. Self-generated noise	✓	✓	0.2	N/A
3. Acoustical signal tests of frequency weightings				
125 Hz	✓	✓	0.3	0.6
2000 Hz	✓	✓	0.3	0.6
8000 Hz	✓	✓	0.3	0.7
4. Electrical signal tests of frequency weightings				
For 10 Hz to 4 kHz	✓	✓	0.3	0.6
For 5 kHz to 10 kHz	✓	✓	0.3	0.7
For > 10 kHz to 20 kHz	✓	✓	0.3	0.8
5. Frequency and time weightings at 1 kHz	✓	✓	0.2	0.5
6. Long-term stability	✓	✓	0.1	0.1
7. Level linearity on the reference level range	✓	✓	0.2	0.3
8. Level linearity including the level range control	✓	✓	0.2	0.3
9. Time burst response	✓	✓	0.2	0.3
10. Peak C-weight level	✓	✓	0.2	0.3
11. Observed linearity	✓	✓	0.2	0.3
12. High level stability	✓	✓	0.1	0.1

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## Continuation of Calibration Certificate

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## 4. Electrical signal tests of frequency weightings

Weighting network response with relation to 1 kHz

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
50	0.0	-0.1	0.0	+0.0
125	0.0	0.0	0.0	+0.1
250	0.0	0.0	0.0	+0.1
500	0.0	0.0	0.0	+0.1
1000	0.0	0.0	0.0	+0.0
2000	0.0	0.0	0.0	+0.0
4000	0.0	0.0	0.0	+0.0
8000	0.0	0.1	0.1	+0.0

## 5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A-weight	84.0	0.0	-
C-weight	84.0	0.0	+0.2
Flat	84.0	0.0	+0.2

5.2 Time weighting at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	84.0	0.0	-
Slow	84.0	0.0	+0.1
Long	84.0	0.0	+0.0

## 6. Long-term stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A-weight	84.0	84.0	0.0	+0.2

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## 8. Level linearity including the level range control

Range	Accepted Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Auto	84.0	84.0	0.0	+0.1

## 9. Time burst response

Time Weighting	Time burst duration, T <sub>b</sub> (ms)	Cycle	Accepted Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	80.0	80.0	-0.1	1.2, +0.0
	2	0	117.0	117.0	0.0	1.0, +2.5
	200	000	118.0	118.0	0.0	+0.0
Slow	2	0	80.0	80.0	0.0	1.0, +5.0
	200	000	117.0	117.0	0.0	+0.0
	0.25	1	80.0	80.0	-0.1	1.2, +0.0
SEL	2	0	80.0	80.0	0.0	1.0, +2.5
	200	000	118.0	118.0	0.0	+0.0

## 10. Peak C-weight level

Number of cycle in test signal	Accepted Value (dB)	Measured Value, Leq (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	112.0	112.0	0.0	-
One	110.4	110.0	-0.4	+0.0

Number of cycle in test signal	Accepted Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	112.0	112.0	0.0	-
Positive half cycle	112.4	112.2	-0.2	+0.0
Negative half cycle	112.4	112.2	-0.2	+0.0

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## Calibration Procedure : CPAC-01

## Calibration Method :

This apparatus was calibrated by using an IEC 61073-1 QUT3 standard for sound level meter (SLM).  
The SLM had been to Acoustical and Electrical signal tests of frequency weighting with Acoustic chamber and Reference Standard Instruments.

For test results of each test item made by observation of each instrument display and also with SLM's display.

## Condition of this result of calibration :

## 1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Exp. Date
Wireless Calibrator	532195	MY10017004	EP-0012-21	09-Feb-22
Wireless Calibrator	530108	MY12007042	EP-0011-21	09-Feb-22
Digital Multimeter	13401A	MY13120104	101-BP-050204	09-Feb-22
Digital Multimeter	13401A	MY13120076	101-BP-050204	08-Feb-22
Digital Multimeter	13401A	MY13120130	101-BP-050204	10-Feb-22
Programmable Attenuator	MA1-1070	4210014	1001077500	08-Mar-22
Condenser Microphone	4100	2077000	AA-1000-21	09-Feb-22
Measuring Amplifier	NA-420A2	3400000	AA-0003-21	10-Feb-22

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

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

3.1 National Institute of Standards (NIST).

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

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## Continuation of Calibration Certificate

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## Result of calibration :

## 1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
95.0 (93.00)	85.0	0.0	+0.3

## 2. Self-generated noise

## 2.1 Thermal test

Measured Value
17.4

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

Frequency Weighting	Measured value (dB)
A-weight	12.0
C-weight	10.2
Flat	12.0

## 3. Acoustical signal tests of frequency weightings

Noise Free-Self acoustic response at a level of 94 dB

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	-0.1	-0.1	-0.1	+0.1
1000	-0.1	-0.1	-0.1	+0.0
8000	-0.1	0.0	0.0	+0.0

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## 5. Level linearity on the reference level range

Accepted Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
117.0	117.0	0.0	+0.1
116.0	116.0	0.0	+0.1
115.0	115.0	0.0	+0.1
114.0	114.0	0.0	+0.1
113.0	113.0	0.0	+0.1
112.0	112.0	0.0	+0.1
111.0	111.0	0.0	+0.1
110.0	110.0	0.0	+0.1
109.0	109.0	0.0	+0.1
108.0	108.0	0.0	+0.1
107.0	107.0	0.0	+0.1
106.0	106.0	0.0	+0.1
105.0	105.0	0.0	+0.1
104.0	104.0	0.0	+0.1
103.0	103.0	0.0	+0.1
102.0	102.0	0.0	+0.1
101.0	101.0	0.0	+0.1
100.0	100.0	0.0	+0.1
99.0	99.0	0.0	+0.1
98.0	98.0	0.0	+0.1
97.0	97.0	0.0	+0.1
96.0	96.0	0.0	+0.1
95.0	95.0	0.0	+0.1
94.0	94.0	0.0	+0.1
93.0	93.0	0.0	+0.1
92.0	92.0	0.0	+0.1
91.0	91.0	0.0	+0.1
90.0	90.0	0.0	+0.1
89.0	89.0	0.0	+0.1
88.0	88.0	0.0	+0.1
87.0	87.0	0.0	+0.1
86.0	86.0	0.0	+0.1
85.0	85.0	0.0	+0.1
84.0	84.0	0.0	+0.1
83.0	83.0	0.0	+0.1
82.0	82.0	0.0	+0.1
81.0	81.0	0.0	+0.1
80.0	80.0	0.0	+0.1
79.0	79.0	0.0	+0.1
78.0	78.0	0.0	+0.1
77.0	77.0	0.0	+0.1
76.0	76.0	0.0	+0.1
75.0	75.0	0.0	+0.1
74.0	74.0	0.0	+0.1
73.0	73.0	0.0	+0.1
72.0	72.0	0.0	+0.1
71.0	71.0	0.0	+0.1
70.0	70.0	0.0	+0.1
69.0	69.0	0.0	+0.1
68.0	68.0	0.0	+0.1
67.0	67.0	0.0	+0.1
66.0	66.0	0.0	+0.1
65.0	65.0	0.0	+0.1
64.0	64.0	0.0	+0.1
63.0	63.0	0.0	+0.1
62.0	62.0	0.0	+0.1
61.0	61.0	0.0	+0.1
60.0	60.0	0.0	+0.1
59.0	59.0	0.0	+0.1
58.0	58.0	0.0	+0.1
57.0	57.0	0.0	+0.1
56.0	56.0	0.0	+0.1
55.0	55.0	0.0	+0.1
54.0	54.0	0.0	+0.1
53.0	53.0	0.0	+0.1
52.0	52.0	0.0	+0.1
51.0	51.0	0.0	+0.1
50.0	50.0	0.0	+0.1
49.0	49.0	0.0	+0.1
48.0	48.0	0.0	+0.1
47.0	47.0	0.0	+0.1
46.0	46.0	0.0	+0.1
45.0	45.0	0.0	+0.1
44.0	44.0	0.0	+0.1
43.0	43.0	0.0	+0.1
42.0	42.0	0.0	+0.1
41.0	41.0	0.0	+0.1
40.0	40.0	0.0	+0.1
39.0	39.0	0.0	+0.1
38.0	38.0	0.0	+0.1
37.0	37.0	0.0	+0.1
36.0	36.0	0.0	+0.1
35.0	35.0	0.0	+0.1
34.0	34.0	0.0	+0.1
33.0	33.0	0.0	+0.1
32.0	32.0	0.0	+0.1
31.0	31.0	0.0	+0.1
30.0	30.0	0.0	+0.1
29.0	29.0	0.0	+0.1
28.0	28.0	0.0	+0.1
27.0	27.0	0.0	+0.1
26.0	26.0	0.0	+0.1
25.0	25.0	0.0	+0.1
24.0	24.0	0.0	+0.1
23.0	23.0	0.0	+0.1
22.0	22.0	0.0	+0.1
21.0	21.0	0.0	+0.1
20.0	20.0	0.0	+0.1
19.0	19.0	0.0	+0.1
18.0	18.0	0.0	+0.1
17.0	17.0	0.0	+0.1
16.0	16.0	0.0	+0.1
15.0	15.0	0.0	+0.1
14.0	14.0	0.0	+0.1
13.0	13.0	0.0	+0.1
12.0	12.0	0.0	+0.1
11.0	11.0	0.0	+0.1
10.0	10.0	0.0	+0.1
9.0	9.0	0.0	+0.1
8.0	8.0	0.0	+0.1
7.0	7.0	0.0	+0.1
6.0	6.0	0.0	+0.1
5.0	5.0	0.0	+0.1
4.0	4.0	0.0	+0.1
3.0	3.0	0.0	+0.1
2.0	2.0	0.0	+0.1
1.0	1.0	0.0	+0.1
0.0	0.0	0.0	+0.1
-1.0	-1.0	0.0	+0.1
-2.0	-2.0	0.0	+0.1
-3.0	-3.0	0.0	+0.1
-4.0	-4.0	0.0	+0.1
-5.0	-5.0	0.0	+0.1
-6.0	-6.0	0.0	+0.1
-7.0	-7.0	0.0	+0.1
-8.0	-8.0	0.0	+0.1
-9.0	-9.0	0.0	+0.1
-10.0	-10.0	0.0	+0.1
-11.0	-11.0	0.0	+0.1
-12.0	-12.0	0.0	+0.1
-13.0	-13.0	0.0	+0.1
-14.0	-14.0	0.0	+0.1
-15.0	-15.0	0.0	+0.1
-16.0	-16.0	0.0	+0.1
-17.0	-17.0	0.0	+0.1
-18.0	-18.0	0.0	+0.1
-19.0	-19.0	0.0	+0.1
-20.0	-20.0	0.0	+0.1
-21.0	-21.0	0.0	+0.1
-22.0	-22.0	0.0	+0.1
-23.0	-23.0	0.0	+0.1
-24.0	-24.0	0.0	+0.1
-25.0	-25.0	0.0	+0.1
-26.0	-26.0	0.0	+0.1
-27.0	-27.0	0.0	+0.1
-28.0	-28.0	0.0	+0.1
-29.0	-29.0	0.0	+0.1
-30.0	-30.0	0.0	+0.1
-31.0	-31.0	0.0	+0.1
-32.0	-32.0	0.0	+0.1
-33.0	-33.0	0.0	+0.1
-34.0	-34.0	0.0	+0.1
-35.0	-35.0	0.0	+0.1
-36.0	-36.0	0.0	+0.1
-37.0	-37.0	0.0	+0.1
-38.0	-38.0	0.0	+0.1
-39.0	-39.0	0.0	+0.1
-40.0	-40.0	0.0	+0.1
-41.0	-41.0	0.0	+0.1
-42.0	-42.0	0.0	+0.1
-43.0	-43.0	0.0	+0.1
-44.0	-44.0	0.0	+0.1
-45.0	-45.0	0.0	+0.1
-46.0	-46.0	0.0	+0.1
-47.0	-47.0	0.0	+0.1
-48.0	-48.0	0.0	+0.1
-49.0	-49.0	0.0	+0.1
-50.0	-50.0	0.0	+0.1
-51.0	-51.0	0.0	+0.1
-52.0	-52.0	0.0	+0.1
-53.0	-53.0	0.0	+0.1
-54.0	-54.0	0.0	+0.1
-55.0	-55.0	0.0	+0.1
-56.0	-56.0	0.0	+0.1
-57.0	-57.0	0.0	+0.1
-58.0	-58.0	0.0	+0.1
-59.0	-59.0	0.0	+0.1
-60.0	-60.0	0.0	+0.1
-61.0	-61.0	0.0	+0.1
-62.0	-62.0	0.0	+0.1
-63.0	-63.0	0.0	+0.1
-64.0	-64.0	0.0	+0.1
-65.0	-65.0	0.0	+0.1
-66.0	-66.0	0.0	+0.1
-67.0	-67.0	0.0	+0.1
-68.0	-68.0	0.0	+0.1
-69.0	-69.0	0.0	+0.1
-70.0	-70.0	0.0	+0.1
-71.0	-71.0	0.0	+0.1
-72.0	-72.0	0.0	+0.1
-73.0	-73.0	0.0	+0.1
-74.0	-74.0	0.0	+0.1
-75.0	-75.0	0.0	+0.1
-76.0	-76.0	0.0	+0.1
-77.0	-77.0	0.0	+0.1
-78.0	-78.0	0.0	+0.1
-79.0	-79.0	0.0	+0.1
-80.0	-80.0	0.0	+0.1
-81.0	-81.0	0.0	+0.1
-82.0	-82.0	0.0	+0.1
-83.0	-83.0	0.0	+0.1
-84.0	-84.0	0.0	+0.1
-85.0	-85.0	0.0	+0.1
-86.0	-86.0	0.0	+0.1
-87.0	-87.0	0.0	+0.1
-88.0	-88.0	0.0	+0.1
-89.0	-89.0	0.0	+0.1
-90.0	-90.0	0.0	+0.1
-91.0	-91.0	0.0	+0.1
-92.0	-92.0	0.0	+0.1
-93.0	-93.0	0.0	+0.1
-94.0	-94.0	0.0	+0.1
-95.0	-95.0	0.0	+0.1
-96.0	-96.0	0.0	+0.1
-97.0	-97.0	0.0	+0.1
-98.0	-98.0	0.0	+0.1
-99.0	-99.0	0.0	+0.1
-100.0	-100.0	0.0	+0.1





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## Calibration Certificate

Equipment : 80750 LEVEL METER  
Manufacturer : KCH  
Model : M-42 Monopole UC-02 / Penetration M0-04  
Serial No. : 0407222 / 10401 / 75486  
ID No. : MCH-10006

Condition As Found : GOOD

Customer : A2S LABORATORY GROUP (THAILAND) CO., LTD.  
808 PHATHANAKON 40, PHATHANAKON ROAD,  
KIDWANG PHU THANAKON, KIDT BANG LUANG,  
BANGKOK, 10250 THAILAND

Location : -  
Ambient Temperature : ( 23.8 ± 3 ) °C  
Pressure : ( 101.3 ± 1 ) kPa  
Relative Humidity : ( 56.8 ± 20 ) %

Received Date : 11 JULY 2021  
Calibration Date : 14 JULY 2021  
Date of Issue : 20 JULY 2021

Calibrated by : Thaisak Pichatong

Approved by : T. Pichatong  
( Thaisak Pichatong )

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

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## Continuation of Calibration Certificate

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### Summary of Measurement Result :

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

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### 4. Electrical signal tests of frequency weightings

Weighting network response at 1 kHz

Frequency (Hz)	Deviation from nominal frequency weighting response curve (dB)			Acceptance Limits
	F <sub>flat</sub>	C-weight	A-weight	
63	-0.1	-0.2	0.0	±0.5
125	0.0	0.0	0.0	±1.5
250	0.0	0.0	0.0	±1.5
500	0.0	0.0	0.0	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.0	0.0	±2.0
4000	0.0	0.0	0.0	±1.0
8000	0.0	0.1	0.1	±5.0

### 5. Frequency and time weightings at 1 kHz

#### 5.1 Frequency weightings at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A-weight	94.0	0.0	-
C-weight	94.0	0.0	±0.2
F <sub>flat</sub>	94.0	0.0	±0.2

#### 5.2 Time weighting at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
F <sub>flat</sub>	94.0	0.0	-
Slow	94.0	0.0	±0.1
Fast	94.0	0.0	±0.1

### 6. Long-term stability

Frequency Weighting	SLM Display at Initial (dB)	SLM Display at Final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A-weight	94.0	94.0	0.0	±0.2

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### 10. Overload indication

Measured value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Positive one half cycle	00.0	0.2
Negative one half cycle	00.0	±1.0

### 11. High level stability

Frequency	SLM Display at Initial	SLM Display at Final	Deviated Value (dB)	Acceptance Limits (dB)
Weighting	1.00	1.00	1.00	1.00
A-weight	171.0	171.0	0.0	±0.2

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

End of Calibration Certificate

QP-012-04-04-02000

T. Pichatong

## Continuation of Calibration Certificate

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### Calibration Procedure : CP-AC-01

### Calibration Method :

This response was calibrated by based on IEC 61073-3 (2003) Standard for sound level meter (SLM).  
The SLM had been calibrated and Electrical signal tests of frequency weighting with Acoustical chamber and Reference  
Standard Instruments.  
For each result of each test were made by observation of each instrument display and also with SLM's display.

### Condition of this result of calibration :

#### 1. Reference Standard Instruments

Instrument	Model	Serial No.	Cert. No.	Due Date
Weyershausen Generator	3220A	MV40017076	IS-0012-21	10-Feb-22
Weyershausen Generator	3211B	MV3202742	IS-0012-21	10-Feb-22
Digital Multimeter	34401A	MV3120104	231-200-050204	10-Feb-22
Digital Multimeter	34401A	MV3120076	231-200-050204	10-Feb-22
Digital Multimeter	34401A	MV3120116	231-200-040204	10-Feb-22
Programmable Attenuator	MA3-1070	62100114	100-077540	08-Mar-22
Condenser Microphone	4180	2077600	AA-1000-21	08-Feb-22
Measuring Amplifier	NA-426A1	3490400	AA-2003-21	10-Feb-22

2. The result of calibration was based on measurement on date and place of calibration but this calibrated item only.

3. This certificate is invalid to be the international system of unit estimated at :

3.1 National Institute of Metrology (Thailand)

3.2 Thailand Institute of Scientific and Technological Research (TISTR)

## Continuation of Calibration Certificate

Cert. No. : ACL21071  
Job No. : VC64AC3003  
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### Result of calibration :

#### 1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limits (dB)
95.9 (20 Hz)	95.9	0.0	±0.2

#### 1. Self-generated noise

##### 1.1 Normal use

Measured Value (dB)
14.0

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

Frequency Weighting	Measured value (dB)
A-weight	21.6
C-weight	21.2
F <sub>flat</sub>	21.2

### 1. Acoustical signal tests of frequency weightings

State the field acoustic response at a level of 94 dB

Frequency (Hz)	Deviation from nominal frequency weighting response curve (dB)			Acceptance Limits
	F <sub>flat</sub>	C-weight	A-weight	
125	0.1	0.1	0.2	±1.5
1000	-0.2	-0.2	-0.1	±1.0
8000	0.1	0.0	0.0	±5.0

QP-012-04-04-02000

T. Pichatong



Cert. No. : ACL21052  
Job No. : VC64AC0044  
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8. Level linearity including the level range control

Range	Assigned Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Auto	94.0	94.0	0.0	±1.0

9. Tone burst response

Time Interval, T <sub>1</sub>	T <sub>2</sub> -T <sub>1</sub>	Assigned Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Weighting	1 sec	0.22	0.22	0.0	±1.0
Freq	1000	0.22	0.22	0.0	±1.0
Wave	1000	0.22	0.22	0.0	±1.0
Mod	1000	0.22	0.22	0.0	±1.0

10. Peak C sound level

Number of cycle in test signal	Assigned Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	±1.0
One	133.4	133.4	0.0	±1.0

Number of cycle in test signal	Assigned Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	±1.0
Positive half cycle	133.4	133.4	0.0	±1.0
Negative half cycle	133.4	133.4	0.0	±1.0

QP-TS12-04-04-020664

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



Cert. No. : ACL21052  
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Calibration Certificate

Equipment : SOUND LEVEL METER  
Manufacturer : RION  
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24  
Serial No. : 01000335 / 189260 / 01998  
ID No. : 189260

Condition As Found : GOOD

Customer : ALS LABORATORY GROUP (THAILAND) CO., LTD.  
104 PHATTHANAKAN 40, PHATTHANAKAN ROAD,  
KHAENG PHATTHANAKAN, KHET SUAN LUANG,  
BANGKOK, 10250 THAILAND.

Location :  
Ambient Temperature : ( 23.0 ± 3 ) °C  
Pressure : ( 101.3 ± 3 ) kPa  
Relative Humidity : ( 50.0 ± 20 ) %  
Received Date : 07 JUNE 2021  
Calibration Date : 07-08 JUNE 2021  
Date of Issue : 09 JUNE 2021

REVIEW BY :  
APPROVED BY :  
NEXT CAL DATE : 7/6/22

Calibrated by : Nathakorn Pongpisan

Approved by :  
( Thanakul Petchurai )

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

QP-TS12-04-04-020664

Cert. No. : ACL21052  
Job No. : VC64AC0044  
Page : 3 of 8

Summary of Measurement Result :

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

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Cert. No. : ACL21052  
Job No. : VC64AC0044  
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5. Level linearity on the reference level range

Assigned Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	±1.0
136.0	136.0	0.0	±1.0
135.0	135.0	0.0	±1.0
134.0	134.0	0.0	±1.0
133.0	133.0	0.0	±1.0
132.0	132.0	0.0	±1.0
131.0	131.0	0.0	±1.0
130.0	130.0	0.0	±1.0
129.0	129.0	0.0	±1.0
128.0	128.0	0.0	±1.0
127.0	127.0	0.0	±1.0
126.0	126.0	0.0	±1.0
125.0	125.0	0.0	±1.0
124.0	124.0	0.0	±1.0
123.0	123.0	0.0	±1.0
122.0	122.0	0.0	±1.0
121.0	121.0	0.0	±1.0
120.0	120.0	0.0	±1.0
119.0	119.0	0.0	±1.0
118.0	118.0	0.0	±1.0
117.0	117.0	0.0	±1.0
116.0	116.0	0.0	±1.0
115.0	115.0	0.0	±1.0
114.0	114.0	0.0	±1.0
113.0	113.0	0.0	±1.0
112.0	112.0	0.0	±1.0
111.0	111.0	0.0	±1.0
110.0	110.0	0.0	±1.0
109.0	109.0	0.0	±1.0
108.0	108.0	0.0	±1.0
107.0	107.0	0.0	±1.0
106.0	106.0	0.0	±1.0
105.0	105.0	0.0	±1.0
104.0	104.0	0.0	±1.0
103.0	103.0	0.0	±1.0
102.0	102.0	0.0	±1.0
101.0	101.0	0.0	±1.0
100.0	100.0	0.0	±1.0
99.0	99.0	0.0	±1.0
98.0	98.0	0.0	±1.0
97.0	97.0	0.0	±1.0
96.0	96.0	0.0	±1.0
95.0	95.0	0.0	±1.0
94.0	94.0	0.0	±1.0
93.0	93.0	0.0	±1.0
92.0	92.0	0.0	±1.0
91.0	91.0	0.0	±1.0
90.0	90.0	0.0	±1.0
89.0	89.0	0.0	±1.0
88.0	88.0	0.0	±1.0
87.0	87.0	0.0	±1.0
86.0	86.0	0.0	±1.0
85.0	85.0	0.0	±1.0
84.0	84.0	0.0	±1.0
83.0	83.0	0.0	±1.0
82.0	82.0	0.0	±1.0
81.0	81.0	0.0	±1.0
80.0	80.0	0.0	±1.0
79.0	79.0	0.0	±1.0
78.0	78.0	0.0	±1.0
77.0	77.0	0.0	±1.0
76.0	76.0	0.0	±1.0
75.0	75.0	0.0	±1.0
74.0	74.0	0.0	±1.0
73.0	73.0	0.0	±1.0
72.0	72.0	0.0	±1.0
71.0	71.0	0.0	±1.0
70.0	70.0	0.0	±1.0
69.0	69.0	0.0	±1.0
68.0	68.0	0.0	±1.0
67.0	67.0	0.0	±1.0
66.0	66.0	0.0	±1.0
65.0	65.0	0.0	±1.0
64.0	64.0	0.0	±1.0
63.0	63.0	0.0	±1.0
62.0	62.0	0.0	±1.0
61.0	61.0	0.0	±1.0
60.0	60.0	0.0	±1.0
59.0	59.0	0.0	±1.0
58.0	58.0	0.0	±1.0
57.0	57.0	0.0	±1.0
56.0	56.0	0.0	±1.0
55.0	55.0	0.0	±1.0
54.0	54.0	0.0	±1.0
53.0	53.0	0.0	±1.0
52.0	52.0	0.0	±1.0
51.0	51.0	0.0	±1.0
50.0	50.0	0.0	±1.0
49.0	49.0	0.0	±1.0
48.0	48.0	0.0	±1.0
47.0	47.0	0.0	±1.0
46.0	46.0	0.0	±1.0
45.0	45.0	0.0	±1.0
44.0	44.0	0.0	±1.0
43.0	43.0	0.0	±1.0
42.0	42.0	0.0	±1.0
41.0	41.0	0.0	±1.0
40.0	40.0	0.0	±1.0
39.0	39.0	0.0	±1.0
38.0	38.0	0.0	±1.0
37.0	37.0	0.0	±1.0
36.0	36.0	0.0	±1.0
35.0	35.0	0.0	±1.0
34.0	34.0	0.0	±1.0
33.0	33.0	0.0	±1.0
32.0	32.0	0.0	±1.0
31.0	31.0	0.0	±1.0
30.0	30.0	0.0	±1.0
29.0	29.0	0.0	±1.0
28.0	28.0	0.0	±1.0
27.0	27.0	0.0	±1.0
26.0	26.0	0.0	±1.0
25.0	25.0	0.0	±1.0

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Job No. : VC64AC0044  
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11. Overload indication

Measured value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Positive	Negative	±1.0
99.0	99.0	±1.0

12. High level stability

Frequency	SLM Display at initial	SLM Display at final	Deviated Value (dB)	Acceptance Limits (dB)
Weighting	137.0	137.0	0.0	±1.0
A-weighting	137.0	137.0	0.0	±1.0

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

End of Calibration Certificate

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Job No. : VC64AC0044  
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Calibration Procedure : CP-AC-01

Calibration Method :

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

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

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0012-21	10-Feb-22
Waveform Generator	33511B	MY52302742	EF-0011-21	10-Feb-22
Digital Multimeter	33461A	MY53220104	EEL-BP_050264	10-Feb-22
Digital Multimeter	33461A	MY53220076	EEL-BP_030264	08-Feb-22
Digital Multimeter	33461A	MY53220116	EEL-BP_040264	10-Feb-22
Programmable Attenuator	MAT-1070	62100114	1500-07774E	08-Mar-22
Condenser Microphone	4180	2977909	AA-1008-21	05-Feb-22
Measuring Amplifier	NA-42KAI	34560495	AA-3003-21	16-Feb-22

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

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

3.1 National Institute of Metrology (Thailand).

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

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Continuation of Calibration Certificate

Cert. No. : ACL21052  
Job No. : VC64AC0044  
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4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long-term stability

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

QP-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL21052  
Job No. : VC64AC0044  
Pages : 7 of 8

8. Level linearity including the level range control

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

9. Tone burst response

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

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, Leq <sub>pk</sub> (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
One	136.4	135.4	-1.0	±3.0

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

QP-TS12-04-04-020664



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Tel: 0-2613-8800 Fax: 0-2613-1879 e-mail: sithiporn@sigthiporn.com sithiporn@sithiporn.com

Cert. No. : ACL21052  
Page : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER  
Manufacturer : KROH  
Model : ME-42 Microphone UC-52 / Pre-amplifier NIS-24  
Serial No. : 80111917 / 149900 / 73247  
ID No. : NIS1 P00004

Condition As Found : 0000

Customer : AJS LABORATORY GROUP (THAILAND) CO., LTD.  
104 PHATHANAKARN 40, PHATHANAKARN ROAD,  
KHWAEAD PRAKARTHAKARN, KHET BANG LUANG,  
BANGKOK, 10210 THAILAND.

Location :  
Ambient Temperature : ( 23.0 ± 3.0 ) °C  
Pressure : ( 101.3 ± 3.0 ) kPa  
Relative Humidity : ( 30.0 ± 30 ) %

Received Date : 22 APRIL 2022  
Calibration Date : 03-04 MAY 2022  
Date of Issue : 09 MAY 2022

Calibrated by : Sathitorn Pongpattana

Approved by : T. Pongpattana  
( Technical Personnel )

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

QP-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL21052  
Job No. : VC64AC0044  
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Result of calibration :

1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limit (dB)
93.9 (93.96)	93.9	0.0	±0.3

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
14.2

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

Frequency Weighting	Measured value (dB)
A-weight	10.8
C-weight	17.1
Flat	22.7

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.1	0.2	0.1	± 1.5
1000	-0.1	-0.1	-0.1	± 1.0
8000	0.3	0.4	0.4	±5.0

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Continuation of Calibration Certificate

Cert. No. : ACL21052  
Job No. : VC64AC0044  
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7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.1	0.1	± 1.1
136.0	136.1	0.1	± 1.1
135.0	135.1	0.1	± 1.1
134.0	134.1	0.1	± 1.1
133.0	133.0	0.0	± 1.1
132.0	132.0	0.0	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.1	0.1	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.1	0.1	± 1.1
114.0	114.1	0.1	± 1.1
109.0	109.1	0.1	± 1.1
104.0	104.1	0.1	± 1.1
99.0	99.1	0.1	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	39.0	0.0	± 1.1
34.0	34.0	0.0	± 1.1
30.0	30.0	0.0	± 1.1
29.0	28.9	-0.1	± 1.1
28.0	28.0	0.0	± 1.1
27.0	26.9	-0.1	± 1.1
26.0	25.9	-0.1	± 1.1
25.0	24.9	-0.1	± 1.1

QP-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL21052  
Job No. : VC64AC0044  
Pages : 8 of 8

11. Overload indication

Measured value (dB)		Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	Negative one-half cycle	0.0	±1.5
89.5	89.5		

12. High level stability

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

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

End of Calibration Certificate

QP-TS12-04-04-020664



## Continuation of Calibration Certificate

Cert. No. : ACS22104  
Job No. : YC8AC0001  
Page : 3 of 8

## Summary of Measurement Result :

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

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## Continuation of Calibration Certificate

Cert. No. : ACS22104  
Job No. : YC8AC0001  
Page : 3 of 8

## 4. Electrical signal test of frequency weightings

Weighting accuracy response with relative to 1 dB.

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
63	0.0	-0.1	0.0	±0.0
125	0.0	0.0	0.0	±0.5
250	0.0	0.0	0.0	±0.5
500	0.0	0.0	0.0	±0.5
1000	0.0	0.0	0.0	±0.0
2000	0.0	0.0	0.0	±0.0
4000	0.0	0.0	0.0	±0.0
8000	0.0	0.1	0.1	±0.0

## 5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

## 6. Long-term stability

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

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T. Rth.

## Continuation of Calibration Certificate

Cert. No. : ACS22104  
Job No. : YC8AC0001  
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## 8. Level accuracy including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Acc	90.0	90.0	0.0	±0.1

## 9. Tone burst response

Time Weighting	Time burst duration, T <sub>b</sub> (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
			90.0	90.0	0.0	±0.0
Fast	0.25	1	100.0	100.0	0.0	±0.0
	2	8	117.0	117.0	0.0	±0.0
	200	800	134.0	134.0	0.0	±0.0
Slow	2	8	100.0	100.0	0.0	±0.0
	200	800	127.6	127.6	0.0	±0.0
	0.25	1	90.0	90.0	0.0	±0.0
SIL	2	8	100.0	100.0	0.0	±0.0
	200	800	128.0	128.0	0.0	±0.0

## 10. Peak C-weight level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, L <sub>peak</sub> (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	110.0	110.0	0.0	-
One	110.4	110.2	-0.2	±0.0

Number of cycle in test signal	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	110.0	110.0	0.0	-
Positive half cycle	110.4	110.2	-0.2	±0.0
Negative half cycle	110.4	110.2	-0.2	±0.0

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T. Rth.

## Continuation of Calibration Certificate

Cert. No. : ACS22104  
Job No. : YC8AC0001  
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## Calibration Procedure : CP-AC-02

## Calibration Method :

This equipment was calibrated by based on IEC-61672-1 (2013) Standard for sound level meter (SLM).  
The SLM had been to Acoustical and Electrical signal test of frequency weighting with Artificial chamber and Reference Standard Instruments.

For test results of each item were made by observation of each instrument display and also with SLM's display.

## Condition of this result of calibration :

## 1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	J2110A	MY4801879	EP-0007-22	04-Feb-23
Waveform Generator	13111B	MY12102740	EP-0009-22	04-Feb-23
Digital Multimeter	34461A	MY13220009	EEL-NP-040001	04-Feb-23
Digital Multimeter	34461A	MY13220076	EEL-NP-050001	04-Feb-23
Digital Multimeter	34461A	MY04024771	EEL-NP-030001	04-Feb-23
Programmable Attenuator	MA2-1070	42100114	EP-0008-22	01-Feb-23
Condenser Microphone	4180	2977800	AA-1103-22	24-Feb-23
Measuring Amplifier	NA-020A	34504001	AA-0003-22	22-Feb-23

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

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

3.1 National Institute of Metrology (Thailand).

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

QP-1512-04-04-02004

T. Rth.

## Continuation of Calibration Certificate

Cert. No. : ACS22104  
Job No. : YC8AC0001  
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## Result of calibration :

## 1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limits (dB)
93.8 (93.8)	93.9	0.0	±0.3

## 2. Self-generated noise

## 2.1 Normal test

Measured Value (dB)
14.8

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

Frequency Weighting	Measured value (dB)
A-weight	11.0
C-weight	17.0
Flat	23.0

## 3. Acoustical signal test of frequency weightings

More time-burst acoustic response at a level of 94 dB

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
127	0.3	0.3	0.3	±0.3
1000	0.3	0.3	0.3	±0.0
8000	0.4	0.3	0.5	±0.0

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## Continuation of Calibration Certificate

Cert. No. : ACS22104  
Job No. : YC8AC0001  
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## 7. Level accuracy on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
117.0	117.0	0.0	±0.1
116.0	116.0	0.0	±0.1
115.0	115.0	0.0	±0.1
114.0	114.0	0.0	±0.1
113.0	113.0	0.0	±0.1
112.0	112.0	0.0	±0.1
111.0	111.0	0.0	±0.1
110.0	110.0	0.0	±0.1
109.0	109.0	0.0	±0.1
108.0	108.0	0.0	±0.1
107.0	107.0	0.0	±0.1
106.0	106.0	0.0	±0.1
105.0	105.0	0.0	±0.1
104.0	104.0	0.0	±0.1
103.0	103.0	0.0	±0.1
102.0	102.0	0.0	±0.1
101.0	101.0	0.0	±0.1
100.0	100.0	0.0	±0.1
99.0	99.0	0.0	±0.1
98.0	98.0	0.0	±0.1
97.0	97.0	0.0	±0.1
96.0	96.0	0.0	±0.1
95.0	95.0	0.0	±0.1
94.0	94.0	0.0	±0.1
93.0	93.0	0.0	±0.1
92.0	92.0	0.0	±0.1
91.0	91.0	0.0	±0.1
90.0	90.0	0.0	±0.1
89.0	89.0	0.0	±0.1
88.0	88.0	0.0	±0.1
87.0	87.0	0.0	±0.1
86.0	86.0	0.0	±0.1
85.0	85.0	0.0	±0.1
84.0	84.0	0.0	±0.1
83.0	83.0	0.0	±0.1
82.0	82.0	0.0	±0.1
81.0	81.0	0.0	±0.1
80.0	80.0	0.0	±0.1
79.0	79.0	0.0	±0.1
78.0	78.0	0.0	±0.1
77.0	77.0	0.0	±0.1
76.0	76.0	0.0	±0.1
75.0	75.0	0.0	±0.1

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Cert. No. : ACL21987  
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### Calibration Certificate

Equipment : SOUND LEVEL METER  
Manufacturer : KEM  
Model : NL-42, Microphone 541-02 / Pre-amplifier N11-24  
Serial No. : 0175943 / 172173-79423  
ID No. : NEM-170404

Condition As Found : GOOD

Customer : ALC LABORATORY GROUP (THAILAND) CO., LTD.  
304 PHAYATHANAKON 46, PHAYATHANAKON ROAD,  
KHWANG PHAYATHANAKON, KHEE SUAN LUANG  
BANGKOK, 10250 THAILAND.

Location :  
Ambient Temperature :  $(23.0 \pm 3.3) ^\circ\text{C}$   
Pressure :  $(1013.3 \pm 3.3) \text{ hPa}$   
Relative Humidity :  $(50.0 \pm 20.0) \%$

Received Date : 18 AUGUST 2021  
Calibration Date : 20-24 AUGUST 2021  
Date of Issue : 25 AUGUST 2021

REVIEW BY : *[Signature]*  
APPROVED BY : *[Signature]*  
TESTING DATE : 20/08/21

Calibrated by : Nattakorn Petchsri

Approved by : *[Signature]*  
( Nattakorn Petchsri )

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

QP-1512-04-023664

### Continuation of Calibration Certificate

Cert. No. : ACL21987  
Job No. : VCM4AC0061  
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#### Summary of Measurement Result :

Parameter	Pass	Fail	Conformity 100%	Maximum permitted uncertainty of measurement (k=1)
1. Absolute sensitivity	✓	-	9.5	0.5
2. Self-generated noise	✓	-	9.5	0.5
3. Acoustic signal test of frequency weighting				
125 Hz	✓	-	9.5	0.6
1000 Hz	✓	-	9.5	0.6
6300 Hz	✓	-	9.5	0.7
4. Electrical signal test of frequency weighting				
For 10 Hz to 4 kHz	✓	-	9.5	0.6
For 4 kHz to 10 kHz	✓	-	9.5	0.7
For 10 kHz to 20 kHz	-	-	-	1.0
5. Frequency and time weightings at 1 kHz	✓	-	9.5	0.2
6. Long-term stability	✓	-	9.5	0.2
7. Level accuracy on the reference level range	✓	-	9.5	0.2
8. Level accuracy including the level range control	✓	-	9.5	0.2
9. Time base response	✓	-	9.5	0.2
10. Peak C-weight level	✓	-	9.5	0.2
11. Overload indication	✓	-	9.5	0.2
12. High level stability	✓	-	9.5	0.2

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*[Signature]*

### Continuation of Calibration Certificate

Cert. No. : ACL21987  
Job No. : VCM4AC0061  
Page : 5 of 8

#### 4. Electrical signal test of frequency weighting

Weighting network response with reference to 1 kHz

Frequency (Hz)	Flat	C-weight	A-weight	Acceptance Limits
63	0.0	0.0	0.0	±0.9
125	0.0	0.1	0.0	±0.5
250	0.0	0.0	0.0	±0.5
500	0.0	0.0	0.0	±0.5
1000	0.0	0.0	0.0	±0.0
2000	0.0	0.0	0.0	±0.9
4000	0.0	0.0	0.0	±0.9
8000	0.0	0.1	0.1	±0.0

#### 5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weightings at 1 kHz

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

#### 6. Long-term stability

Frequency Weighting	SLM Display at Initial (dB)	SLM Display at Final (dB)	Deviation Value (dB)	Acceptance Limits (dB)
A-weight	94.0	94.0	0.0	±0.1

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*[Signature]*

### Continuation of Calibration Certificate

Cert. No. : ACL21987  
Job No. : VCM4AC0061  
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#### 10. Overload indication

Measured value (dB)	Deviation Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	99.0	0.0
Negative one-half cycle	99.0	0.0

#### 11. High level stability

Frequency Weighting	SLM Display at Initial (dB)	SLM Display at Final (dB)	Deviation Value (dB)	Acceptance Limits (dB)
A-weight	137.0	137.0	0.0	±0.2

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

End of Calibration Certificate

QP-1512-04-023664

*[Signature]*

### Continuation of Calibration Certificate

Cert. No. : ACL21987  
Job No. : VCM4AC0061  
Page : 7 of 8

#### Calibration Procedure : CP-AC-01

#### Calibration Method :

This equipment was calibrated by hand on IEC 61672-1 Class 1 standard for sound level meter (SLM).  
The SLM had been in thermal and electrical signal test of frequency weighting with Institute standard and Reference Standard Instruments.  
For test results of each item were made by observation of each instrument display and also with SLM's display.

#### Condition of this result of calibration :

##### 1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Exp. Date
Waveform Generator	33200A	M740017076	17-0012-21	16-Feb-22
Waveform Generator	33311B	M75002742	17-0011-21	16-Feb-22
Digital Multimeter	33841A	M751220104	021-0P-010304	10-Feb-22
Digital Multimeter	3486A	1387023	021-0P-001204	10-Feb-22
Digital Multimeter	34841A	M751220118	021-0P-041204	10-Feb-22
Programmable Instrument	8441-0050	02100114	17-00127501	16-Feb-22
Condenser Microphone	4100	2377000	AA-0100-31	01-Feb-22
Measuring Amplifier	9A-420A2	34500401	AA-0003-31	16-Feb-22

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

3. This certificate is applicable to the international system of units mentioned as :

3.1 National Institute of Metrology (Thailand)

3.2 Thailand Institute of Standards and Technological Research (TISTR)

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*[Signature]*

### Continuation of Calibration Certificate

Cert. No. : ACL21987  
Job No. : VCM4AC0061  
Page : 8 of 8

#### Result of calibration :

##### 1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation Value (dB)	Acceptance Limits (dB)
93.0 (93.0dB)	93.0	0.0	±0.5

##### 2. Self-generated noise

2.1 Thermal test

Measured Value (dB)
17.3

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

Frequency Weighting	Measured value (dB)
A-weight	12.0
C-weight	18.0
Flat	23.9

##### 3. Acoustic signal test of frequency weighting

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

Frequency (Hz)	Flat	C-weight	A-weight	Acceptance Limits
125	0.0	0.4	0.4	±1.5
1000	0.0	0.1	0.1	±1.0
8000	0.0	0.7	0.7	±0.0

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*[Signature]*



Cert. No. : ACL21087  
Job No. : VCBAC0801  
Page : 1 of 8

A. Level linearity including the level range control

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

B. Time based response

Time	Time based duration, Th (sec)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limit (dB)
Weighting	0.25	1	106.0	107.0	-0.1	±0.5
Freq	2	8	127.0	127.0	0.0	±0.1
Time	0.05	800	134.0	134.0	0.0	±0.5
Time	0.25	1	106.0	106.0	0.0	±0.5
Time	0.05	800	127.0	127.0	0.0	±0.5
Time	0.25	1	106.0	106.0	0.0	±0.5
Time	0.05	800	134.0	134.0	0.0	±0.5

C. Peak C sound level

Number of cycle in one signal	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limit (dB)
Continuous	120.0	120.0	0.0	±0.1
One	126.4	126.4	0.0	±0.4

Number of cycle in one signal	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limit (dB)
Continuous	120.0	120.0	0.0	±0.1
Positive half cycle	120.4	120.4	0.0	±0.2
Negative half cycle	120.4	120.4	0.0	±0.2

QP-1512-04-04-Q2000

CERTIFICATE OF CALIBRATION

Certificate No. : 01000000  
Page 1 of 2

Equipment Name : Test Room Monitor with Sensor  
Manufacturer : Sanyo  
Model : W500-2  
Serial No : 17021701  
ID No : 1001\_000000

Customer : NAC Technology group (Thailand) Co., Ltd.  
Address : 104 Pathumwan Rd, Pathumwan Rd, Bangkok 10330, Thailand  
Tel : 002 555 8888 12913 Fax : 002 555 8888 0001

Request date : 17 Jul 2022  
Calibration date : 17 Jul 2022  
Issue date : 17 Jul 2022

Reference used during Calibration  
1. Standard Temperature and Humidity (ISO 9001:2015)  
Serial No : 10010000-0000-0000-0000-0000  
2. Digital Temperature Indicator (Type : 10010000-0000-0000-0000-0000)  
3. Serial No : 10010000-0000-0000-0000-0000

Calibration Condition  
Temperature : (25.0 ± 0.5) °C  
Relative Humidity : (50 ± 5) %

Calibration Procedure  
The temperature calibration was done by 1. Standard Temperature and Humidity (ISO 9001:2015) according to the standard method and 2. Digital Temperature Indicator (Type : 10010000-0000-0000-0000-0000) according to the standard method.

Uncertainty  
The measurement results are available in the measurement report of each test through calibration certificate of the equipment (Type : 10010000-0000-0000-0000-0000) according to the standard method.

Calibrated by : NAC Technology group (Thailand) Co., Ltd.  
Checked by : NAC Technology group (Thailand) Co., Ltd.



Approved Signature : NAC Technology group (Thailand) Co., Ltd.  
NAC Technology group (Thailand) Co., Ltd.

This certificate is valid only for the equipment listed in this certificate. It is not valid for other equipment. The certificate is valid only for the equipment listed in this certificate.

CERTIFICATE OF CALIBRATION

Certificate No. : 01000000  
Page 1 of 2

Equipment Name : Test Room Monitor with Sensor  
Manufacturer : Sanyo  
Model : W500-2  
Serial No : 17021701  
ID No : 1001\_000000

Customer : NAC Technology group (Thailand) Co., Ltd.  
Address : 104 Pathumwan Rd, Pathumwan Rd, Bangkok 10330, Thailand  
Tel : 002 555 8888 12913 Fax : 002 555 8888 0001

Request date : 17 Jul 2022  
Calibration date : 17 Jul 2022  
Issue date : 17 Jul 2022

Reference used during Calibration  
1. Standard Temperature and Humidity (ISO 9001:2015)  
Serial No : 10010000-0000-0000-0000-0000  
2. Digital Temperature Indicator (Type : 10010000-0000-0000-0000-0000)  
3. Serial No : 10010000-0000-0000-0000-0000

Calibration Condition  
Temperature : (25.0 ± 0.5) °C  
Relative Humidity : (50 ± 5) %

Calibration Procedure  
The temperature calibration was done by 1. Standard Temperature and Humidity (ISO 9001:2015) according to the standard method and 2. Digital Temperature Indicator (Type : 10010000-0000-0000-0000-0000) according to the standard method.

Uncertainty  
The measurement results are available in the measurement report of each test through calibration certificate of the equipment (Type : 10010000-0000-0000-0000-0000) according to the standard method.

Calibrated by : NAC Technology group (Thailand) Co., Ltd.  
Checked by : NAC Technology group (Thailand) Co., Ltd.



Approved Signature : NAC Technology group (Thailand) Co., Ltd.  
NAC Technology group (Thailand) Co., Ltd.

This certificate is valid only for the equipment listed in this certificate. It is not valid for other equipment. The certificate is valid only for the equipment listed in this certificate.

Cert. No. : ACL21087  
Job No. : VCBAC0801  
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D. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limit (dB)
177.0	177.0	0.0	±0.1
178.0	178.0	0.0	±0.1
179.0	179.0	0.0	±0.1
180.0	180.0	0.0	±0.1
181.0	181.0	0.0	±0.1
182.0	182.0	0.0	±0.1
183.0	183.0	0.0	±0.1
184.0	184.0	0.0	±0.1
185.0	185.0	0.0	±0.1
186.0	186.0	0.0	±0.1
187.0	187.0	0.0	±0.1
188.0	188.0	0.0	±0.1
189.0	189.0	0.0	±0.1
190.0	190.0	0.0	±0.1
191.0	191.0	0.0	±0.1
192.0	192.0	0.0	±0.1
193.0	193.0	0.0	±0.1
194.0	194.0	0.0	±0.1
195.0	195.0	0.0	±0.1
196.0	196.0	0.0	±0.1
197.0	197.0	0.0	±0.1
198.0	198.0	0.0	±0.1
199.0	199.0	0.0	±0.1
200.0	200.0	0.0	±0.1
201.0	201.0	0.0	±0.1
202.0	202.0	0.0	±0.1
203.0	203.0	0.0	±0.1
204.0	204.0	0.0	±0.1
205.0	205.0	0.0	±0.1
206.0	206.0	0.0	±0.1
207.0	207.0	0.0	±0.1
208.0	208.0	0.0	±0.1
209.0	209.0	0.0	±0.1
210.0	210.0	0.0	±0.1
211.0	211.0	0.0	±0.1
212.0	212.0	0.0	±0.1
213.0	213.0	0.0	±0.1
214.0	214.0	0.0	±0.1
215.0	215.0	0.0	±0.1
216.0	216.0	0.0	±0.1
217.0	217.0	0.0	±0.1
218.0	218.0	0.0	±0.1
219.0	219.0	0.0	±0.1
220.0	220.0	0.0	±0.1
221.0	221.0	0.0	±0.1
222.0	222.0	0.0	±0.1
223.0	223.0	0.0	±0.1
224.0	224.0	0.0	±0.1
225.0	225.0	0.0	±0.1
226.0	226.0	0.0	±0.1
227.0	227.0	0.0	±0.1
228.0	228.0	0.0	±0.1
229.0	229.0	0.0	±0.1
230.0	230.0	0.0	±0.1
231.0	231.0	0.0	±0.1
232.0	232.0	0.0	±0.1
233.0	233.0	0.0	±0.1
234.0	234.0	0.0	±0.1
235.0	235.0	0.0	±0.1
236.0	236.0	0.0	±0.1
237.0	237.0	0.0	±0.1
238.0	238.0	0.0	±0.1
239.0	239.0	0.0	±0.1
240.0	240.0	0.0	±0.1
241.0	241.0	0.0	±0.1
242.0	242.0	0.0	±0.1
243.0	243.0	0.0	±0.1
244.0	244.0	0.0	±0.1
245.0	245.0	0.0	±0.1
246.0	246.0	0.0	±0.1
247.0	247.0	0.0	±0.1
248.0	248.0	0.0	±0.1
249.0	249.0	0.0	±0.1
250.0	250.0	0.0	±0.1
251.0	251.0	0.0	±0.1
252.0	252.0	0.0	±0.1
253.0	253.0	0.0	±0.1
254.0	254.0	0.0	±0.1
255.0	255.0	0.0	±0.1
256.0	256.0	0.0	±0.1
257.0	257.0	0.0	±0.1
258.0	258.0	0.0	±0.1
259.0	259.0	0.0	±0.1
260.0	260.0	0.0	±0.1
261.0	261.0	0.0	±0.1
262.0	262.0	0.0	±0.1
263.0	263.0	0.0	±0.1
264.0	264.0	0.0	±0.1
265.0	265.0	0.0	±0.1
266.0	266.0	0.0	±0.1
267.0	267.0	0.0	±0.1
268.0	268.0	0.0	±0.1
269.0	269.0	0.0	±0.1
270.0	270.0	0.0	±0.1
271.0	271.0	0.0	±0.1
272.0	272.0	0.0	±0.1
273.0	273.0	0.0	±0.1
274.0	274.0	0.0	±0.1
275.0	275.0	0.0	±0.1
276.0	276.0	0.0	±0.1
277.0	277.0	0.0	±0.1
278.0	278.0	0.0	±0.1
279.0	279.0	0.0	±0.1
280.0	280.0	0.0	±0.1
281.0	281.0	0.0	±0.1
282.0	282.0	0.0	±0.1
283.0	283.0	0.0	±0.1
284.0	284.0	0.0	±0.1
285.0	285.0	0.0	±0.1
286.0	286.0	0.0	±0.1
287.0	287.0	0.0	±0.1
288.0	288.0	0.0	±0.1
289.0	289.0	0.0	±0.1
290.0	290.0	0.0	±0.1
291.0	291.0	0.0	±0.1
292.0	292.0	0.0	±0.1
293.0	293.0	0.0	±0.1
294.0	294.0	0.0	±0.1
295.0	295.0	0.0	±0.1
296.0	296.0	0.0	±0.1
297.0	297.0	0.0	±0.1
298.0	298.0	0.0	±0.1
299.0	299.0	0.0	±0.1
300.0	300.0	0.0	±0.1
301.0	301.0	0.0	±0.1
302.0	302.0	0.0	±0.1
303.0	303.0	0.0	±0.1
304.0	304.0	0.0	±0.1
305.0	305.0	0.0	±0.1
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307.0	307.0	0.0	±0.1
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309.0	309.0	0.0	±0.1
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316.0	316.0	0.0	±0.1
317.0	317.0	0.0	±0.1
318.0	318.0	0.0	±0.1
319.0	319.0	0.0	±0.1
320.0	320.0	0.0	±0.1
321.0	321.0	0.0	±0.1
322.0	322.0	0.0	±0.1
323.0	323.0	0.0	±0.1
324.0	324.0	0.0	±0.1
325.0	325.0	0.0	±0.1
326.0	326.0	0.0	±0.1
327.0	327.0	0.0	±0.1
328.0	328.0	0.0	±0.1
329.0	329.0	0.0	±0.1
330.0	330.0	0.0	±0.1
331.0	331.0	0.0	±0.1
332.0	332.0	0.0	±0.1
333.0	333.0	0.0	±0.1
334.0	334.0	0.0	±0.1
335.0	335.0	0.0	±0.1
336.0	336.0	0.0	±0.1
337.0	337.0	0.0	±0.1
338.0	338.0	0.0	±0.1
339.0	339.0	0.0	±0.1
340.0	340.0	0.0	±0.1
341.0	341.0	0.0	±0.1
342.0	342.0	0.0	±0.1
343.0	343.0	0.0	±0.1
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352.0	352.0	0.0	±0.1
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361.0	361.0	0.0	±0.1
362.0	362.0	0.0	±0.1
363.0	363.0	0.0	±0.1
364.0	364.0	0.0	±0.1
365.0	365.0	0.0	±0.1
366.0	366.0	0.0	±0.1
367.0	367.0	0.0	±0.1
368.0	368.0	0.0	±0.1
369.0	369.0	0.0	±0.1
370.0	370.0	0.0	±0.1
371.0	371.0	0.0	±0.1
372.0	372.0	0.0	±0.1
373.0	373.0	0.0	±0.1
374.0	374.0	0.0	±0.1
375.0	375.0	0.0	±0.1
376.0	376.0	0.0	±0.1
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378.0	378.0	0.0	±0.1
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380.0	380.0	0.0	±0.1
381.0	381.0	0.0	±0.1
382.0	382.0	0.0	±0.1
383.0	383.0	0.0	±0.1
384.0	384.0	0.0	±0.1
385.0	385.0	0.0	±0.1
386.0	386.0	0.0	±0.1
387.0	387.0	0.0	±0.1
388.0	388.0	0.0	±0.1
389.0	389.0	0.0	±0.1
390.0	390.0	0.0	±0.1
391.0	391.0	0.0	±0.1
392.0	392.0	0.0	±0.1
393.0	393.0	0.0	±0.1
394.0	394.0	0.0	±0.1
395.0	395.0	0.0	±0.1
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397.0	397.0	0.0	±0.1
398.0	398.0	0.0	±0.1
399.0	399.0	0.0	±0.1
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407.0	407.0	0.0	±0.1
408.0	408.0	0.0	±0.1
409.0	409.0	0.0	±0.1
410.0	410.0	0.0	±0.1
411.0	411.0	0.0	±0.1
412.0	412.0	0.0	±0.1
413.0	413.0	0.0	±0.1
414.0	414.0	0.0	±0.1
415.0	415.0	0.0	±0.1
416.0	416.0	0.0	±0.1
417.0	417.0	0.0	±0.1
418.0	418.0	0.0	±0.1
419.0	419.0	0.0	±0.1
420.0	420.0	0.0	±0.1
421.0	421.0	0.0	±0.1
422.0	422.0	0.0	±0.1
423.0	423.0	0.0	±0.1
424.0	424.0	0.0	±0.1
425.0	425.0	0.0	±0.1
426.0	426.0	0.0	±0.1
427.0	427.0	0.0	±0.1
428.0	428.0	0.0	±0.1
429.0	429.0	0.0	±0.1
430.0	430.0	0.0	±0.1
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433.0	433.0	0.0	±0.1
434.0	434.0	0.0	±0.1
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437.0	437.0	0.0	±0.1
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446.0	446.0	0.0	±0.1
447.0	447.0	0.0	±0.1
448.0	448.0	0.0	±0.1
449.0	449.0	0.0	±0.1
450.0	450.0	0.0	±0.1
451.0	451.0	0.0	±0.1
452.0	452.0	0.0	±0.1
453.0	453.0	0.0	±0.1
454.0	454.0	0.0	±0.1
455.0	455.0	0.0	±0.1
456.0	456.0	0.0	±0.1
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458.0	458.0	0.0	±0.1
459.0	459.0	0.0	±0.1
460.0	460.0	0.0	±0.1
461.0	461.0	0.0	±0.1
462.0	462.0	0.0	±0.1
463.0	463.0	0.0	±0.1
464.0	464.0	0.0	±0.1
465.0	465.0	0.0	±0.1
466.0	466.0	0.0	±0.1
467.0	467.0	0.0	±0.1
468.0	468.0	0.0	±0.1
469.0	469.0	0.0	±0.1
470.0	470.0	0.0	±0.1
471.0	471.0	0.0	±0.1
472.0	472.0	0.0	±0.1
473.0	473.0	0.0	±0.1
474.0	474.0	0.0	±0.1
475.0	475.0	0.0	±0.1
476.0	476.0	0.0	±0.1
477.0	477.0	0.0	±0.1</











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

Unit Under Calibration	Standard pH Buffer Solution	Actual pH Reading	Actual mV Reading (mV)	Uncertainty of pH measurement (pH)	Coverage factor
pH Electrode S/N: 8080801	4.008 6.865 10.012	4.010 6.868 10.011	150.2 -22.5 -155.7	0.0068 0.0077 0.015	0.93 0.90 0.90

Function: Temperature Measurement  
(\*) Without adjustment  
This equipment was contacted with Temperature Probe.  
Model: PHLab Expert Pro-100  
Serial No.: 8080801  
Dimension of probe:  
Length: 150 mm  
Diameter: 12 mm  
Insertion Depth: 100 mm

Calibration Point (°C)	Standard Temperature (°C)	UAC Reading (°C)	Error (°C)	Uncertainty of measurement (± °C)	Coverage factor
20.0	20.000	20.2	0.187	0.20	0.91

Remark: UAC = Unit Under Calibration  
The reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor k, providing a level of confidence of approximately 95 %.

-00-

**Certificate of Calibration**  
Equipment: Bottle  
Capacity: 50 mL  
Serial No.:  
ID No.: BKK\_EN0171  
Manufacturer: Witing  
Made in: Germany  
Submitted by: ALS Laboratory Group (Thailand) Co., Ltd.  
104 Phatthanakan Rd., Phatthanakan Rd., Khwaeng Phatthanakan, Khet Suan Luang, Bangkok 10250 Thailand  
Ambient Temperature: (20 ± 2.5) °C  
Relative Humidity: (50 ± 10) %  
Barometric Pressure: 759 mmHg  
Calibration Procedure: ASTM E 242 - 07  
Calibrated by: Sa-angrak Wongsri  
Approved by: [Signature]  
Issue Date: 31 March 2021  
The Uncertainty is for a confidence probability of approximately 95 %

**Metrological Center**  
SCI ECO Services Company Limited  
33/2 Moo 3, T.Banpa, A.Kaengkhioi, Saraburi 18110, Thailand.  
Saraburi Tel: +66 3627 3096 Fax: +66 3627 3100  
Bangkok Tel: +668 9205 8851, +668 8247 2360  
Website: www.scieco.co.th E-Mail: calibrate@scieco.co.th

Certificate No. T211009 Page 1 of 4

**Certificate of Calibration**  
Equipment: Chamber (Cold Room)  
Manufacturer: KOLDTECH  
Model: KM 320  
Serial No.: TBN-1012061/05  
Customer Code: BKK\_EN0167  
ID No.: T2463A3  
Customer: ALS Laboratory Group (Thailand) Co., Ltd.  
104 Phatthanakan 40, Phatthanakan Rd., Khwaeng Phatthanakan, Khet Suan Luang, Bangkok 10250  
Customer Location: Laboratory  
Date of Receipt: 6 May 2021  
Calibrated By: Watcharaporn Songthong (Technician)  
Approved By: [Signature] / Boonchai Suriyawong (Site Calibration Manager)  
Date of Issue: 20 MAY 2021

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

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

**Condition of this calibration result**  
1. Reference Standard Instrument  
Instrument: 1) Document Process Calibrator 2) Ref. Standard Thermometer  
Bottle No.: 1309C002 3064213  
4802054 1-1010244 201222  
Due Date: 24 Nov 2021 15 Oct 2021  
This certification is traceable to the International System of Unit measured at:  
- Traceable to National Institute of Metrology (Thailand), NMI

2. Certified Reference Materials  
The measurement results are traceable to SI through CIP (item 1.4), AAS-ASQ National Accreditation Board, Accredited No. 44-1038

Buffer Solution	Manufacturer	Lot No.	Exp. date
pH 4.008	CIP achem	706804	30 Mar 2022
pH 6.865	CIP achem	722380	18 Dec 2021
pH 10.012	CIP achem	722387	19 Dec 2021

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

**Calibration Results**  
Function: mV Measurement  
Performing standard curve by Fluor at pH (4.7, 7.0)

Unit Under Calibration	Nominal Value	Standard Voltage Input	Actual Reading	Uncertainty of Measurement (mV)	Coverage factor
pH Meter S/N: 802049028	pH	mV	mV	pH	
	4.000	177.49	177.4	4.000	0.996
	7.000	0.00	-0.1	7.000	0.996
	10.000	-177.46	-177.5	10.000	0.996

**Maintenance Plan** YEAR: 2021

class	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
100												

**Periodical maintenance check list for Konelab**

Item	4M	12M	Noted
1. Diluent/wash tubing change	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
2. ISL tubing change	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
3. Springs check/change	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
4. Dispensing check/ change	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
5. Waste tubing change when necessary	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
6. Lamp check/change	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
7. Water paddle/paddle change(not Konelab20)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
8. ISL nozzle check/change	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
9. Pump tubing check/ change	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
10. Broken/leak out part check/ change	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
11. Peristaltic pump check/ cleaning/ lubrication	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
12. Heating check	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
13. Cooling check	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
14. Dispenser mechanic check/adjustment	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
15. Gasket transfer mechanic check/adjustment	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
16. Dispenser movement check/adjustment	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
17. Sample/reagent register check/adjustment	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
18. Dispensing tubing tightness check	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
19. Photometer and optics cleaning/check/adjustment	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
20. Ventilation PC cleaning if necessary	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
21. Mechanic cleaning/lubrication	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
22. Instrument cleaning if necessary	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
23. Complete analyzer testing with waterblank/QC or sample	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
24. Test parameters/Adjustment/config. Save to USB key	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
25. UPS Test	<input type="checkbox"/>	<input checked="" type="checkbox"/>	

Phone: 03-640 Instrument: Aquaplan 200  
Date/Time: 24-05-21 Serial no.: 20011  
Service done by: [Signature] Install date: [Signature]  
Signature of customer: [Signature] Date/Time: 27/5/21

**Condition of this result of calibration**  
1. Reference Standard Instruments  
Instrument: 1) Balance 2) Thermo-Hygrometer 3) Thermometer  
Serial No.: 30705 1314208712 140PC007  
Model: 2-WM191 3041434 301191  
Certificate No.: NMI 19 June 2021 NMI 18 Oct 2021  
Traceability: NMI NMI  
Due date: 02 Mar 2022 19 June 2021 18 Oct 2021  
This certification is traceable to SI Unit  
2. The certificate is valid only for the item calibrated on date and place of calibration.  
3. True value is converted to true volume at the standard temperature of 20 °C

**Calibration result**

Nominal capacity (mL)	Reading (mL)	Uncertainty (± mL)	k Factor
50	50.0041	0.001	2.00

Remark: mL = cm<sup>3</sup>  
The reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor k, providing a level of confidence of approximately 95 %.

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**Metrological Center**  
SCI ECO Services Company Limited  
33/2 Moo 3, T.Banpa, A.Kaengkhoh, Saraburi 18110  
Telephone : +66 2 586 5760-4 Fax : +66 2 586 5760-5  
Website : www.scieco.co.th E-Mail : calibrate@scg.co.th

Certificate No. T21011001 Page 1 of 1

### Calibration Report



**Measurement Results**

Set Point	Temp	Reading	Offset	Uncertainty
20.0	20.0	20.0	0.0	±0.1
25.0	25.0	25.0	0.0	±0.1
30.0	30.0	30.0	0.0	±0.1
35.0	35.0	35.0	0.0	±0.1
40.0	40.0	40.0	0.0	±0.1
45.0	45.0	45.0	0.0	±0.1
50.0	50.0	50.0	0.0	±0.1
55.0	55.0	55.0	0.0	±0.1
60.0	60.0	60.0	0.0	±0.1
65.0	65.0	65.0	0.0	±0.1
70.0	70.0	70.0	0.0	±0.1
75.0	75.0	75.0	0.0	±0.1
80.0	80.0	80.0	0.0	±0.1
85.0	85.0	85.0	0.0	±0.1
90.0	90.0	90.0	0.0	±0.1
95.0	95.0	95.0	0.0	±0.1
100.0	100.0	100.0	0.0	±0.1

The reported uncertainty of temperature measurement was ±0.1 °C.  
The calibration was performed in accordance with the above calibration data.  
The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k=2, providing a level of confidence of approximately 95%.

Approved By: 

PM-L13 11/15-05-07

**Metrological Center**  
SCI ECO Services Company Limited  
33/2 Moo 3, T.Banpa, A.Kaengkhoh, Saraburi 18110, Thailand.  
Website : www.scieco.co.th E-Mail : calibrate@scg.co.th


Certificate No. T211650 Page 2 of 3

### Calibration Report

**Equipment** : Chamber ( Oven )  
**Date of Calibration** : 22 July 2021  
**Environment** : Temperature : 25.6-25.7 °C  
Line Voltage : 227.5-233.3 V  
Relative Humidity : 55 - 65 %RH

**Condition of this results of calibration :**

- This equipment was calibrated by insert nine resistance thermometer detectors into its chamber , the other one resistance thermometer detector use for ambient temperature measurement . The calibration was done in accordance with W1-T20 ( based on ASTM E145-94 ( Reapproved 2001 ) and AS2353-1986 ) . All data shown below were final values and the initial data from customer request . The temperature scale used was based on ITS - 90 .
- Reference Standard Instrument :  
Instrument Model Instrument No. Certificate No. Due Date  
RTD 100 ohm 13-CH1-10 T202056 24 September 2021  
DATA LOGGER 34970A T121 T202056 24 September 2021
- This certificate is traceable to : National Institute of Metrology ( Thailand ) through Metrological Center ( NSC-TIS-TIS 17025 CALIBRATION 0244 ) .
- Condition of calibrated item : good  
Equipment Description :  
Time Constant 2 Hour 10 Minute At 104 °C  
Fresh Air Dumper ☒ Open ☐ Min ☒ Medium ☐ Max  
☐ Close ☐ Not Available
- Adjustment :  
( X ) without adjustment ( ) after adjustment

Approved By: 

PM-L13 11/15-05-03

**TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)**  
CALIBRATION AND TESTING EQUIPMENT SERVICES  
33/2 Moo 3, T.Banpa, A.Kaengkhoh, Saraburi 18110, Thailand.  
Website : www.scieco.co.th E-Mail : calibrate@scg.co.th

Cert. No. : 21011001 Page : 1 of 2

### Certificate of Calibration

**Equipment** : Conductivity Meter  
**Manufacturer** : Mettler Toledo  
**Model** : SevenCompact  
**Serial No.** : 942983167  
**ID No.** : BKK\_EN0081  
**Condition As Received** : Used Item  
**Received Date** : 17 November 2021  
**Calibration Date** : 19 November 2021  
**Reference** : 2171-000010C-0  
**Submitted by** : ALS Laboratory Group (Thailand) Co., Ltd.  
134 Phatthanakan Rd.,  
Khwaeng Phatthanakan, Khet Suan Luang,  
Bangkok 10250 Thailand

**Ambient Temperature** : (20 ± 0.5) °C  
**Relative Humidity** : (50 ± 10) %  
**Calibration Procedure** : In-house method  
- CFCM - based on direct measurement by using reference material (RMA)

**Calibrated by** : Watan, Sornwan  
**Approved by** :   
Approval Signature  
( ) Mettler, Sornwan  
( ) Sornwan, Mettler  
( ) Sornwan, Mettler  
Issue Date : 22 November 2021  
The measurements are for a confidence probability of approximately 95%.  
This certificate was issued in accordance with the ISO 17025:2017 standard.  
Approval of the report is given by the Technical Director.

A 0007877

**Metrological Center**  
SCI ECO Services Company Limited  
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Telephone : +66 2 586 5760-4 Fax : +66 2 586 5760-5  
Website : www.scieco.co.th E-Mail : calibrate@scg.co.th

Certificate No. T21011001 Page 1 of 1

### Calibration Report



**Measurement Results**

Set Point	Temp	Reading	Offset	Uncertainty
20.0	20.0	20.0	0.0	±0.1
25.0	25.0	25.0	0.0	±0.1
30.0	30.0	30.0	0.0	±0.1
35.0	35.0	35.0	0.0	±0.1
40.0	40.0	40.0	0.0	±0.1
45.0	45.0	45.0	0.0	±0.1
50.0	50.0	50.0	0.0	±0.1
55.0	55.0	55.0	0.0	±0.1
60.0	60.0	60.0	0.0	±0.1
65.0	65.0	65.0	0.0	±0.1
70.0	70.0	70.0	0.0	±0.1
75.0	75.0	75.0	0.0	±0.1
80.0	80.0	80.0	0.0	±0.1
85.0	85.0	85.0	0.0	±0.1
90.0	90.0	90.0	0.0	±0.1
95.0	95.0	95.0	0.0	±0.1
100.0	100.0	100.0	0.0	±0.1

The reported uncertainty of temperature measurement was ±0.1 °C.  
The calibration was performed in accordance with the above calibration data.  
The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k=2, providing a level of confidence of approximately 95%.

Approved By: 

PM-L13 11/15-05-07

**Metrological Center**  
SCI ECO Services Company Limited  
33/2 Moo 3, T.Banpa, A.Kaengkhoh, Saraburi 18110, Thailand.  
Website : www.scieco.co.th E-Mail : calibrate@scg.co.th

Certificate No. T211650 Page 1 of 3

### Certificate of Calibration

**Equipment** : Chamber ( Oven )  
**Manufacturer** : Memmert  
**Model** : UF 450  
**Serial No.** : B7170531  
**Customer Code** : BKK-EN0273  
**ID No.** : T8042A4  
**Customer** : ALS Laboratory Group (Thailand) Co., Ltd.  
104 Phatthanakan 40, Phatthanakan Rd.,  
Khwaeng Phatthanakan, Khet Suan Luang, Bangkok 10250

**Customer Location** : Oven Room  
**Date of Receipt** : 16 July 2021  
**Calibrated By** : Atiphong Rongrat ( Technician )  
**Approved By** :  / Boonchai Suriyawong (Site Calibration Manager)  
**Date of Issue** : 23 JUL 2021

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

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

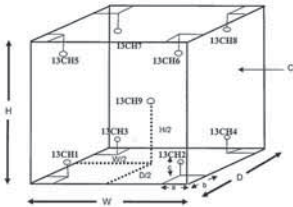
Approved By: 

PM-L13 11/15-05-04

**Metrological Center**  
SCI ECO Services Company Limited  
33/2 Moo 3, T.Banpa, A.Kaengkhoh, Saraburi 18110, Thailand.  
Website : www.scieco.co.th E-Mail : calibrate@scg.co.th

Certificate No. T211650 Page 3 of 3

### Calibration Report




**Remark** :  
Internal Dimensions of Chamber : W(Width) = 104 cm , H(Height) = 72 cm and D(Depth) = 60 cm.  
Size of Installed Standard sensor number 13CH1 to number 13CH9 : a = 5 cm, b = 5 cm and c = 5 cm.  
Size of Installed Standard sensor number 13CH9 : W/2 = 104 cm/2, H/2 = 72 cm/2 and D/2 = 60 cm/2

**Measurement Results**

Calibration Point	Average Standard Reading at each position (°C)								
	13CH1	13CH2	13CH3	13CH4	13CH5	13CH6	13CH7	13CH8	13CH9
104	104.34	104.10	103.94	104.63	103.75	104.79	103.41	104.74	103.40
180	180.62	180.63	180.75	180.38	179.47	180.97	178.80	180.63	178.86

Setting (°C)	Chamber (Oven)		Temperature Distribution			
	Min	Max	Stability (±°C)	Uniformity (°C)	Uncertainty (±°C)	Coverage Factor k
104.0	104	104.1	0.04	1.7	0.59	2.00
180.0	180	180.1	0.02	2.7	0.73	2.00

\* The quoted uncertainty exclude "uniformity"  
The calibration result apply only the above calibrated item.  
The result of test was found accurate as shown on data and place of test only.  
The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k which for a t-distribution, providing a level of confidence of approximately 95% .

Approved By: 

PM-L13 11/15-05-04



**TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)**  
CORPORATE SERVICES & EQUIPMENT CALIBRATION AND TESTING SERVICES  
1044 PATTANAKARN ROAD 101, SUKHUMVIT, BANGKOK 10110, THAILAND  
TEL: 02-277-0888 FAX: 02-277-0888

**Certificate of Testing**  
Cert. No.: 217198  
Page: 1 of 2

Equipment: DO Meter  
Manufacturer: YSI  
Model: 5100  
Serial No.: 15L103204  
ID No.: BKK\_210205  
Received Date: 15 January 2021  
Test Date: 19 January 2021  
Reference: 2101-0428WDC-2  
Submitted by: ALS Laboratory Group (Thailand) Co., Ltd.  
104 Phatthanakan Rd., Phatthanakan Rd., Khwaeng Phatthanakan, Khet Suan Luang, Bangkok 10250 Thailand  
Laboratory Condition: Temperature: (28 ± 0.1) °C  
Humidity: (38 ± 3%) %  
Test Procedure: In-house method / CP-CAB  
by Comparison Technique with Aqueous Modification Method  
Calibrated by: Nissakorn Sittichan  
Approved by: [Signature]  
Approved Signature  
Date: 25 January 2021

REVISION BY: [Signature]  
APPROVED BY: [Signature]  
NEXT CAL. DATE: 04/01/22

10251901

**TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)**  
CORPORATE SERVICES & EQUIPMENT CALIBRATION AND TESTING SERVICES  
1044 PATTANAKARN ROAD 101, SUKHUMVIT, BANGKOK 10110, THAILAND  
TEL: 02-277-0888 FAX: 02-277-0888

**Certificate of Calibration**  
Cert. No.: 217198  
Page: 1 of 2

Equipment: DO Meter with Sensor  
Manufacturer: YSI  
Model: 5100  
Serial No.: 15L103204  
ID No.: BKK\_210205  
Submitted by: ALS Laboratory Group (Thailand) Co., Ltd.  
104 Phatthanakan Rd., Phatthanakan Rd., Khwaeng Phatthanakan, Khet Suan Luang, Bangkok 10250 Thailand  
Location: TPA On-Site Calibration Laboratory  
Received Date: 15 January 2021  
Calibrated Date: 21 January 2021  
Ambient Temperature: (28 ± 0.1) °C  
Relative Humidity: (38 ± 3%) %  
AC Line Voltage: (220 ± 22) V  
Calibrated by: Nissakorn Sittichan  
Approved by: [Signature]  
Approved Signature  
Date: 28 January 2021

10251901

**Metrological Center**  
SGI ECO Services Company Limited  
102 Moo 5, T. Bangpa, A. Bangkhong, Suburban 10110, Thailand  
Bangkok Tel: +66 2027 5080 Fax: +66 2027 2100  
Bangkok Tel: +66 9 055 8801, +66 9 0247 2380  
Website: www.metrocenter.co.th E-Mail: metrocenter@metrocenter.co.th

**Certificate of Calibration**  
Cert. No.: 217198  
Page: 1 of 2

Equipment: Chamber (Incubator)  
Manufacturer: SHEL LAB  
Model: 2020-2E  
Serial No.: 802899  
Customer Code: BKK\_EN0805  
ID No.: T7499A6  
Customer: ALS Laboratory Group (Thailand) Co., Ltd.  
104 Phatthanakan Rd., Phatthanakan Rd., Khwaeng Phatthanakan, Khet Suan Luang, Bangkok 10250  
Customer Location: Wet Chemistry Lab2  
Date of Receipt: 1 October 2021  
Calibrated By: Sujjar Nakkakred (Site Calibration Manager)  
Approved By: [Signature] /Bouanchai Suriyawong (Site Calibration Manager)  
Date of Issue: 07 OCT 2021

REVISION BY: [Signature]  
APPROVED BY: [Signature]  
NEXT CAL. DATE: 04/01/22

10251901

**TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)**  
CORPORATE SERVICES & EQUIPMENT CALIBRATION AND TESTING SERVICES  
1044 PATTANAKARN ROAD 101, SUKHUMVIT, BANGKOK 10110, THAILAND  
TEL: 02-277-0888 FAX: 02-277-0888

**Condition of this result of calibration**  
1. Reference Standard Instrument:  
Instrument: DO Meter  
Serial No.: 15L103204  
Certificate No.: 217198  
Exp. date: 19 Apr 2022  
This certification is traceable to the International System of Units maintained at:  
- Traceable to National Institute of Metrology (Thailand), NIMT  
2. Certified Reference Materials:  
- Conductivity calibration solution, Thermo Scientific (traceable to NIST)  
Conductivity Solution: Manufacturer: Lot No.: Exp. date:  
84 µS/cm Thermo Scientific 08150 23 Feb 2022  
1413.0 µS/cm Thermo Scientific 17100 30 Apr 2024  
12.80 µS/cm Thermo Scientific 23051 07 June 2023  
3. Control Conductivity calibration solution temperature by Water bath (25 ± 0.1) °C  
4. This certificate is valid only to the item calibrated on date and place of calibration.

**Calibration results**  
Parameter: Conductivity Measurement  
(\*) After Adjustment at 1413 µS/cm  
Conductivity Electrode Serial No.: 021270404

Standard Conductivity Solution	Before Adjustment UQC Reading	After Adjustment UQC Reading	Uncertainty of Measurement (K)	Coverage factor
84 µS/cm	85.52 µS/cm	85.52 µS/cm	4.3 µS/cm	3.00
1413.0 µS/cm	1419 µS/cm	1413 µS/cm	15 µS/cm	3.00
12.80 µS/cm	12.82 µS/cm	12.79 µS/cm	0.14 µS/cm	3.00

Remark:  
- UQC = Unit Under Calibration  
- Adjustment Cell constant = 0.99929 cm<sup>2</sup>

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

10251901

**TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)**  
CORPORATE SERVICES & EQUIPMENT CALIBRATION AND TESTING SERVICES  
1044 PATTANAKARN ROAD 101, SUKHUMVIT, BANGKOK 10110, THAILAND  
TEL: 02-277-0888 FAX: 02-277-0888

**Result: Dissolved Oxygen Meter Adjustment With Air 100 %**  
Dissolved Oxygen Probe No.: 10C130772

Titration Method (Aqueous Modification Method)	DO Meter Reading (mg/L)	Standard Deviation (mg/L)
8.10	8.10	0.008

This report was verified only for the instrument was tested. It is allowable to use for study the system efficiency. The environmental impact control and present to organization if may concerned intend to use for advertising and related purpose is prohibited. This report may not be reproduced other in full without written approval of the laboratory.

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CORPORATE SERVICES & EQUIPMENT CALIBRATION AND TESTING SERVICES  
1044 PATTANAKARN ROAD 101, SUKHUMVIT, BANGKOK 10110, THAILAND  
TEL: 02-277-0888 FAX: 02-277-0888

**Equipment: DO Meter with Sensor**  
Condition As Received: Used Item  
Reference: 2101-0428WDC-2  
Procedure Used: Calibration was conducted using in-house calibration procedure CP-0121 according to comparison with Industrial Platinum Resistance Thermometer (IPRT) 190 Temperature Bath.  
The temperature scale used was based on ITS-90.  
**Condition of this result of calibration**  
1. Reference Standard Instrument:  
Instrument: Model: Serial No.: Cert. No.: Exp. date:  
1) Digital Thermometer 1502 0180001 201309 20 Nov 2021  
2. This certificate is valid only to the item calibrated on date and place of calibration.  
3. This certification is traceable to the International System of Units maintained at:  
- National Institute of Metrology (Thailand) (NIMT)  
**Result of Calibration:** (°C) Without Adjustment  
Parameter: Temperature measurement  
This instrument was calibrated with: Temperature sensor, S/N: 19C130772

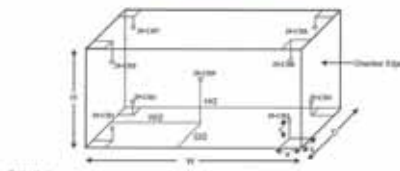
Calibration Point (°C)	Immersion Depth (mm)	Standard Temperature (°C)	UQC Reading (°C)	Error (°C)	Uncertainty (°C)	Coverage Factor
20.00	60	20.000	19.94	-0.062	0.15	2.00

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

10251901



## Calibration Report



Internal Dimensions of Chamber : W (Width) = 10 cm, H (Height) = 10 cm, D (Depth) = 10 cm.  
Size of Inserted Standard sensor (D-CM) :  $\phi=5$  mm,  $\lambda=5$  mm, and  $\alpha=5$  mm.  
Size of Inserted Standard sensor (D-CM) : W12 = 10 mm, H12 = 10 mm, D12 = 10 mm.

## Measurement Results

Average Standard Reading at each position (°C)									
Calibration Point	D-CM1	D-CM2	D-CM3	D-CM4	D-CM5	D-CM6	D-CM7	D-CM8	D-CM9
20	20.24	20.26	20.29	20.30	20.31	20.32	20.33	20.34	20.35
22	22.00	22.01	22.02	22.03	22.04	22.05	22.06	22.07	22.08

Chamber (Sensor)			Temperature Distribution			
Reading (°C)			Reading (°C)			
Min, Max, Average			Min, Max, Average			
20.0	-	20.0	0.00	1.00	0.20	1.00
22.0	-	22.0	0.00	0.00	0.00	1.00

\* The quoted uncertainty includes "self-heating".  
The calibration must apply only to the above calibration item.  
The result of the test was found accurate to within  $\pm 0.01$  and  $\pm 0.01$  mm.  
The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor  $k=2$ , which for a distribution, providing a level of confidence of approximately 95 %.

Approved By:   
TMC 211123 (01/01/2023)



Cert. No.: 2101170  
Page: 2 of 2

## Condition of this calibration result

- Reference Standard Instrument :  
Instrument : Serial No. : ID No. : Cert. No. : Due Date :  
1) Document Process Calibration : 42100000 : 13000000 : 21012021 : 27 Apr 2022  
This certificate is traceable to the International System of Unit maintained at:  
- Towards to National Institute of Metrology (Thailand), NIMT

- Calibrated Reference Materials : (The measurement results are traceable to IS through DPA class L40, 8000-AS2 Industrial Automation Board, Accredited No. 401-1905)

Buffer Solution	Manufacturer	Lot No.	Exp. date
pH 4.008	DPA class	791071	02 Aug 2022
pH 6.862	DPA class	791071	02 Aug 2022
pH 10.015	DPA class	791071	02 Aug 2022

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

## Calibration Results

Function: pH Measurement

Performing standard curve by Fluke at pH (6.7, 10)

Unit Under Calibration	Nominal Value		Standard Voltage		Actual Reading		Uncertainty of Measurement		Coverage Factor	
	pH	mV	mV	mV	pH	mV	(mV)	(mV)	k	k
pH Meter	4.00	177.48	177	4.00	0.08	3.00	0.08	3.00	2.00	2.00
SN: 0000010475	7.00	0.00	0	7.00	0.08	2.00	0.08	2.00	2.00	2.00
	10.00	-177.48	-178	10.00	0.08	2.00	0.08	2.00	2.00	2.00

## Function: pH Measurement

Performing three buffers standard curve by using buffer nominal pH (6.7, 10)

Unit Under Calibration	Standard pH Buffer Solution	Actual pH Reading	Uncertainty of pH measurement	Coverage Factor
pH Electrode	4.008	4.01	0.001	2.00
SN: 0101101	6.862	6.86	0.000	2.00
	10.015	10.01	0.000	2.00

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 %.

u=

a 1087116



Cert. No.: 21100304  
Page: 2 of 2

Equipment : pH Meter with Sensor  
Condition As-Received : Used Item  
Reference : 2110-0011000-0

## Procedure Used

Calibration were conducted using in-house calibration procedure CP-0121 according to completion with Industrial Platinum Resistance Thermometer (IPRT) in Temperature Bath.  
The temperature scale used was based on ITS-90.

## Condition of this result of calibration

- Reference standard instrument

Instrument	Model	Serial No.	Cert. No.	Due Date
Digital Thermometer	1002A	AG0947	2111144	02 Oct 2022

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

- This certificate is traceable to the International System of Unit.

## Result of Calibration

Function: Temperature measurement

This instrument was compared with: Thermocouple Type T, SN: 2101102

Calibration Point (°C)	Immersion Depth (mm)	Standard Temperature (°C)	MAC Reading (°C)	Error (°C)	Uncertainty (°C)	Coverage Factor
20.0	100	20.000	20.1	0.001	0.30	2.00
25.0	100	25.000	25.1	0.001	0.30	2.00
30.0	100	30.000	30.2	0.002	0.30	2.00
35.0	100	35.004	35.2	0.006	0.30	2.00
40.0	100	40.000	40.3	0.007	0.30	2.00
45.0	100	45.000	45.2	0.002	0.30	2.00
50.0	100	50.004	50.2	0.006	0.30	2.00

MAC: 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 %.

u=

a 1088339

## Calibration Report

Equipment : Chamber (Sensor)  
Date of Calibration : 8-5 October 2022  
Environment : Temperature : 23.8-24.9 °C  
Line Voltage : 227.5-231.1 V  
Relative Humidity : 35 - 45 %RH

## Condition of this result of calibration

- This equipment was calibrated by laser class resistance thermometer detector line in chamber, for other use resistance thermometer detector was for ambient temperature measurement. The calibration was done in accordance to W1728 (based on ASTM E141-04 (Reapproved 2005) and A2373-09b).  
All data shown below were found values and the initial data from customer request. The temperature scale used was based on ITS-90.

Reference Standard Instrument	Model	Serial No.	Certificate No.	Due Date
RTD	100 class	29-CH1-005	T210110	2 February 2022
DATA LOGGER	14070A	147	T210110	2 February 2022

- This certificate is traceable to: National Institute of Metrology (Thailand) through Metrological Center (NIMT-TMC-TN 17021 CALIBRATION 0204)

- Condition of calibrated item: good

Equipment Description :  
Type : Chamber : 20 : Min : 20 : Max : 20 : °C  
Peak Air Density : 10 : Min : 10 : Max : 10 : °C

Non Available

- Adjustment : ( ) without adjustment ( X ) after adjustment

Approved By:   
TMC 211123 (01/01/2023)

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Cert. No.: 2101170  
Page: 1 of 2

## Certificate of Calibration

Equipment : pH Meter  
Manufacturer : Mettler Toledo  
Model : Seven2Go  
Serial No. : 8000010470  
ID No. : 8000010470  
Condition As-Received : Used Item  
Received Date : 23 December 2021  
Calibration Date : 23 December 2021  
Reference : 2110-0011000-0  
Submitted by : ALB Laboratory Group (Thailand) Co., Ltd.  
104 Phatthanaburi Rd., Phatthanaburi Rd.,  
Khaeng Phatthanaburi, Khwaeng Phatthanaburi, Bangkok 10200 Thailand

Ambient Temperature : 23.8 ± 0.5 °C  
Relative Humidity : 35 ± 10 %  
Calibration Procedure :  
- In-house method  
- CP-0121 by direct measurement with standard voltage calibrator and direct measurement with certified reference material (CRM)

Calibrated by : Wanida Sirichuan

Approved by :   
Approved Signature

Issue Date : 24 December 2021

The Uncertainty level for a confidence probability of approximately 95%

Expanded Uncertainty (k=2) : 0.001 °C (at 23 °C)

Approved by : Wanida Sirichuan, Director of Metrological Center (NIMT-TMC-TN 17021 CALIBRATION 0204)

A 0036553

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Cert. No.: 21100304  
Page: 1 of 2

## Certificate of Calibration

Equipment : pH Meter with Sensor  
Manufacturer : Mettler Toledo  
Model : Seven2Go  
Serial No. : 8000010470  
ID No. : 8000010470  
Submitted by : ALB Laboratory Group (Thailand) Co., Ltd.  
104 Phatthanaburi Rd., Phatthanaburi Rd.,  
Khaeng Phatthanaburi, Khwaeng Phatthanaburi, Bangkok 10200 Thailand  
Location : TPA On Site Calibration Laboratory

Received Order : 23 December 2021  
Calibrated Date : 27 December 2021  
Ambient Temperature : 28.8 ± 0.5 °C  
Relative Humidity : 10 ± 10 %  
AC Line Voltage : 220.8 ± 0.2 V

Calibrated by : Pawanee Mahab

Approved by :   
Approved Signature

Issue Date : 9 January 2022

The Uncertainty level for a confidence probability of approximately 95%

Expanded Uncertainty (k=2) : 0.001 °C (at 28 °C)

Approved by : Pawanee Mahab, Director of Metrological Center (NIMT-TMC-TN 17021 CALIBRATION 0204)

A 0036304



## Instrument Details

## Purpose

This section describes the as found system configuration.

## Details

Spectrometer 1	
Manufacturer	Agilent Technologies
Name	5100 BVDV
Model Number	G8019A
Sample Introduction	Double pass glass cyclonic spraychamber and neospray nebulizer
Serial Number	MY16010005
Firmware Revision	5365
Chiller 1	
Manufacturer	Agilent Technologies
Name	Other Unspecified
Other Unspecified Name	Chiller
Model Number	Other Unspecified
Other Unspecified Model Number	G3292-80201
Serial Number	2009-00159
Autosampler 1	
Manufacturer	Agilent Technologies
Name	SP4
Model Number	G8410A
Serial Number	AU15440764
Switching Valve Accessory 1	
Manufacturer	Agilent Technologies
Name	BVS 2+
Model Number	G8495A
Serial Number	AU16040115

Date: September 13, 2021 5:49:11 PM  
System ID: MY16010005

Page 2 / 5

User Name: phingrapha.jearphong

Username: ASBQW00000

System ID: MY16010005

Print Date: September 13, 2021 5:49:12 PM

QIQW 5100 BVDV ALB 1000001 Transaction log:

Time	Transaction Date	Activity Performed	Type of Transaction	Optional Information
September 8, 2021 8:40:09 AM		SessionCreated	Session	None
September 8, 2021 8:40:09 AM		Configuration	Session	None
September 8, 2021 8:49:09 AM		EndSession	Session	User is Phingrapha and does not require an unlock code
September 8, 2021 9:07:00 AM		EplLoaded	Session	EQP details for primary technique [24] - The path (Protocol/ProtocolConfiguration) was G3292-80201-03-00-00-00 EQP File Name: (24.02.00.mpl), EQP Name: (AgilentRecommended)
September 8, 2021 9:07:11 AM		Configuration	Session	None
September 8, 2021 9:07:16 AM		Qualification	Session	OQ
September 8, 2021 9:07:19 AM		Execution	Preparation: 5100 BVDV Qualitative Test - No separate execution	None
September 8, 2021 9:34:35 AM		Execution	Preparation: 5100 BVDV Qualitative Test - No separate execution	Run Count: 1
September 8, 2021 9:34:35 AM		Execution	Instrument Tests: 5100 BVDV Qualitative Test - No separate execution	None
September 8, 2021 9:31:27 AM		Execution	Instrument Tests: 5100 BVDV Qualitative Test - No separate execution	Run Count: 1

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Date: September 13, 2021 5:49:11 PM  
System ID: MY16010005

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## Agilent CrossLab Compliance

Qualification Type:	ES-OQ
System ID:	MY16010005
EQP Name:	AgilentRecommended
EQP Details:	Agilent Technologies System
EQP Revision:	ES.02.50
EQP Release Date:	March 2020
Date:	September 13, 2021 5:50:41 PM
Report Type:	Report
Org. Name:	ALB Laboratory Group (Thailand) Co., Ltd.
Org. Location:	104 Phatthanakan 49 Phatthanakan Rd., Bangkok 10250

Date: September 13, 2021 5:50:41 PM  
System ID: MY16010005

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## Certificate of System Qualification

## ES-OQ

System ID: MY16010005  
Organization Name: ALB Laboratory Group (Thailand) Co., Ltd.  
Organization Location: 100 Phatthanakan 49 Phatthanakan Rd., Bangkok 10250

Date: September 13, 2021 5:49:11 PM  
EQP Name: AgilentRecommended  
EQP Revision: ES.02.50  
Overall Qualification Status: Pass

Preparation: [Pass]  
Instrument Tests: [Pass]  
Autosampler Operation: [Pass]



Date: September 13, 2021 5:49:11 PM  
System ID: MY16010005

Page 1 / 5

BKK\_EL0037

## Electronic Signature

## Purpose

This signature page was created and published because the ACE sign-off action was executed, which is valid for the entire document, including attachments. The ACE sign-off is an electronic signature that requires two distinct identification components: unique username and personal password. The Agilent representative who has delivered this service understands the meaning and legal status of an electronic signature. As a trained official operator, the Agilent representative has a unique password and login to access ACE and electronically sign this document. (Other e-signatures can be applied to this document using a Document Content Management or other suitable method defined in your data access and control procedures.)

Details  
Full Name of Signer: Kanyakorn Subparajarn  
Logged On User Name: phingrapha.jearphong@agilent.com  
Signature Creation Date: September 13, 2021  
Reason for Signature: Executed protocol and published this original version of document

## Regulatory Disclaimer

This document provides a protocol to verify and record instrument configuration and evidence of proper operation. It has been prepared from our interpretation of applicable regulations as well as industry best practices. The document is designed to provide an important component of a complete compliance package. Validation depends upon many factors and use of this protocol alone does not assure compliance. Agilent Technologies makes no promises or representations as to its sufficiency for any specific regulatory program.

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Date: September 13, 2021 5:49:11 PM  
System ID: MY16010005

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User Name: phingrapha.jearphong

Username: ASBQW00000

System ID: MY16010005

Print Date: September 13, 2021 5:49:12 PM

QIQW 5100 BVDV ALB 1000001 Transaction log:

Time	Transaction Date	Activity Performed	Type of Transaction	Optional Information
September 8, 2021 8:31:30 AM		Start	Autosampler Operation: Autosampler 1 - SP4	None
		Execution	Autosampler Operation: Autosampler 1 - SP4	Qualitative Test - No separate execution
September 8, 2021 8:31:30 AM		End	Autosampler Operation: Autosampler 1 - SP4	Run Count: 1
		Execution	Autosampler Operation: Autosampler 1 - SP4	Qualitative Test - No separate execution
September 8, 2021 9:31:30 AM		End	Qualification	Session
		Qualification	Session	OQ
September 8, 2021 9:31:30 AM		Reporting	Session	None
September 8, 2021 10:55:40 AM		AutoClosed	Session	None
September 13, 2021 5:01:38 PM		AutoPatched	Session	None
September 13, 2021 5:01:38 PM		SessionPatched	Session	None
September 13, 2021 5:01:38 PM		Start	Qualification	Session
		Qualification	Session	OQ
September 13, 2021 5:01:38 PM		Reporting	Session	Report Generated: Certificate

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Date: September 13, 2021 5:49:11 PM  
System ID: MY16010005

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## Test Summary

### Purpose

This section includes a status for each scheduled test and the overall qualification. For each test that is run, (1) the status is automatically determined based on pre-defined limits, and (2) the total number of times the test was run is displayed. For detailed results and specifications for a test, refer to the test results in this EQR.

Details	Status	Runs
Test		
Preparation : \$100 BVDV	Pass	1
Instrument Tests : \$100 BVDV	Pass	1
Autosampler Operation : Autosampler 1 - SPS4	Pass	1
Overall Qualification Status		
Pass		

Date: September 13, 2021 5:50:41 PM  
System ID: MY16010005

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## Instrument Details

### Purpose

This section describes the as found system configuration.

#### Details

Spectrometer 1	
Manufacturer	Agilent Technologies
Name	\$100 BVDV
Model Number	G8010A
Sample Introduction	Double pass glass cyclonic spraychamber and seaspray nebulizer
Serial Number	MY16010005
Firmware Revision	5395
Chiller 1	
Manufacturer	Agilent Technologies
Name	Other Unspecified
Other Unspecified Name	Chiller
Model Number	Other Unspecified
Other Unspecified Model Number	G3292-80201
Serial Number	2005-00159
Autosampler 1	
Manufacturer	Agilent Technologies
Name	SPS4
Model Number	G8410A
Serial Number	AJ15440794
Switching Valve Accessory 1	
Manufacturer	Agilent Technologies
Name	SVS 2+
Model Number	G8485A
Serial Number	AJ16040115

Date: September 13, 2021 5:50:41 PM  
System ID: MY16010005

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## Preparation

### Purpose

This test records a status for each preparation task for the Agilent ICP-OES.

#### Configuration Details

Model/Serial No.: G8010A MY16010005

Results	Observed Result	Expected Result	Status
Criteria			
Does the plasma ignite successfully in the first three attempts?	Yes	Yes	Pass
Was the detector calibration performed and completed successfully?	Yes	Yes	Pass
Was the instrument calibration performed and completed successfully?	Yes	Yes	Pass

Date: September 13, 2021 5:50:41 PM  
System ID: MY16010005

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## Table of Contents

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## Service Details

### Purpose

This section includes local contact and delivery details for this service.

#### General Details

Service Order No./Request:	6004823273
EQP Name:	Agilent/Recommended
EQP Revision:	ES.02.50
Report Type:	Report

#### Organization Details

Name:	ALS Laboratory Group (Thailand) Co., Ltd.
Location:	104 Phatthanakan 40 Phatthanakan Rd., Bangkok 10250

#### Local Contact Details

Name:	Khun Thilma Roongpong
Job Title:	Scientist 2, Life Sciences
Qualification Location:	ICP Room

#### Operator Details

Name:	Kanyakorn sukparthajarn
Job Title:	Field Service Engineer

#### Data Acquisition Details

Acquisition Software Name:	ICP Expert
Acquisition Software Revision:	7.5.3.11953

#### Customer Data System (CDS):

En: ICP Expert

Date: September 13, 2021 5:50:41 PM  
System ID: MY16010005

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## Protocol Details

### Purpose

This section lists the revisions for all test units used in this report. For complete test-specific and high-level change details, refer to the Revision History document.

Test Revision	Test
ES.02.50	Autosampler Operation
ES.02.50	Instrument Tests
ES.02.50	Preparation

Date: September 13, 2021 5:50:41 PM  
System ID: MY16010005

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Image Details: Was the instrument calibration performed and completed successfully?

Date and Time: September 8, 2021 9:33:30 AM

Host Name: ASBK00V0328

Overall Test Status: Pass

Runs: 1

Date: September 13, 2021 5:50:41 PM

System ID: MY16010005

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### Autosampler Operation

Purpose: This test verifies that the autosampler operates properly.

Configuration Details: Model/Serial No.: G8410A AU15460764

Results: Observed Result Expected Result Status

Does the autosampler successfully move to the specified location(s)? Yes Yes Pass

Overall Test Status: Pass

Runs: 1

Date: September 13, 2021 5:50:41 PM

System ID: MY16010005

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### Attachments

Location	Category	Document Name	Page
EQR	General	Certificate of Qualification for ACE	1
EQR	General	Certificate of Qualification for ACE	1
EQR	General	Operator's training certificate and qualifications	1
EQR	Material	Certificate of Analysis Wavelength calibration solution	4
EQR	Comments	General	1
EQR	General	Instrument's Test Report	5
EQR	General	Instrument's Test Report	4

Date: September 13, 2021 5:50:41 PM

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### Test Evidence

Image Details: Was the detector calibration performed and completed successfully?

Date and Time: September 8, 2021 9:07:42 AM

Host Name: ASBK00V0328

Overall Test Status: Pass

Runs: 1

Date: September 13, 2021 5:50:41 PM

System ID: MY16010005

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### Instrument Tests

Purpose: This test records a status for each of the automated tests within the Agilent ICP-OES CDS. For detailed test criteria, refer to the attached report.

Configuration Details: Model/Serial No.: G8010A MY16010005

Results: Observed Result Expected Result Status

Are the Functional Tests results within acceptance criteria?

Subsystem Communications: Yes Yes Pass

Air Flow: Yes Yes Pass

Water Flow: Yes Yes Pass

Gas Flows: Yes Yes Pass

RF Generator: Yes Yes Pass

Camera: Yes Yes Pass

Optics: Yes Yes Pass

Are the Instrument Performance Tests results within acceptance criteria?

Resolution: Yes Yes Pass

Sensitivity: Yes Yes Pass

Precision: Yes Yes Pass

Overall Test Status: Pass

Runs: 1

Date: September 13, 2021 5:50:41 PM

System ID: MY16010005

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### Declaration of Change Control

This document is under change control. Revision history is maintained and printed on each document. Access to the master documents is limited to process owners. Documents receive periodic review and cannot be assigned an evergreen status. The qualification performed according to this document refers only to the hardware/software configuration in place at the time of the qualification. Agilent Technologies recommends that instrument configuration change management procedures be in place in order to maintain the validation process. Any changes to the analytical or computer hardware or software must be clearly specified. A change management system provides a means for determining the degree of requalification required according to the extent of the changes made. All details of the changes must be thoroughly recorded and documented, together with details of completed tests and their results. Note: Hardware/software configuration management is the customer's responsibility.

Date: September 13, 2021 5:50:41 PM

System ID: MY16010005

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## Comments

Date/Time:	September 13, 2021 5:27:56 PM
Test:	General
Comment:	Start OQ on 08 Sep 21 and found water flow fail, So repair job complete for 13 Sep 21 and OQ continue to complete.

Date: September 13, 2021 5:00:41 PM  
System ID: MY16010005

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Document Name: Instrument's Test Report

Resolution Test			Pass
Element Wavelength	Specification	Width	
A (194.213 nm)	± 0.40	7.44	
A (194.560 nm)	± 0.30	6.43	
C (193.827 nm)	± 11.80	8.89	
Pa (200.353 nm)	± 8.20	8.93	
Co (204.152 nm)	± 1.60	11.06	
Zn (213.857 nm)	± 8.70	7.27	
Pr (229.353 nm)	± 9.50	7.52	
Co (224.754 nm)	± 7.70	13.86	
Se (196.026 nm)	± 8.40	7.80	
Mn (257.810 nm)	± 13.30	8.89	
Na (287.816 nm)	± 20.30	16.83	
Cr (267.716 nm)	± 11.00	8.93	
Co (264.754 nm)	± 25.00	16.14	
Co (267.716 nm)	± 14.30	17.79	
Se (196.026 nm)	± 33.50	26.34	
Se (194.453 nm)	± 44.00	33.37	
Se (193.752 nm)	± 26.00	22.38	
Se (193.408 nm)	± 36.00	26.06	
Se (194.171 nm)	± 42.00	26.48	
Se (193.268 nm)	± 74.00	35.58	
K (786.481 nm)	± 85.00	26.42	

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Date: September 13, 2021 5:00:41 PM  
System ID: MY16010005

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Document Name: Instrument's Test Report

Resolution Test			Pass
Element Wavelength	Specification	Measured Value % RSD	
A (194.213 nm)	± 1.00	0.45	
Se (194.453 nm)	± 1.00	0.49	
K (786.481 nm)	± 1.00	0.34	

Element Wavelength	Specification	Measured Value % RSD	
A (194.560 nm)	± 1.00	0.34	
Se (196.026 nm)	± 1.00	0.58	
Zn (204.200 nm)	± 1.00	0.39	
Zn (213.857 nm)	± 1.00	0.38	
Co (214.439 nm)	± 1.00	0.30	
Pr (229.353 nm)	± 1.00	0.47	
Mn (257.810 nm)	± 1.00	0.79	
Cr (267.716 nm)	± 1.00	0.30	
Co (264.754 nm)	± 1.00	0.48	
A (206.152 nm)	± 1.00	0.30	
Se (193.408 nm)	± 1.00	0.50	
K (786.481 nm)	± 1.00	0.40	

## Report Detail:

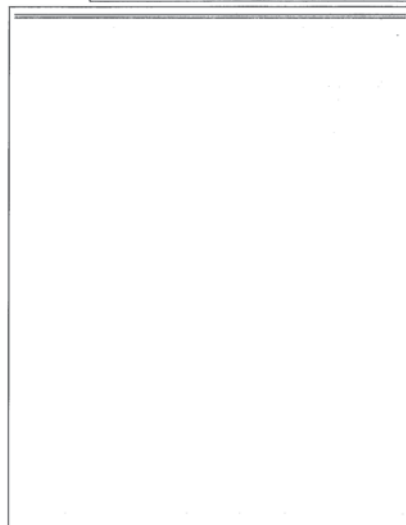
Tests Run - Operator: Kanyam S.  
Subsystem Communications Test: Started  
Subsystem Status:  
Main Power Module - Passed  
Gas Control Module - Passed  
RF Generator - Passed  
Peristaltic Module - Passed  
Optical Control Module - Passed  
Peristaltic Pump - Passed  
Subsystem Communications Test Completed - Passed  
Optics Test: Started  
Test View Mode Interference Status:  
LED On - Passed  
Shutter opened - Passed  
Peak Intensity Radial mode 3002176.14 - Passed  
Shutter closed - Passed  
Peak Intensity Radial mode 3002176.14 - Passed  
Shutter opened - Passed  
Optical Power Factor: Calculated Value = 2.05, Factory Value = 2.05  
Peak Intensity Axial mode 3102050.48 - Passed

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Document Name: Certificate of Analysis Wavelength calibration solution



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## General

Document Name: Instrument's Test Report

Report Summary	
Instrument Model	Agilent 51000110 BVDV KDP-003
Instrument ID	GR10AGB014A
Instrument Serial Number	MY16010005
Software Version	7.5.3.11993
Firmware Version	000
Tested By	Kanyam S.
Test started on	9/9/2021 6:51:21 AM
Test Completed On	9/9/2021 6:56:30 AM

Result Summary	
Subsystem Communications Test	Pass
Air Flow Test	Skipped
Water Flow Test	Skipped
Gas Flow Test	Skipped
RF Generator Test	Skipped
Camera Test	Skipped
Optics Test	Pass
Advanced Valve System Test	Skipped
Resolution Test	Pass
Sensitivity Test	Pass
Precision Test	Pass

Subsystem Communications Test		Pass
Optics Test	Pass	

Optics Test				Pass
Radial	Axial	BVDV		
Intensity	3002176	3102050	3410088	
Wavelength	727.213	727.213	727.213	

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System ID: MY16010005

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Document Name: Instrument's Test Report

Sensitivity Test			Pass		
Fluid					
Element Wavelength	Specification	Method	Standard	Block	
A (194.560 nm)	± 46.0	GBR	38.8	365.1	34.3
Se (196.026 nm)	± 41.0	GBR	35.9	704.4	113.8
Zn (213.857 nm)	± 142.0	GBR	108.3	29674.4	197.9
Pr (229.353 nm)	± 46.0	GBR	106.6	1362.6	182.2
Mn (257.810 nm)	± 816.0	GBR	8661.7	12143.8	368.9
A (206.152 nm)	± 3.4	GBR	5.3	34237.9	368.8
Se (193.408 nm)	± 24.0	GBR	35.1	101616.2	10963.7
K (786.481 nm)	± 1.8	GBR	4.4	82043.9	18321.8
Aval					
Element Wavelength	Specification	Method	Standard	Block	
A (194.560 nm)	± 204.0	GBR	262.4	5165.8	274.5
Se (196.026 nm)	± 109.0	GBR	106.9	3603.2	321.0
Zn (204.200 nm)	± 243.0	GBR	703.8	12488.9	137.0
Zn (213.857 nm)	± 174.0	GBR	4524.5	120662.8	656.4
Co (214.439 nm)	± 4227.0	GBR	4808.6	87902.4	375.1
Pr (229.353 nm)	± 1030.0	GBR	1017.9	7693.7	484.3
Mn (257.810 nm)	± 10625.0	GBR	16008.8	633891.8	1104.7
Cr (267.716 nm)	± 1045.0	GBR	4116.3	173999.6	1731.9
Co (264.754 nm)	± 19.0	GBR	46.5	188353.3	3980.0
A (206.152 nm)	± 6.0	GBR	16.7	100662.8	3497.5
Se (193.408 nm)	± 60.0	GBR	168.0	537429.7	37100.0
K (786.481 nm)	± 24.0	GBR	54.9	3536127.0	38564.9

## Precision Test

Precision Test			Pass
Element Wavelength	Specification	Measured Value % RSD	
A (194.560 nm)	± 2.60	1.08	
Se (196.026 nm)	± 2.60	1.38	
Zn (213.857 nm)	± 1.00	0.40	
Pr (229.353 nm)	± 3.80	0.72	
Mn (257.810 nm)	± 1.00	0.44	

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## Document Name: Instrument's Test Report

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Document Name: Instrument's Test Report

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Date: September 13, 2021 5:50:41 PM  
System ID: MY10010005

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### Purpose

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### Details

Full Name of Signer:	Kanyakorn Sukpradjanern
Logged On User Name:	phirapha.jeemspong@agilent.com
Signature Creation Date:	September 13, 2021
Reason for Signature:	Executed protocol and published this

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System ID: MY10010006

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Document Name: Instrument's Test Report

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Date: September 13, 2021 5:50:41 PM  
System ID: MY16010005

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Document Name: Instrument's Test Record

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Date: September 13, 2021 5:50:41 PM  
System ID: Mr16010006

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Document Name: Instrument's Test Report

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Date: September 13, 2021 5:50:41 PM  
System ID: MY16010005

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User Name: phitapha.jangphong

Hardware: ABB000038

System ID: MY1610005

Print Date: September 13, 2021 5:04 PM

QCMW 5100 CP005 ALB 05kg/1 Transaction log:

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
September 8, 2021 9:01:30 AM	Start	Execution	Autosampler Operation: Autosampler 1 - SP50; Qualitative Test: No sequence associated	None
September 8, 2021 9:01:30 AM	End	Execution	Autosampler Operation: Autosampler 1 - SP50; Qualitative Test: No sequence associated	Run Count: 1
September 8, 2021 9:01:30 AM	End	Qualification	Session	QQ
September 8, 2021 9:01:30 AM	Start	Reporting	Session	None
September 8, 2021 10:05:40 AM	Auto	AutoClosed	Session	None
September 13, 2021 5:01:26 PM	Auto	AutoRefreshed	Session	None
September 13, 2021 5:01:26 PM	Auto	SessionRefreshed	Session	None
September 13, 2021 5:01:26 PM	Start	Qualification	Session	QQ
September 13, 2021 5:47:00 PM	Auto	Reporting	Session	Report Generated: Certificate

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Date: September 13, 2021 5:04 PM  
System ID: MY1610005

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Website: www.scg.co.th E-Mail: callcenter@scg.co.th

Certificate No. T282396

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## Certificate of Calibration

Equipment: 1 Hot Block  
Manufacturer: 1 Environmental Express  
Model: 1 SC 196  
Serial No.: 1 6974CECW3285  
Customer Code: 1 BKK\_FL0054  
ID No.: 1 TS306A3  
Customer: 1 ALS Laboratory Group (Thailand) Co., Ltd.  
104 Phothanakan 40, Phothanakan Rd., Khwaeng Phothanakan,  
Khet Suan Luang, Bangkok 10250  
Customer Location: 1 Acid Digestion Lab  
Date of Receipt: 1 12 November 2020  
Calibrated By: 1 Watcharapen Songthong (Technician)  
Approved By: 1 Banchal Suriyong (Site Calibration Manager)  
Date of Issue: 1 17 NOV 2021

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

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THA-17-0000-00-07



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Certificate No. T282396

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## Calibration Report

01	02	03	04	05	06	07	08
09	10	11	12	13	14	15	16
17	18	19	20	21	22	23	24
25	26	27	28	29	30	31	32
33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48
49	50	51	52	53	54	55	56
57	58	59	60	61	62	63	64

Continued

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No.1 = T903	No.13 = T903	No.25 = T903	No.37 = T907
No.2 = T902	No.14 = T904	No.26 = T908	No.38 = T908
No.3 = T903	No.15 = T901	No.27 = T907	No.39 = T908
No.4 = T904	No.16 = T904	No.38 = T908	No.40 = T940
No.5 = T905	No.17 = T917	No.39 = T909	No.41 = T911
No.6 = T906	No.18 = T908	No.38 = T908	No.42 = T902
No.7 = T907	No.19 = T909	No.31 = T901	No.43 = T903
No.8 = T908	No.20 = T940	No.32 = T902	No.44 = T904
No.9 = T909	No.21 = T901	No.33 = T903	No.45 = T905
No.10 = T900	No.22 = T902	No.34 = T904	No.46 = T906
No.11 = T901	No.23 = T903	No.35 = T905	No.47 = T907
No.12 = T902	No.24 = T904	No.36 = T906	No.48 = T908

Approved By:

THA-17-0000-00-07

User Name: phitapha.jangphong

Hardware: ABB000038

QCMW 5100 CP005 ALB 05kg/1 Transaction log:

System ID: MY1610005

Print Date: September 13, 2021 5:04 PM

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
September 8, 2021 9:01:30 AM	Auto	SessionClosed	Session	None
September 8, 2021 9:01:30 AM	Start	Configuration	Session	None
September 8, 2021 9:01:30 AM	Auto	Endless	Licensing	User is Field Engineer and does not require an unlock code
September 8, 2021 9:01:30 AM	Auto	ExpLoaded	Session	SOP details for primary methods (SOP): File path: (Phitapha@scg.com)@scg.com SOP File Name: (SOP 05kg) SOP Name: (Agilent@scg.com)
September 8, 2021 9:01:31 AM	End	Configuration	Session	None
September 8, 2021 9:01:31 AM	Start	Qualification	Session	OK
September 8, 2021 9:01:31 AM	Start	Execution	Preparation: 0100 BVD0 Qualitative Test: No subjects associated	None
September 8, 2021 9:24:30 AM	Start	Execution	Preparation: 0100 BVD0 Qualitative Test: No subjects associated	Run Count: 1
September 8, 2021 9:24:30 AM	Start	Execution	Instrument Tests: 0100 BVD0 Qualitative Test: No subjects associated	None
September 8, 2021 9:31:37 AM	End	Execution	Instrument Tests: 0100 BVD0 Qualitative Test: No subjects associated	Run Count: 1

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Date: September 13, 2021 5:04 PM  
System ID: MY1610005

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User Name: phitapha.jangphong		System ID: MY1610005		
Hardware: ABB0000038		Print Date: September 13, 2021 5:04 PM		
QCMW 5100 CP005 ALB 05kg/1 Transaction log				
Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
September 13, 2021 5:01:26 PM	Auto	Reporting	Session	Report Signed: Certificate PDF Name: QCMW 5100 CP005 ALB 05kg/1_2021-09-13_Certific te_1.pdf User Name: phitapha.jangphong@ngl ent.com Full Name of Signer: Kanyasorn Subkehaengsom Reason for signature: Electronic printed and published this original version of document
September 13, 2021 5:02:26 PM	Auto	Reporting	Session	Report Generated - Report

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Date: September 13, 2021 5:04 PM  
System ID: MY1610005

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Certificate No. T282396

Page 2 of 6

## Calibration Report

Equipment: 1 Hot Block  
Date of Calibration: 1 17 November 2020  
Environment: 1 Temperature 28.8-28.3 °C  
Line Voltage: 224.2-227.8 V

## Conditions of this result of test:

1. This instrument was calibrated by using 30 standard thermocouples type T into its chamber and test according to NIST 738. All data shown below were final values and the initial data may be obtained upon request.

The temperature inside steel was based on ITS-90.

## 2. Reference Standard Instrument

Instrument	Model	Instrument No.	Certificate No.	Due Date
TC	TYPE F	T901-T908	T282318	30 October 2021
TC	TYPE F	T901-T908	T282319	30 October 2021
DATA LOGGER	3478A	7151	T282319	30 October 2021

3. This certificate is traceable to:  
National Institute of Metrology (Thailand) through Metrological Center (NIST 738-733 T282318-2733H 0104)

## 4. Condition of calibrated item: good

## 5. UUC Description:

Time Constant: 1 Hour

Fresh Air Disperser: 1 On 1 Off

Check: 1 Yes 1 No

1 Not Available

## 6. Result of test:

( X ) without adjustment ( ) after adjustment

Approved By:

THA-17-0000-00-07



Certificate No. T282198

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### Calibration Report

#### Measurement Results

		Average Standard Reading at each position (°C)									
Calibration Point		TN21	TN22	TN23	TN24	TN25	TN26	TN27	TN28	TN29	TN30
50	Min	100.49	100.51	100.47	100.54	100.50	100.46	100.54	100.51	100.49	100.50
	Max	100.49	100.51	100.49	100.54	100.50	100.46	100.54	100.51	100.49	100.50
	Average	100.54	100.52	100.53	100.54	100.50	100.50	100.54	100.51	100.50	100.50
		TN31	TN32	TN33	TN34	TN35	TN36	TN37	TN38	TN39	TN40
100	Min	100.50	100.51	100.49	100.47	100.50	100.57	100.77	100.60	100.50	100.49
	Max	100.51	100.52	100.51	100.48	100.49	100.58	100.78	100.60	100.51	100.52
	Average	100.50	100.51	100.50	100.48	100.49	100.78	100.77	100.60	100.51	100.50
		TN51	TN52	TN53	TN54	TN55	TN56	TN57	TN58	TN59	TN60
150	Min	100.50	100.51	100.49	100.47	100.50	100.57	100.77	100.60	100.50	100.49
	Max	100.51	100.52	100.51	100.48	100.49	100.58	100.78	100.60	100.51	100.52
	Average	100.50	100.51	100.50	100.48	100.49	100.78	100.77	100.60	100.51	100.50
		TN71	TN72	TN73	TN74	TN75	TN76	TN77	TN78	TN79	TN80
200	Min	100.50	100.51	100.49	100.47	100.50	100.57	100.77	100.60	100.50	100.49
	Max	100.51	100.52	100.51	100.48	100.49	100.58	100.78	100.60	100.51	100.52
	Average	100.50	100.51	100.50	100.48	100.49	100.78	100.77	100.60	100.51	100.50

Approved By: [Signature]

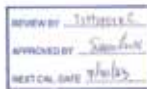
File: L11 000198-00-07

Certificate No. T282198

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### Certificate of Calibration

Equipment : HEATING BLOCK  
Manufacturer : Environmental Express  
Model : SC 196  
Serial No. : 6974CECW3248  
Customer Code : HKC\_E18854  
ID No. : TS106A3  
Customer : AJS Laboratory Group (Thailand) Co., Ltd.  
101 Phothanaka 40, Phothanaka Rd., Klongkro Phothanaka,  
Khet Suan Luang, Bangkok 10250  
Customer Location : Acid Digestion Lab  
Date of Receipt : 30 March 2022  
Calibrated By : Waiharapong Sangtong (Technician)  
Approved By : [Signature] / Sujar Naksakul (Site Calibration Manager)  
Date of Issue : 12 APR 2022



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

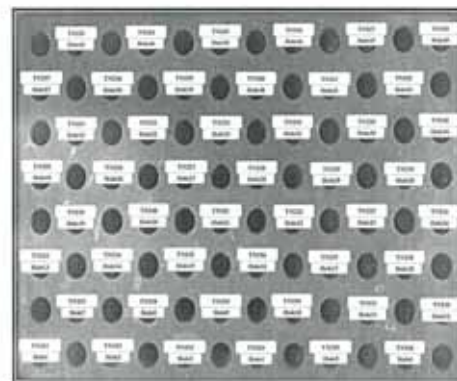
This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation Scheme which has assessed the measurement capability of the laboratory and its capability to incorporate national standards and to the units of measurement realized at the corresponding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

File: L11 000198-00-07

Certificate No. T282198

Page 3 of 6

### Calibration Report



FRONT CONTROL

Approved By: [Signature]

File: L11 000198-00-07

Certificate No. T282198

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### Calibration Report

#### Measurement Results

		Average Standard Reading at each position (°C)									
Calibration Point		TN21	TN22	TN23	TN24	TN25	TN26	TN27	TN28	TN29	TN30
50	Min	93.00	93.00	93.00	93.00	93.00	93.00	93.00	93.00	93.00	93.00
	Max	93.00	93.00	93.00	93.00	93.00	93.00	93.00	93.00	93.00	93.00
	Average	93.00	93.00	93.00	93.00	93.00	93.00	93.00	93.00	93.00	93.00
		TN31	TN32	TN33	TN34	TN35	TN36	TN37	TN38	TN39	TN40
100	Min	93.00	93.00	93.00	93.00	93.00	93.00	93.00	93.00	93.00	93.00
	Max	93.00	93.00	93.00	93.00	93.00	93.00	93.00	93.00	93.00	93.00
	Average	93.00	93.00	93.00	93.00	93.00	93.00	93.00	93.00	93.00	93.00
		TN51	TN52	TN53	TN54	TN55	TN56	TN57	TN58	TN59	TN60
150	Min	93.00	93.00	93.00	93.00	93.00	93.00	93.00	93.00	93.00	93.00
	Max	93.00	93.00	93.00	93.00	93.00	93.00	93.00	93.00	93.00	93.00
	Average	93.00	93.00	93.00	93.00	93.00	93.00	93.00	93.00	93.00	93.00
		TN71	TN72	TN73	TN74	TN75	TN76	TN77	TN78	TN79	TN80
200	Min	93.00	93.00	93.00	93.00	93.00	93.00	93.00	93.00	93.00	93.00
	Max	93.00	93.00	93.00	93.00	93.00	93.00	93.00	93.00	93.00	93.00
	Average	93.00	93.00	93.00	93.00	93.00	93.00	93.00	93.00	93.00	93.00

Approved By: [Signature]

File: L11 000198-00-07

Certificate No. T282198

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### Calibration Report

Std Block		Temperature Distribution	
Setting (°C)	Reading (°C)	Stability (±°C)	Uncertainty (±°C)
	Min, Max, Average		
100.0	100.3, 100.5, 100.4	0.20	1.12
100.0	100.3, 100.3, 100.3	0.21	1.04

\* The quoted uncertainty includes "repeatability" and "uniformity".  
The calibration result apply only the above calibrated item.  
The result of test was based accuracy as shown on data and place of test only.  
The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k=2, providing a level of confidence of approximately 95%.

Approved By: [Signature]

File: L11 000198-00-07

Certificate No. T282198

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### Calibration Report

Equipment : HEATING BLOCK  
Date of Calibration : 7 April 2022  
Environment : Temperature : 23.8-24.1 °C  
Line Voltage : 220-230 V  
Relative Humidity : 55-65 %RH

Condition of this results of calibration :  
1. This equipment was calibrated by using two standard thermocouples type T into its chamber, the other one standard thermocouples type T for the ambient temperature measurement. The calibration was done in accordance to NIST-1913.  
All data shown below were final values and the initial data from customer request. The temperature value used was based on ITS-90.  
2. Reference Standard (Instrument) :  
Instrument Model Instrument No. Certificate No. Due Date  
SC TYPE T T2110-TN29 T210004 08 Jun 2022  
SC TYPE T T2110-TN30 T210004 08 Jun 2022  
DATA LOGGERS 14076A T210004 08 Jun 2022  
3. This certificate is issued in accordance to:  
National Institute of Metrology (Thailand) through Metrological Center : 1001-T282198-T282198-T282198-T282198  
4. Condition of calibrated item : good  
Equipment Description :  
Type : SC-196  
Temp. Range : 50-200 °C  
Heating Air Flow : On/Off  
5. Adjustment :  
( ) without adjustment ( ) after adjustment

Approved By: [Signature]

File: L11 000198-00-07



### Calibration Report

**Measurement Results**

Calibration Point		Average Standard Reading at each position (°C)					
		TN120	TN202	TN210	TN214	TN218	TN219
C10: 20.00°C	Max	199.97	199.99	199.99	199.99	199.97	199.99
	Min	199.99	199.97	199.99	199.99	199.99	199.99
	Average	199.98	199.98	199.99	199.99	199.98	199.99
B1: 20.00°C	Max	199.97	199.99	199.99	199.99	199.97	199.99
	Min	199.99	199.97	199.99	199.99	199.99	199.99
	Average	199.98	199.98	199.99	199.99	199.98	199.99
B2: 20.00°C	Max	199.97	199.99	199.99	199.99	199.97	199.99
	Min	199.99	199.97	199.99	199.99	199.99	199.99
	Average	199.98	199.98	199.99	199.99	199.98	199.99
B4: 20.00°C	Max	199.97	199.99	199.99	199.99	199.97	199.99
	Min	199.99	199.97	199.99	199.99	199.99	199.99
	Average	199.98	199.98	199.99	199.99	199.98	199.99
B7: 20.00°C	Max	199.97	199.99	199.99	199.99	199.97	199.99
	Min	199.99	199.97	199.99	199.99	199.99	199.99
	Average	199.98	199.98	199.99	199.99	199.98	199.99
B8: 20.00°C	Max	199.97	199.99	199.99	199.99	199.97	199.99
	Min	199.99	199.97	199.99	199.99	199.99	199.99
	Average	199.98	199.98	199.99	199.99	199.98	199.99

Approved By: \_\_\_\_\_

TN120: 20.00°C

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## EQUIPMENT QUALIFICATION REPORT (EQR)

**Agilent CrossLab Compliance**

Qualification Type: ICPMS-03

System ID: JF15471168

EQP Name: Agilent8600

EQP Revision: ICPMS02.00

EQP Publish Date: March 2020

Date: September 30, 2021 4:07:18 PM

Report Type: Report

Org. Name: KJL Laboratory Group (Thailand) Co., Ltd.

Org. Location: 104 Phatthana Road, Boon Lueang, Bangkok 10250

Revised By: \_\_\_\_\_

Approved By: \_\_\_\_\_

Next Cal. Date: 29 March 2022

Date: September 30, 2021 4:07:18 PM

System ID: JF15471168

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## Test Summary

Purpose: This section includes a status for each scheduled test and the overall qualification. For each test that is run, (1) the status is automatically determined based on pre-defined limits, and (2) the total number of times the test was run is displayed. For detailed results and specifications for a test, refer to the test results in this EQR.

Test	Status	Runs
Autosampler Check : SP04	Pass	1
Integrated Sample Introduction System (ISIS) Check : IS03	Pass	1
Autotune : G6403A	Pass	1
Background (No Gas Mode) : G6403A	Pass	1
Background (Gas Mode) : G6403A	Pass	1
20-Minute Stability (No Gas Mode) : G6403A	Pass	1

Overall Qualification Status: Pass

Date: September 30, 2021 4:07:18 PM

System ID: JF15471168

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### Calibration Report

**Measurement Results**

Calibration Point		Average Standard Reading at each position (°C)					
		TN120	TN202	TN210	TN214	TN218	TN219
C10: 20.00°C	Max	199.97	199.99	199.99	199.99	199.97	199.99
	Min	199.99	199.97	199.99	199.99	199.99	199.99
	Average	199.98	199.98	199.99	199.99	199.98	199.99
B1: 20.00°C	Max	199.97	199.99	199.99	199.99	199.97	199.99
	Min	199.99	199.97	199.99	199.99	199.99	199.99
	Average	199.98	199.98	199.99	199.99	199.98	199.99
B2: 20.00°C	Max	199.97	199.99	199.99	199.99	199.97	199.99
	Min	199.99	199.97	199.99	199.99	199.99	199.99
	Average	199.98	199.98	199.99	199.99	199.98	199.99
B4: 20.00°C	Max	199.97	199.99	199.99	199.99	199.97	199.99
	Min	199.99	199.97	199.99	199.99	199.99	199.99
	Average	199.98	199.98	199.99	199.99	199.98	199.99
B7: 20.00°C	Max	199.97	199.99	199.99	199.99	199.97	199.99
	Min	199.99	199.97	199.99	199.99	199.99	199.99
	Average	199.98	199.98	199.99	199.99	199.98	199.99
B8: 20.00°C	Max	199.97	199.99	199.99	199.99	199.97	199.99
	Min	199.99	199.97	199.99	199.99	199.99	199.99
	Average	199.98	199.98	199.99	199.99	199.98	199.99

Approved By: \_\_\_\_\_

TN120: 20.00°C

**Metrological Center**  
**SCI ECO Services Company Limited**  
 332 Moo 3, T.Bangpa, A.Kaengkhro, Saraburi 18110  
 Telephone : +66 2 586 5760-4 Fax : +66 2 586 5109  
 Website : www.sci-eco.co.th E-Mail : calibrate@sci-eco.th

Certificate No. T238798 Page 5 of 6

## Calibration Report

**Measurement Results:**

Testing (°C)	Temperature Distribution			
	Reading (°C)			Stability (°C)
	Min	Max	Average	
100.0	100.0	100.0	100.0	0.00
100.0	100.0	100.0	100.0	0.00

\* The speed accuracy is within 0.001°C.

The calibration results apply to the items calibrated.

The result of this test is based on the data and physical law.

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

Approved By: \_\_\_\_\_

TN120: 20.00°C

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System ID: JF15471168

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## Instrument Details

### Purpose

This section describes the as found system configuration.

### Details

#### ICP-MS 1

Manufacturer	Agilent Technologies
Name	7900
Model Number	GS403A
Installed Options	#100H: Standard Package with Hydrogen option
Detector Type	BQ
Nebulizer	Mist Mix (G3161)
Spray Chamber	Quartz
Torch	Quartz
Sampling Cone	Ni
Skinner Cone	Ni
Serial Number	JP15471169
Firmware Revision	C.01.04

#### ISIS 1

Manufacturer	Agilent Technologies
Name	ISIS3
Model Number	GS411A
Type	Peristaltic pump system
Serial Number	JP15510227

#### Autosampler 1

Manufacturer	Agilent Technologies
Name	SPS4
Model Number	GS410A
Serial Number	AU19430722

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System ID: JP15471169

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## Calculation Formulas

### Purpose

This section includes calculation formulas for all available tests. Depending upon which tests are scheduled, all or some apply to your qualification.

For a description of calculations for ICP-MS tests performed by the MassHunter software, refer to the MassHunter application and documentation.

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## Autosampler Check

### Purpose

This test demonstrates that the autosampler module is correctly installed and connected. It does not test module performance.

Results	Criteria	Observed Result	Expected Result	Status
After the self test, is probe in the home position?				
	Yes	Yes	Pass	
As commanded, is the probe positioned at vial Z?				
	Yes	Yes	Pass	
Setpoint Status:	Pass			Run: 1
Overall Autosampler Check Test Status				
Pass				

Date: September 30, 2021 4:07:18 PM  
System ID: JP15471169

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## Service Details

### Purpose

This section includes local contact and delivery details for this service.

#### General Details

Service Order No./Request:	6004837154
EQP Name:	Agilent/Recommended
EQP Revision:	ICPMS.02.00
Report Type:	Report

#### Organization Details

Name:	ALS Laboratory Group (Thailand) Co., Ltd.
Location:	104 Prathumwan 40, Suan Luang, Bangkok 10250.

#### Local Contact Details

Name:	Chatchanal Komarsikul
Job Title:	Manager
Qualification Location:	Laboratory

#### Operator Details

Name:	Pantep Kuraethain
Job Title:	Field Service Engineer

#### Data Acquisition Details

Acquisition Software Name:	MassHunter
Acquisition Software Revision:	C.01.04

#### Customer Data System (CDS)

Signal: MassHunter

Date: September 30, 2021 4:07:18 PM  
System ID: JP15471169

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## Chiller 1

Manufacturer	Agilent Technologies
Name	Chiller
Model Number	G3290A
Serial Number	3U1810713

Date: September 30, 2021 4:07:18 PM  
System ID: JP15471169

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## Protocol Details

### Purpose

This section lists the revisions for all test units used in this report. For complete test-specific and high-level change details, refer to the Revision History document.

Test Revision	Test
ICPMS.02.00	20-Minute Stability (No Gas Mode)
ICPMS.02.00	Autosampler Check
ICPMS.02.00	Auditune
ICPMS.02.00	Background (Gas Mode)
ICPMS.02.00	Background (No Gas Mode)
ICPMS.02.00	Integrated Sample Introduction System (ISIS) Check

Date: September 30, 2021 4:07:18 PM  
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## Autotune

## Purpose

This test uses traceable checkout standards to run a software-executed autotune in all modes. The tune report provides values for peak width, mass axis, sensitivity, unde species, and doubly-charged species tests.

## Setpoint

## Results

Peakwidth Mass 7

Agilent Recommended:

Status:

Peakwidth Mass 89

Agilent Recommended:

Status:

Peakwidth Mass 205

Agilent Recommended:

Status:

Mass Axis 7

Agilent Recommended:

Status:

Mass Axis 89

Agilent Recommended:

Status:

Mass Axis 205

Agilent Recommended:

Status:

Date: September 30, 2021 4:07:18 PM  
System ID: JP15471169

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## Background (No Gas Mode)

## Purpose

This test examines the background of the ICP-MS in no gas mode by monitoring ions during a blank run.

## Setpoint

## Conditions

Masses:

7	AMU
89	AMU
205	AMU

## Measurements and Results

Masses (AMU):

Measured Value:

Agilent Recommended:

Status:

Setpoint Status: (Pass)

Run: 1

Overall Background (No Gas Mode) Test Status

Pass

Date: September 30, 2021 4:07:18 PM  
System ID: JP15471169

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## 20-Minute Stability (No Gas Mode)

## Purpose

This test monitors the abundance of ions present in the checkout standard over a 20-minute period to verify that the signal is stable. The %RSD of the abundance of given ions is calculated internally by the software and compared to the limit.

## Setpoint

## Conditions

Mode:

Masses:

Integration Time:

Peak Pattern:

Repetitions:

Sweeps/Replicates:

Spectrum
7, 8, 89, 140, 205
9.99 sec
3 points/peak
30
100

## Measurements and Results

Masses (AMU):

Stability RSD:

Agilent Recommended:

Status:

Setpoint Status: (Pass)

Run: 1

Overall 20-Minute Stability (No Gas Mode) Test Status

Pass

Date: September 30, 2021 4:07:18 PM  
System ID: JP15471169

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## Integrated Sample Introduction System (ISIS) Check

## Purpose

This test demonstrates that the ISIS module is correctly installed and connected. It does not test module performance.

## Setpoint

## Results

Criteria

Observed Result

Expected Result

Status

Setpoint Status: (Pass)

Run: 1

Overall Integrated Sample Introduction System (ISIS) Check Test Status

Pass

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Mass 7 Sensitivity No Gas

Agilent Recommended:

Status:

Mass 89 Sensitivity No Gas

Agilent Recommended:

Status:

Mass 205 Sensitivity No Gas

Agilent Recommended:

Status:

Mass 89 Sensitivity He

Agilent Recommended:

Status:

Mass 89 Sensitivity H2

Agilent Recommended:

Status:

Oxide Ratio 150/140

Agilent Recommended:

Status:

Doubly Charged Species Ratio 70/140

Agilent Recommended:

Status:

Setpoint Status: (Pass)

Run: 1

Overall Autotune Test Status

Pass

Date: September 30, 2021 4:07:18 PM  
System ID: JP15471169

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## Background (Gas Mode)

## Purpose

This test examines the background of the ICP-MS in the various gas modes by monitoring ions during a blank run.

## Setpoint

Gas Mode:

Conditions

Mass:

Integration Time:

Cycles:

Helium
78 AMU
1.0 sec
20

## Measurements and Results

Mass (AMU):

Measured Value:

Agilent Recommended:

Status:

Setpoint Status: (Pass)

Run: 1

Setpoint Gas Mode: Hydrogen

Conditions

Mass:

Integration Time:

Cycles:

78 AMU
1.0 sec
20

## Measurements and Results

Mass (AMU):

Measured Value:

Agilent Recommended:

Status:

Setpoint Status: (Pass)

Run: 1

Overall Background (Gas Mode) Test Status

Pass

Date: September 30, 2021 4:07:18 PM  
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## Attachments

Training requirements note: The delivery engineer attaches an ACE technique-specific training certificate to the Equipment Qualification Report (EQR). Obtaining ACE technique-specific certification includes pre-require training for Data Integrity, General Compliance topics (GMP, GLP, ALCOA, etc.), instrument hardware and software components, and the ACE technique itself. This one certificate encompasses all pre-require trainings as documented in the Agilent Learning Management System called Success Factors.

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EQR	General	Certificate of System Qualification	18
EQR	General	Operator's training certificate and qualifications	19
EQR	General	Certificate of Qualification for ACE	20
EQR	General	Certificate of Qualification for ACE	21
EQR	General	Tune reports	22
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General

Document Name: Operator's training certificate and qualifications

Agilent Technologies

### Certificate of Completion

Learner Name: Parthiv Karmacharia

Title Of Course: AN-CE-ICPM5-2-038-A-Agilent 7890 ICPM5 ISE update training

Completion Date: June 7, 2024

Certified By Company: Learning at Agilent

All Service and Support training certificates have the following specific sections:

A certificate for Service and Support training is only valid while employed by Agilent Technologies or while working as an Agilent authorized service provider. Through which the service employee has ongoing access to Agilent's Safety Alerts, Service News, internal technical updates, update training, course descriptions, internal support, course packs, and other updates. Completion of training alone, without being employed by Agilent Technologies, does not qualify an individual to safely install, service or maintain Agilent products.

Date: September 30, 2021 4:07:18 PM  
System ID: JP15471189

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General

Document Name: Certificate of Qualification for ACE

Agilent Technologies

### Certificate of Completion

Learner Name: Parthiv Karmacharia

Title Of Course: AN-CE-ICPM5-2-035-B: CrossLab Compliance Hardware Specific Delivery for Agilent IC-MS Systems

Completion Date: October 31, 2020

Certified By Company: Learning at Agilent

All Service and Support training certificates have the following specific sections:

A certificate for Service and Support training is only valid while employed by Agilent Technologies or while working as an Agilent authorized service provider. Through which the service employee has ongoing access to Agilent's Safety Alerts, Service News, internal technical updates, update training, course descriptions, internal support, course packs, and other updates. Completion of training alone, without being employed by Agilent Technologies, does not qualify an individual to safely install, service or maintain Agilent products.

Date: September 30, 2021 4:07:18 PM  
System ID: JP15471189

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## Declaration of Change Control

This document is under change control. Revision history is maintained and printed on each document. Access to the master documents is limited to process owners. Documents receive periodic review and cannot be assigned an evergreen status. The qualification performed according to this document refers only to the hardware/software configuration in place at the time of the qualification. Agilent Technologies recommends that instrument configuration change management procedures be in place in order to maintain the validation process. Any changes to the analytical or computer hardware or software must be clearly specified. A change management system provides a means for determining the degree of requalification required according to the extent of the changes made. All details of the changes must be thoroughly recorded and documented, together with details of completed tests and their results. Note: Hardware/software configuration management is the customer's responsibility.

Date: September 30, 2021 4:07:18 PM  
System ID: JP15471189

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General

Document Name: Certificate of System Qualification

Agilent Technologies

### Agilent Compliance Engine Self Qualification

Date: September 14, 2021 4:08:18 PM

Device Serial #: AC450029 Platform Revision: ACE 3.11

Individual self-qualification reports for each specific technique installed are also available upon request. They provide additional details on the general report from the complex summary and are structured by the actual algorithms challenged during the process. There is not a one-to-one relationship between algorithms and IQ program tests because some algorithms are used by several tests and several multiple similar hardware components of the qualified systems.

Technique Type	Tests Completed	Result
Atomic Absorption	7	Confirms
Catalytic Electrodes	10	Confirms
Distillation	6	Confirms
Enzymatic Biochemistry	3	Confirms
Gas Chromatography - GC/MS	17	Confirms
Gas Chromatography	38	Confirms
Gas Permeation Chromatography	6	Confirms
ICP-MS	6	Confirms
Infrared Spectroscopy	7	Confirms
Liquid Chromatography	11	Confirms
Liquid Chromatography - LC/MS	8	Confirms
Monofluoride	18	Confirms
Sample Preparation - Gas Chromatography	9	Confirms
Sample Preparation - Liquid Chromatography	6	Confirms
Supercritical Fluid Chromatography	16	Confirms
Software	8	Confirms
UV-Vis Spectrophotometer	13	Confirms

Overall Qualification Status: Confirms

Date: September 30, 2021 4:07:18 PM  
System ID: JP15471189

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General

Document Name: Certificate of Qualification for ACE

Agilent Technologies

### Certificate of Completion

Learner Name: Parthiv Karmacharia

Title Of Course: AN-CE-SS-0-030-A: ACE 3.X User Update Training

Completion Date: July 1, 2020

Certified By Company: Learning at Agilent

All Service and Support training certificates have the following specific sections:

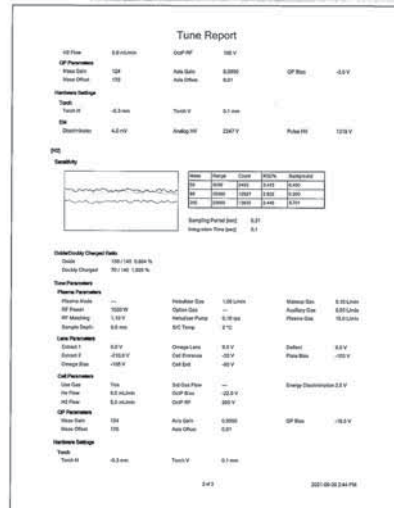
A certificate for Service and Support training is only valid while employed by Agilent Technologies or while working as an Agilent authorized service provider. Through which the service employee has ongoing access to Agilent's Safety Alerts, Service News, internal technical updates, update training, course descriptions, internal support, course packs, and other updates. Completion of training alone, without being employed by Agilent Technologies, does not qualify an individual to safely install, service or maintain Agilent products.

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Document Name: Tune reports



Date: September 30, 2021 4:07:18 PM  
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### General

Document Name: Test Report



Date: September 30, 2021 4:07:18 PM  
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### General

Document Name: Test Report

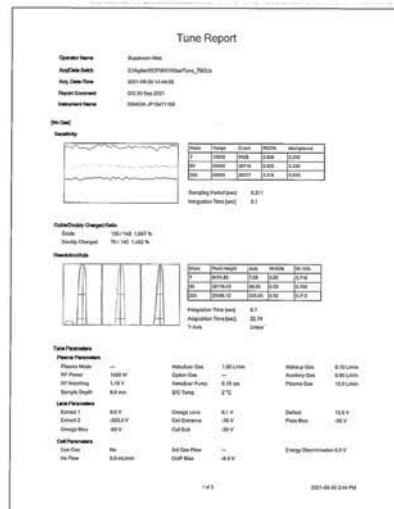


Date: September 30, 2021 4:07:18 PM  
System ID: JP15471160

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### General

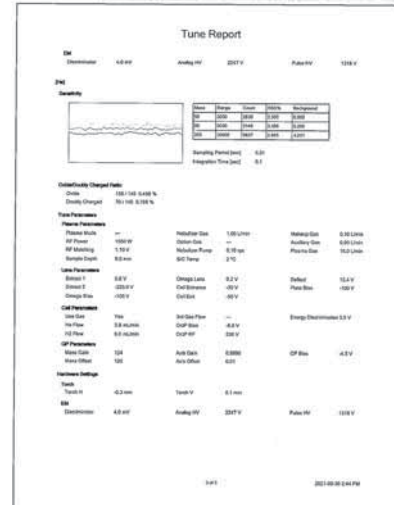
Document Name: Tune reports



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Document Name

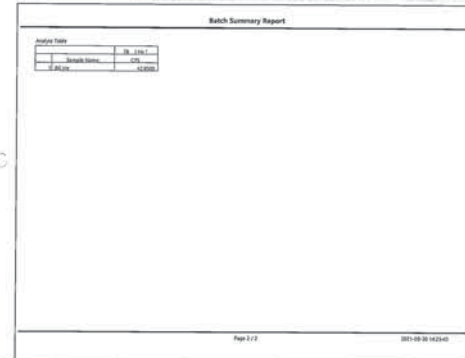
[illegible]

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Document Name:

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
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Date: September 30, 2021 4:07:18 PM  
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REVIEW BY Subot H  
APPROVED BY Subot H  
NEXT CAL DATE 2/10/2020

## Maintenance Protocol

Atomic Fluorescence Spectrometer  
**mercur DUO /**  
**mercur DUO plus**

## Maintenance works basic unit

- lighten up and check inside the Meniscus
- stand check if gold tags are broken
- stand check if Spectrometer is contaminated
- stand check of the Fluorescence cell
- stand check of the absorption cell, test window
- reactor cleaning
- check pump-churn, if necessary change it
- check solvent draw (SPE)
- check drying-line, output gas-liquid separator
- test Shubb-Dewar
- check gas flows
- check volume flows, reagents
- recording stray light values
- measurement may 30 sgl

### Maintenance works Aboqangiler

- lubricate the drawing winding (Teflon grease-rose)
- clean the drawing cylinder, if necessary exchange it
- lubricate the winding system of the height drive with some drops of oil
- check the toothed belt
- check the position of the mechanical stopper (height: 13mm)
- check the pump rate of mixing pump (146 AS22, typ 74h204 AS225, typ 116)
- check the pump rate of washing tank
- check the electrical hose connections for good contact
- check the connectors of the magnetic valves
- check the dusting hose for blocking, if necessary exchange it

Device parameter	nominal value	actual value
<b>Analytical parameters Fluorescence cell</b>		
Conditions: max conc.: 10 µg/L, FMT voltage: <u>369</u> V		
Blank solution		int. 0.0030
without enrichment / FBR 30 ng/L	RR > 0.0018	int. 0.0030
	REED < 3 %	RESD: 1.87 %
Conditions: max conc.: 1.7 µg/L, FMT voltage: <u>392</u> V		
Blank solution		int. 0.0040
with enrichment / FBR 35 ng/L	RR > 0.008	int. 0.0040
Fib. (cat. 10, 14, 16)	RR > 3 %	RESD: 0.47 %
		<u>9.26%</u>
<b>Analytical parameters Absorption cell</b>		
Blank solution		Ext. 0.0016
without enrichment / FBR 100 ng/L	Ext. < 0.0012	Ext. 0.0016
	REED < 3 %	RESD: 1.1 %
<b>Comments</b>		
-		

11. Signature Technician  
Signature Technician  
Bangladesh, 6/02/  
Place, Date (DDMMYYYY)

Signature Customer  
L. Fox Hunt  
Place Date (DDMMYYYY)

User Name: jacob@\_kenneth@home  
 Hostname: A380XW0211

System ID: JF16471018  
 Print Date: September 19, 2021 4:47:32 PM

ALS QDWH T005 10/04/21 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
September 19, 2021 4:02:07 PM	Auto	Reporting	Session	Report Generated : Certificate
September 19, 2021 4:03:17 PM	Auto	Reporting	Session	Report Generated : Report
September 19, 2021 4:03:39 PM	Start	Qualification	Session	OO
September 19, 2021 4:04:08 PM	End	Qualification	Session	OO
September 19, 2021 4:04:08 PM	Start	Reporting	Session	None
September 19, 2021 4:04:30 PM	Auto	Reporting	Session	Report Generated : Certificate
September 19, 2021 4:04:36 PM	Auto	Reporting	Session	Report Generated : Report

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Serial No.: E170A0193 Customer No.: 309-002  
Date: 6/06/2013 Carried out by: A. Graham, ELM

**Maintenance with following Operational Qualification (OQ)**  
(requires a separate OQ protocol)

Company	2000 Research Triangle Blvd (University) Bldg
User	John Smith
Department	Lab
Street	100 Research Triangle Blvd
Zip Code, City	27709 Research Triangle Park
Country	USA
Phone	
Fax	
E-mail	

Device parameter	nominal value	actual value
visual check general lightness inside the Monitor	0.5	changed
visual check Outlines	0.5	changed
visual check spectrometer		
Fluorescence cell	0.5	changed
Absorption cell, not window	0.5	changed
lens	0.5	changed
Saturn drive (REV)	0.5	changed
	0.5	changed
check pump lines	0.5	changed
check hoses and lines connections	0.5	changed
check and clear reactor	0.5	changed
check drying lines output Gas liquid separator	0.5	changed
check bubble sensor	0.5	not ok
<b>Check gasflow</b>		
Argon pressure value 4	1.3 - 1.5 bar	1.5 bar
Value 1	0.5 bar or 0.001 MPa	0.5 bar
Value 2	0.01 MPa or 0.001 MPa	0.001
Value 3	0.01 MPa or 0.001 MPa	0.001
Value 4	0.01 MPa or 0.001 MPa	0.001
<b>Check liquidflow</b>		
Acid	2.5 l/min or 1 m3	2.5 m3/min
Rest agent	2.5 l/min or 1 m3	2.5 m3/min
Sample	1 l/min or 1 m3	0.5 m3/min
<b>Adventitious light - values</b>	(V)	from file
100	0	0
200	0	0
300	0	0
350	0	1
400	1	5
450	0	0
500	0	0
550	0	0
575	0	0
600	0	0



**Equipment:** Autoclave  
**Condition As Received:** Used Item  
**Reference:** 2113-0600C-2  
**Procedure Used:** 2113-0600C-2

**Cart. No.:** 21702108  
**Page:** 2 of 3


Calibration was conducted using the calibration procedure CP-OT02 according to direct measurement method with Data Acquisition which connected with Thermocouple Type T.  
The temperature scale used was based on ITS-90.

**Condition of this result of calibration:**

- Reference standard instrument:
- This certificate is valid only to the item calibrated on date and place of calibration.
- This certificate is traceable to the International System of Units.
- This result of calibration covers laboratory autoclaves for the sterilization of goods and material which could be infected with organisms categorized as Hazard Group 1, 2 and 3.  
[T] = Comparison of pathogen according to hazard and category of containment, second edition, 1996.  
2 does not cover autoclaves for use with material infect with organisms in Hazard Group 4, for which complete containment and sterilization of infected condensate is considered to be essential.  
This result of calibration does not apply to sterilizers or disinfectors used for medical, dental, pharmaceutical or veterinary purposes which are directly concerned with patient care, or those used for fabrics subjected to sterilization which are required to be dry at the end of cycle.

**Result of Calibration:** (°C) Without Adjustment

**Function of UUC:** Temperature Source



Environment	
Temperature (°C)	Humidity (%)
24	31
25	33
25	33

Position	Description	Ref. Std. ID No.
1	Center of chamber	19-147C-01
2	Temperature sensor	19-147C-02
3	Exhaust port	19-147C-03

**Issue Date:** 30 Mar 2022

**Approved By:** [Signature]

**Approved Signature:**

**Issue Date:** 3 February 2022

**Uncertainty:** For a confidence probability of approximately 95%.

**Calibration No.:** 1085616

**Equipment:** Autoclave  
**Condition As Received:** Used Item  
**Reference:** 2113-0600C-2  
**Procedure Used:** 2113-0600C-2

**Cart. No.:** 21702108  
**Page:** 1 of 3

### Certificate of Calibration

**Equipment:** Autoclave  
**Manufacturer:** SHALAB  
**Model:** 1015A  
**Serial No.:** 000009  
**ID No.:** DEX\_M02010

**Submitted by:** ALS Laboratory Group (Thailand) Co., Ltd.  
124 Phatthanaburi Rd., Phatthanaburi Rd.,  
Khuang Phatthanaburi, Khao Suan Luang,  
Bangkok 10250 Thailand

**Location:** Institute & Municipal Reading  
**Received Order:** 21 January 2022  
**Calibration Date:** 21 January 2022  
**Ambient Temperature:** (26 ± 1) °C  
**Relative Humidity:** (30 ± 3) %

**Calibrated by:** Kiroki Wilson

**Approved by:** [Signature]  
**Approved Signature:**

**Issue Date:** 3 February 2022

**Uncertainty:** For a confidence probability of approximately 95%.

**Calibration No.:** 1085777

**Equipment:** Incubator  
**Condition As Received:** Used Item  
**Reference:** 2201-06180C-1  
**Procedure Used:** 2113-0600C-2

**Cart. No.:** 22701002  
**Page:** 1 of 3

Calibration was conducted using calibration procedure CP-OT02 according to direct measurement method with Data Acquisition which connected with Resistance Temperature Detector (RTD).  
The temperature scale used was based on ITS-90.

**Condition of this result of calibration:**

- Reference standard instrument:
- This certificate is valid only to the item calibrated on date and place of calibration.
- This certificate is traceable to the International System of Units.

**Result of Calibration:** (°C) Without Adjustment

**Function of UUC:** Temperature Source

**Fresh air setting:** Close

Calibration Point (°C)	UUC Setting (°C)	UUC Reading (°C)	Temperature stability (°C)	Temperature uniformity (°C)	Overall Variation (°C)	Uncertainty (°C)	Coverage Factor
35.0	35.5	35.0	0.043	0.01	0.42	0.30	2

Measured Temperature (°C)								
Position	1	2	3	4	5	6	7	8
35.0	34.801	34.808	34.802	35.012	35.040	35.010	35.034	35.040

**Average:** The average of 30 values in each position.  
**Temperature stability:** One-half of the greatest maximum difference of measured temperature at any one sensor.  
**Temperature uniformity:** The maximum difference of measured temperatures at any sensor and the measured temperature at the reference location which are observed at the same time or at as close an observation time as possible to determine the temperature pattern is homogeneity within the chamber under steady-state conditions.  
**Overall Variation:** The difference of the maximum and minimum measured temperature throughout observation.  
**UUC:** Unit Under Calibration.  
**Note:** The reported uncertainty of measurement was included stability and included uniformity.  
The reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor k, providing a level of confidence of approximately 95 %.

**Calibration No.:** 1082308

**Equipment:** Autoclave  
**Condition As Received:** Used Item  
**Reference:** 2113-0600C-2  
**Procedure Used:** 2113-0600C-2

**Cart. No.:** 21702108  
**Page:** 1 of 3

### Certificate of Calibration

**Equipment:** Autoclave  
**Manufacturer:** ABB Laboratory  
**Model:** Myerline 528  
**Serial No.:** 3487702  
**ID No.:** DEX\_M02041

**Submitted by:** ALS Laboratory Group (Thailand) Co., Ltd.  
124 Phatthanaburi Rd., Phatthanaburi Rd.,  
Khuang Phatthanaburi, Khao Suan Luang,  
Bangkok 10250 Thailand  
Media Preparation Room

**Location:** Institute & Municipal Reading  
**Received Order:** 1 December 2021  
**Calibration Date:** 1 December 2021  
**Ambient Temperature:** (26 ± 1) °C  
**Relative Humidity:** (30 ± 3) %

**Calibrated by:** Kiroki Wilson

**Approved by:** [Signature]  
**Approved Signature:**

**Issue Date:** 7 December 2021

**Uncertainty:** For a confidence probability of approximately 95%.

**Calibration No.:** 10807203

**Equipment:** Autoclave  
**Condition As Received:** Used Item  
**Reference:** 2113-0600C-2  
**Procedure Used:** 2113-0600C-2

**Cart. No.:** 21702108  
**Page:** 2 of 3

**Result of Calibration:** (°C) Without Adjustment

**Operating parameter Set:** Temperature = 121.0 °C  
**Stabilization period:** 10 minute

UUC Setting (°C)	UUC Reading (°C)	Position	Average* Standard Reading (°C)	Stability (°C)	Pressure Reading (bar)	Uncertainty (°C)	Coverage Factor
121.0	120.7	1	120.760	0.018	1.1	0.76	2
		2	120.674				
		3	120.619				

**Average\*:** The average of 30 values in each position.  
**Stability:** One-half of the greatest maximum difference of measured temperature at any one position.  
**UUC:** Unit Under Calibration.  
**Note:** The reported uncertainty of measurement was included stability and included uniformity.  
The reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor k, providing a level of confidence of approximately 95 %.

**Calibration No.:** 1085615

**Equipment:** Incubator  
**Condition As Received:** Used Item  
**Reference:** 2201-06180C-1  
**Procedure Used:** 2113-0600C-2

**Cart. No.:** 22701002  
**Page:** 2 of 3

Calibration was conducted using calibration procedure CP-OT02 according to direct measurement method with Data Acquisition which connected with Resistance Temperature Detector (RTD).  
The temperature scale used was based on ITS-90.

**Condition of this result of calibration:**

- Reference standard instrument:
- This certificate is valid only to the item calibrated on date and place of calibration.
- This certificate is traceable to the International System of Units.

**Result of Calibration:** (°C) Without Adjustment

**Function of UUC:** Temperature Source

**Fresh air setting:** Close



Environment during calibration		
Parameter	Beginning	Finished
Temp. (°C)	25	25
REL. Humid. (%)	53	54
AC Supply (VHz)	220	221

Position	Ref. Std. ID No.
1	19-1487C-01
2	19-1487C-02
3	19-1487C-03
4	19-1487C-04
5	19-1487C-05
6	19-1487C-06
7	19-1487C-07
8	19-1487C-08
9 (ref.)	19-1487C-09

**Probe Installation Details:**  
A = 16 mm, B = 16 mm, C = 0.90 mm, D = 16 mm, E = 16 mm, F = 16 mm, G = 16 mm, H = 16 mm, I = 16 mm, J = 16 mm, K = 16 mm, L = 16 mm, M = 16 mm, N = 16 mm, O = 16 mm, P = 16 mm, Q = 16 mm, R = 16 mm, S = 16 mm, T = 16 mm, U = 16 mm, V = 16 mm, W = 16 mm, X = 16 mm, Y = 16 mm, Z = 16 mm.

**Calibration No.:** 1082309



**TECHNOLOGY PROMOTION ASSOCIATION (TIPA) (THAILAND) JAPAN**  
 (สมาคมส่งเสริมเทคโนโลยี (ไทย-ญี่ปุ่น) จำกัด (มหาชน))  
 104 Phatthanaburi Rd., Phatthanaburi, 41000, Thailand  
 TEL. 03721 4400-1 FAX. 03721 4400-2

**Equipment:** Hot Air Oven  
**Condition As-Received:** Used Item  
**Reference:** 2106-010100-2  
**Cert. No.:** 217M1101  
**Page:** 2 of 3

**Procedure Used:**  
 Calibration were conducted using calibration procedure CP-0102 according to direct measurement method with Data Acquisition which connected with Thermocouple Type T.

**Condition of this result of calibration:**  
 1. Reference standard instrument:  
 Instrument: Model: Serial No.: Cert. No.: Date Due:  
 1) Data Acquisition: M4723A: MYS7013025: 211403: 28 Feb. 2023

2. This certificate is valid only to the item calibrated on date and place of calibration.  
 3. This certification is traceable to the International System of Unit.

**Result of Calibration:** (°) Without Adjustment  
**Function of UUC:** Temperature Source  
**Probe set setting:** Close

**Environment during calibration**

	Beginning	Finished
Temp. (°C)	25	25
REL. Humid. (%)	89	79
AC Supply (V/R)	220	220

**Position:** Ref. Std. ID No.

Position	Ref. Std. ID No.
1	19-PTG-01
2	19-PTG-02
3	19-PTG-03
4	19-PTG-04
5	19-PTG-05
6	19-PTG-06
7	19-PTG-07
8	19-PTG-08
9 (ref.)	19-PTG-09

**Probe Installation Detail:** (Dimension of Chamber):

Dimension	Value
W	5.0 mm
H	5.0 mm
D	5.0 mm
Capacity	0.24 m³

**Issue Date:** 24 May 2023  
 The Uncertainty are for a confidence probability of approximately 95%.

**Approved by:**  
 ( ) Pongsitorn Tanyasud  
 ( / ) Maitree Suthasane  
 ( / ) Sont Inga

**Issue Date:** 24 May 2023  
 The Uncertainty are for a confidence probability of approximately 95%.

**Signature:**

a 1059245

**TECHNOLOGY PROMOTION ASSOCIATION (TIPA) (THAILAND) JAPAN**  
 (สมาคมส่งเสริมเทคโนโลยี (ไทย-ญี่ปุ่น) จำกัด (มหาชน))  
 104 Phatthanaburi Rd., Phatthanaburi, 41000, Thailand  
 TEL. 03721 4400-1 FAX. 03721 4400-2

**Equipment:** Water Bath  
**Condition As-Received:** Used Item  
**Reference:** 2106-010100-2  
**Cert. No.:** 217M1071  
**Page:** 1 of 3

**Procedure Used:**  
 Calibration were conducted using calibration procedure CP-0102 according to direct measurement method with Data Acquisition which connected with Industrial Platinum Resistance Thermometer (4W1).

**Condition of this result of calibration:**  
 1. Reference standard instrument:  
 Instrument: Model: Serial No.: Cert. No.: Date Due:  
 1) Data Acquisition: M4723A: MYS7013025: 211403: 28 Feb. 2023

2. This certificate is valid only to the item calibrated on date and place of calibration.  
 3. This certification is traceable to the International System of Unit.

**Result of Calibration:** (°) Without Adjustment  
**Function of UUC:** Temperature Source

**Environment during calibration**

	Beginning	Finished
Temp. (°C)	25	25
REL. Humid. (%)	89	79
AC Supply (V/R)	220	220

**Position:** Ref. Std. ID No.

Position	Ref. Std. ID No.
1	19-PTG-01
2	19-PTG-02
3	19-PTG-03
4	19-PTG-04
5	19-PTG-05
6	19-PTG-06
7	19-PTG-07
8	19-PTG-08
9 (ref.)	19-PTG-09

**Probe Installation Detail:** (Dimension of Chamber):

Dimension	Value
W	5.0 mm
H	5.0 mm
D	5.0 mm
Capacity	0.24 m³

**Issue Date:** 24 May 2023  
 The Uncertainty are for a confidence probability of approximately 95%.

**Approved by:**  
 ( ) Pongsitorn Tanyasud  
 ( / ) Maitree Suthasane  
 ( / ) Sont Inga

**Issue Date:** 24 May 2023  
 The Uncertainty are for a confidence probability of approximately 95%.

**Signature:**

a 0041433

**TECHNOLOGY PROMOTION ASSOCIATION (TIPA) (THAILAND) JAPAN**  
 (สมาคมส่งเสริมเทคโนโลยี (ไทย-ญี่ปุ่น) จำกัด (มหาชน))  
 104 Phatthanaburi Rd., Phatthanaburi, 41000, Thailand  
 TEL. 03721 4400-1 FAX. 03721 4400-2

**Equipment:** Water Bath  
**Condition As-Received:** Used Item  
**Reference:** 2106-010100-2  
**Cert. No.:** 217M1071  
**Page:** 3 of 3

**Procedure Used:**  
 Calibration were conducted using calibration procedure CP-0102 according to direct measurement method with Data Acquisition which connected with Industrial Platinum Resistance Thermometer (4W1).

**Condition of this result of calibration:**  
 1. Reference standard instrument:  
 Instrument: Model: Serial No.: Cert. No.: Date Due:  
 1) Data Acquisition: M4723A: MYS7013025: 211403: 28 Feb. 2023

2. This certificate is valid only to the item calibrated on date and place of calibration.  
 3. This certification is traceable to the International System of Unit.

**Result of Calibration:** (°) Without Adjustment  
**Function of UUC:** Temperature Source

**Environment during calibration**

	Beginning	Finished
Temp. (°C)	25	25
REL. Humid. (%)	89	79
AC Supply (V/R)	220	220

**Position:** Ref. Std. ID No.

Position	Ref. Std. ID No.
1	19-PTG-01
2	19-PTG-02
3	19-PTG-03
4	19-PTG-04
5	19-PTG-05
6	19-PTG-06
7	19-PTG-07
8	19-PTG-08
9 (ref.)	19-PTG-09

**Probe Installation Detail:** (Dimension of Chamber):

Dimension	Value
W	5.0 mm
H	5.0 mm
D	5.0 mm
Capacity	0.24 m³

**Issue Date:** 24 May 2023  
 The Uncertainty are for a confidence probability of approximately 95%.

**Approved by:**  
 ( ) Pongsitorn Tanyasud  
 ( / ) Maitree Suthasane  
 ( / ) Sont Inga

**Issue Date:** 24 May 2023  
 The Uncertainty are for a confidence probability of approximately 95%.

**Signature:**

a 1109673

**TECHNOLOGY PROMOTION ASSOCIATION (TIPA) (THAILAND) JAPAN**  
 (สมาคมส่งเสริมเทคโนโลยี (ไทย-ญี่ปุ่น) จำกัด (มหาชน))  
 104 Phatthanaburi Rd., Phatthanaburi, 41000, Thailand  
 TEL. 03721 4400-1 FAX. 03721 4400-2

**Equipment:** Hot Air Oven  
**Condition As-Received:** Used Item  
**Reference:** 2106-010100-2  
**Cert. No.:** 217M1101  
**Page:** 1 of 3

**Procedure Used:**  
 Calibration were conducted using calibration procedure CP-0102 according to direct measurement method with Data Acquisition which connected with Industrial Platinum Resistance Thermometer (4W1).

**Condition of this result of calibration:**  
 1. Reference standard instrument:  
 Instrument: Model: Serial No.: Cert. No.: Date Due:  
 1) Data Acquisition: M4723A: MYS7013025: 211403: 28 Feb. 2023

2. This certificate is valid only to the item calibrated on date and place of calibration.  
 3. This certification is traceable to the International System of Unit.

**Result of Calibration:** (°) Without Adjustment  
**Function of UUC:** Temperature Source

**Environment during calibration**

	Beginning	Finished
Temp. (°C)	25	25
REL. Humid. (%)	89	79
AC Supply (V/R)	220	220

**Position:** Ref. Std. ID No.

Position	Ref. Std. ID No.
1	19-PTG-01
2	19-PTG-02
3	19-PTG-03
4	19-PTG-04
5	19-PTG-05
6	19-PTG-06
7	19-PTG-07
8	19-PTG-08
9 (ref.)	19-PTG-09

**Probe Installation Detail:** (Dimension of Chamber):

Dimension	Value
W	5.0 mm
H	5.0 mm
D	5.0 mm
Capacity	0.24 m³

**Issue Date:** 21 June 2021  
 The Uncertainty are for a confidence probability of approximately 95%.

**Approved by:**  
 ( ) Pongsitorn Tanyasud  
 ( / ) Maitree Suthasane  
 ( / ) Sont Inga

**Issue Date:** 21 June 2021  
 The Uncertainty are for a confidence probability of approximately 95%.

**Signature:**

a 0029135

**TECHNOLOGY PROMOTION ASSOCIATION (TIPA) (THAILAND) JAPAN**  
 (สมาคมส่งเสริมเทคโนโลยี (ไทย-ญี่ปุ่น) จำกัด (มหาชน))  
 104 Phatthanaburi Rd., Phatthanaburi, 41000, Thailand  
 TEL. 03721 4400-1 FAX. 03721 4400-2

**Equipment:** Hot Air Oven  
**Condition As-Received:** Used Item  
**Reference:** 2106-010100-2  
**Cert. No.:** 217M1101  
**Page:** 2 of 3

**Procedure Used:**  
 Calibration were conducted using calibration procedure CP-0102 according to direct measurement method with Data Acquisition which connected with Industrial Platinum Resistance Thermometer (4W1).

**Condition of this result of calibration:**  
 1. Reference standard instrument:  
 Instrument: Model: Serial No.: Cert. No.: Date Due:  
 1) Data Acquisition: M4723A: MYS7013025: 211403: 28 Feb. 2023

2. This certificate is valid only to the item calibrated on date and place of calibration.  
 3. This certification is traceable to the International System of Unit.

**Result of Calibration:** (°) Without Adjustment  
**Function of UUC:** Temperature Source

**Environment during calibration**

	Beginning	Finished
Temp. (°C)	25	25
REL. Humid. (%)	89	79
AC Supply (V/R)	220	220

**Position:** Ref. Std. ID No.

Position	Ref. Std. ID No.
1	19-PTG-01
2	19-PTG-02
3	19-PTG-03
4	19-PTG-04
5	19-PTG-05
6	19-PTG-06
7	19-PTG-07
8	19-PTG-08
9 (ref.)	19-PTG-09

**Probe Installation Detail:** (Dimension of Chamber):

Dimension	Value
W	5.0 mm
H	5.0 mm
D	5.0 mm
Capacity	0.24 m³

**Issue Date:** 21 June 2021  
 The Uncertainty are for a confidence probability of approximately 95%.

**Approved by:**  
 ( ) Pongsitorn Tanyasud  
 ( / ) Maitree Suthasane  
 ( / ) Sont Inga

**Issue Date:** 21 June 2021  
 The Uncertainty are for a confidence probability of approximately 95%.

**Signature:**

a 1059244

**TECHNOLOGY PROMOTION ASSOCIATION (TIPA) (THAILAND) JAPAN**  
 (สมาคมส่งเสริมเทคโนโลยี (ไทย-ญี่ปุ่น) จำกัด (มหาชน))  
 104 Phatthanaburi Rd., Phatthanaburi, 41000, Thailand  
 TEL. 03721 4400-1 FAX. 03721 4400-2

**Equipment:** Water Bath  
**Condition As-Received:** Used Item  
**Reference:** 2106-010100-2  
**Cert. No.:** 217M1071  
**Page:** 2 of 3

**Procedure Used:**  
 Calibration were conducted using calibration procedure CP-0102 according to direct measurement method with Data Acquisition which connected with Industrial Platinum Resistance Thermometer (4W1).

**Condition of this result of calibration:**  
 1. Reference standard instrument:  
 Instrument: Model: Serial No.: Cert. No.: Date Due:  
 1) Data Acquisition: M4723A: MYS7013025: 211403: 28 Feb. 2023

2. This certificate is valid only to the item calibrated on date and place of calibration.  
 3. This certification is traceable to the International System of Unit.

**Result of Calibration:** (°) Without Adjustment  
**Function of UUC:** Temperature Source

**Environment during calibration**

	Beginning	Finished
Temp. (°C)	25	25
REL. Humid. (%)	89	79
AC Supply (V/R)	220	220

**Position:** Ref. Std. ID No.

Position	Ref. Std. ID No.
1	19-PTG-01
2	19-PTG-02
3	19-PTG-03
4	19-PTG-04
5	19-PTG-05
6	19-PTG-06
7	19-PTG-07
8	19-PTG-08
9 (ref.)	19-PTG-09

**Probe Installation Detail:** (Dimension of Chamber):

Dimension	Value
W	5.0 mm
H	5.0 mm
D	5.0 mm
Capacity	0.24 m³

**Issue Date:** 21 June 2021  
 The Uncertainty are for a confidence probability of approximately 95%.

**Approved by:**  
 ( ) Pongsitorn Tanyasud  
 ( / ) Maitree Suthasane  
 ( / ) Sont Inga

**Issue Date:** 21 June 2021  
 The Uncertainty are for a confidence probability of approximately 95%.

**Signature:**

a 1109674