



MITR PHOL
Bio Power

ภาคผนวก ง

เอกสารสอบเทียบเครื่องมือตรวจวัดและวิเคราะห์

List of Instruments Certification for Air & Noise Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration	Remark
Ambient									
1	Orifice Transfer Standard Calibrator	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM ₁₀)	Thermo Scientific	G25A 158M	Tisch Environmental, Inc.	22062020	22 Jun 20	21 Jun 22	-
2	U-Tube Manometer	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM ₁₀)	Dwyer	1221-36-W/M -	Technology Promotion Association (Thailand-Japan)	21P445	9 Feb 21	8 Feb 22	-
3	Flow Meter	Particular Matter (PM _{2.5})	Mesa Labs	- 160491	Innovative Instrument Co., Ltd.	21-AFM-096	31 Aug 21	30 Aug 22	-
4	Aneroid Barometer	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM ₁₀) Particular Matter (PM _{2.5})	Barigo, Germany	-	Technology Promotion Association (Thailand-Japan)	21P2499	21 Jul 21	20 Jul 22	-
5	Dial Thermo-Hygrometer	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM ₁₀) Particular Matter (PM _{2.5})	Barigo, Germany	-	Technology Promotion Association (Thailand-Japan)	21H804	8 Apr 21	7 Apr 22	-
6	Standard Gases (Mixture)	Nitrogen Dioxide	Airgas	CC159599 2015PSIG	Airgas an Air Liquide company	E04NI99E15A01QC	30 Jul 19	30 Jul 22	-
7	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Scientific	42i 1180540064	UAE Consultant Co., Ltd.	110202021	11 Feb 21	10 Feb 22	-
8	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Scientific	42i 1182920006	UAE Consultant Co., Ltd.	26022021	26 Feb 21	25 Feb 22	-
9	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Scientific	42i 1182920009	UAE Consultant Co., Ltd.	25022021	25 Nov 22	24 Nov 22	-
10	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Scientific	42i 1191503038	UAE Consultant Co., Ltd.	4112021	4 Nov 21	3 Nov 22	-
11	Standard Gases (Mixture)	Sulphur Dioxide	Airgas	CC159599 2015PSIG	Airgas an Air Liquide company	E04NI99E15A01QC	30 Jul 19	30 Jul 22	-

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No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration	Remark
Ambient									
12	Sulphur Dioxide Analyzer	Sulphur Dioxide	Thermo Scientific	43i 1201778111	UAE Consultant Co.,Ltd.	14062021	14 Jun 21	13 Jun 22	-
13	Sulphur Dioxide Analyzer	Sulphur Dioxide	Thermo Scientific	43i 1201778112	UAE Consultant Co.,Ltd.	14062021	14 Jun 21	13 Jun 22	-
14	Sulphur Dioxide Analyzer	Sulphur Dioxide	Thermo Scientific	43i 1201778114	UAE Consultant Co.,Ltd.	09062021	9 Jun 21	8 Jun 22	-
15	Sulphur Dioxide Analyzer	Sulphur Dioxide	Thermo Scientific	43i 1201778116	UAE Consultant Co.,Ltd.	09062021	9 Jun 21	8 Jun 22	-
16	Wind Speed/Wind Direction	WS/WD	LSI LASTEM	E-LOG305 20040002	Thai Meteorological Department	275/21	20 May 21	19 May 22	-
17	Sound Level Calibrator (Acoustic Calibrator)	Calibrate Sound Level Meter	Svantek	SV35A 73249	Innovative Instrument Co.,Ltd.	21-ACT-187	28 May 21	27 May 22	-
18	Sound Level Meter	L _{Aeq} 24 hours, L _{Amax}	Larson Davis	LxT2 0005402	Larson Davis-A PCB Piezotronics Div.	2021000495	15 Jan 21	14 Jan 22	-
19	Sound Level Meter	L _{Aeq} 24 hours, L _{Amax}	Larson Davis	LxT2 0005403	Larson Davis-A PCB Piezotronics Div.	2021000493	15 Jan 21	14 Jan 22	-

List of Instruments Certification for Air & Noise Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration	Remark
Workplace									
1	Sound Level Calibrator (Acoustic Calibrator)	Calibrate Sound Level Meter	Svantek	SV35A 73249	Innovative Instrument Co.,Ltd.	21-ACT-187	28 May 21	27 May 22	-
2	Sound Level Meter	$L_{Aeq} 8 \text{ hour}$, L_{Amax}	Rion, Japan	NL-42 00609500	Sithiporn Associates Co., Ltd.	ACL21035	20 Jan 21	19 Jan 22	-
3	Sound Level Meter	$L_{Aeq} 8 \text{ hour}$, L_{Amax}	Rion, Japan	LxT2 0005396	Sithiporn Associates Co., Ltd.	D0001.8378	11 Jan 21	10 Jan 22	-
4	Sound Level Meter	$L_{Aeq} 8 \text{ hour}$, L_{Amax}	Rion, Japan	NL-42 00709670	Sithiporn Associates Co., Ltd.	ACL21039	20 Jan 21	19 Jan 22	-
5	Sound Level Meter	$L_{Aeq} 8 \text{ hour}$, L_{Amax}	Rion, Japan	NL-42 00709682	Sithiporn Associates Co., Ltd.	ACL21040	20 Jan 21	19 Jan 22	-
6	Sound Level Meter	$L_{Aeq} 8 \text{ hour}$, L_{Amax}	Rion, Japan	NL-42 00409050	Sithiporn Associates Co., Ltd.	ACL21033	20 Jan 21	19 Jan 22	-
7	Flow Meter	Calibrate personal pump	TSI.Inc	4146 41461922007	Innovative Instrument Co.,Ltd.	21-AFM-052	8 Jun 21	7 Jun 22	-
8	Flow Meter	Calibrate personal pump	TSI.Inc	4146 41461813030	Innovative Instrument Co.,Ltd.	21-AFM-073	23 Jul 21	22 Jul 22	-
9	Aneroid Barometer	Total Dust Respirable Dust	Barigo, Germany	-	Technology Promotion Association (Thailand-Japan)	21P1156	31 Mar 21	30 Mar 22	-
10	Dial Thermo-Hygrometer	Total Dust Respirable Dust	Barigo, Germany	-	Technology Promotion Association (Thailand-Japan)	21H804	8 Apr 21	7 Apr 22	-
11	Thermal Environment Monitor	Heat Meter	3M	QuesTemp 32 TPS030004	Innovative Instrument Co.,Ltd.	21-TPM-304	9 Nov 21	8 Nov 22	-
12	Thermal Environment Monitor	Heat Meter	3M	QuesTemp 32 TPS030006	Innovative Instrument Co.,Ltd.	21-TPM-303	9 Nov 21	8 Nov 22	-

List of Instruments Certification for Air & Noise Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration	Remark
Workplace									
13	Digital Light Meter	Light	Extech Instrument, Taiwan	407026 A 052262	Innovative Instrument Co.,Ltd.	21-LXM-029	11 May 21	10 May 22	-
14	Sound Level Calibrator (Noise Dosimeter)	Noise Dosimeter	Svantek	SV35A 44792	Innovative Instrument Co.,Ltd.	21-ACT-186	28 May 21	27 May 22	-
15	Noise Dosimeter	Noise Dosimeter	3M	NP-DL NLE030011	Innovative Instrument Co.,Ltd.	21-ACT-393	22 Oct 21	21 Oct 22	-
16	Noise Dosimeter	Noise Dosimeter	3M	NP-DL NLH030046	Innovative Instrument Co.,Ltd.	21-ACT-341	2 Sep 21	1 Sep 22	-
17	Noise Dosimeter	Noise Dosimeter	3M	NP-DL NLE030025	Innovative Instrument Co.,Ltd.	21-ACT-270	23 Jul 21	22 Jul 22	-
18	Noise Dosimeter	Noise Dosimeter	Svantek	SV104IS 67627	Svantek	21-ACT-361	20 Sep 21	19 Sep 22	-
19	Noise Dosimeter	Noise Dosimeter	Svantek	SV104 91923	Svantek	23022021	23 Feb 21	22 Feb 22	-

List of Instruments Certification for Air & Noise Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration	Remark
Stack									
1	Pre-Test Console	Total Suspended Particulate	Apex Instruments, USA.	XC-572-V 0807047	Envi Equipment Service Co., Ltd.	E21-0813	19 Aug 21	18 Aug 22	-
2	Flue gas Analyzer	Sulphur Dioxide Oxide of Nitrogen as Nitrogen Dioxide Carbon Monoxide	Testo	Testo 350 60899617	Entech Industrial Sulation Co., Ltd.	G 640118	1 Mar 21	28 Feb 22	-

List of Opacity Training Certification for Opacity Mesurement

No.	Name	Training Couse	Train	Date	Remark
1	Mr.Apiwich Toungee	Opacity	Pollution Control Department	12-13 March 2015	-
2	Mr.Natthapong Mounghchai	Opacity	Pollution Control Department	22-23 March 2018	-

List of Instruments Certification for Water Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration	Remark
Water									
1	pH Meter	pH	Horiba	LAQUA-PH210 HA9M0047	Technology Promotion Association (Thailand-Japan)	21CH528	21 Apr 21	20 Apr 22	-
2	DO Meter	DO	YSI	Pro 20i 18K104053	Technology Promotion Association (Thailand-Japan)	21TW170	18 Aug 21	17 Aug 22	-

รายการใบรับรองสอบเทียบ/ทวนสอบ เครื่องมือหลักประจำห้องปฏิบัติการวิเคราะห์

List of Certificate of Calibration for Laboratory Instruments.

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration	Remark
Laboratory Equipment for Air Analysis									
1	UV-VIS Spectrophotometer	Ammonia	Agilent Technologies	Cary60 G6860A / MY15410009	DQE Services Co.,Ltd.	SP21-015	29 May 21	28 May 22	-
2	UV-VIS Spectrophotometer		Hitachi	U-1900 / 2021-064	DQE Services Co.,Ltd.	SP21-008	25 Jan 21	24 Jan 22	-
3	Ion Chromatrography (IC)	Hydrogen Chloride (HCl), Nitric Acid (HNO ₃) Sulphuric Acid (H ₂ SO ₄), Sodium Hydroxide (NaOH)	Dionex	DX-120 / 03010223	Archemica Lab Co.Ltd.	Qualification Report Anion (ID#042)	10 Jun 21	9 Jun 22	-
4	Analytical Balance (Readability 0.1 mg)	ฝุ่นละอองรวม (TSP) ฝุ่นละอองขนาดเล็กกว่า 10 ไมครอน (PM10)	Mettler-Toledo	AB204-S / 1128312528	National Food Institute, Ministry of Industry, Thailand	2200704-001-01	24 Nov 21	23 Nov 22	-
5	Analytical Balance (Readability 0.1 mg)		Mettler-Toledo	AB204-S/FACT / B108115858	National Food Institute, Ministry of Industry, Thailand	2102572-001-01	26 Apr 21	25 Apr 22	-
6	Analytical Balance (Readability 0.001 mg)	ฝุ่นละอองขนาดไม่เกิน 2.5 ไมครอน (PM-2.5), ฝุ่นทุกขนาด (Total Dust), ฝุ่นขนาดที่สามารถเข้าถึง และสะสมในถุงลมปอดได้ (Respirable Dust)	Mettler-Toledo	XP6 / B322373893	National Food Institute, Ministry of Industry, Thailand	2102572-002-01	26 Apr 21	25 Apr 22	-
Laboratory Equipment for Water Analysis									
7	pH Meter	pH Temperature	Mettler-Toledo	seven Compact S220 / C113432421	National Food Institute, Ministry of Industry, Thailand	2103189-001-01	14 Jun 21	13 Jun 22	-
8	pH Meter		Mettler-Toledo	Seven Easy S20 / 1231155210	National Food Institute, Ministry of Industry, Thailand	2103189-002-01	14 Jun 20	13 Jun 21	-
9	UV-VIS Spectrophotometer	COD, Colour Nitrate, Sulphate	Agilent Technologies	Cary60 G6860A / MY15410009	DQE Services Co.,Ltd.	SP22-016	23 May 22	22 May 23	-
10	UV-VIS Spectrophotometer		Hitachi	U-1900 / 2021-064	DQE Services Co.,Ltd.	SP22-007	24 Jan 22	23 Jan 22	-

รายการใบรับรองสอบเทียบ/ทวนสอบ เครื่องมือหลักประจำห้องปฏิบัติการวิเคราะห์

List of Certificate of Calibration for Laboratory Instruments.

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration	Remark
Laboratory Equipment for Water Analysis									
11	BOD Incubator	BOD	Arco	UC4-1320 / (UAE.WAO.002/2550)	Technology Promotion Association (Thailand-Japan)	21TM1405	17 Aug 21	16 Aug 22	-
12	BOD Incubator		Arco	UC4-1320 / (WAO.018/2559)	Technology Promotion Association (Thailand-Japan)	21TM1406	17 Aug 21	16 Aug 22	-
13	Analytical Balance (Repeatability 0.01 mg)	TDS	Mettler-Toledo	AX105DR / 1122100406	National Food Institute, Ministry of Industry, Thailand	2200708-001-01	24 Nov 21	24 Nov 22	-
14	Hot Air Oven		Memmert	UF55 / B216.1666	Technology Promotion Association (Thailand-Japan)	21TM1876	29 Oct 21	29 Oct 22	-
15	COD Reactor (Heating Block)	COD	Hanna	HI839800-02 / H018500I	Hanna Instruments (Thailand) Ltd. (Thailand-Japan)	HIT-2132-0756	5 Aug 21	4 Aug 22	-
16	Analytical Balance (Repeatability 0.1 mg)	น้ำมันและไขมัน (Oil & Grease)	Mettler-Toledo	XSR204 / C117635043	Mettler-Toledo (Thailand) Ltd.	2202934-001-01	13 May 22	12 May 23	-
17	Incubator	โคลิฟอร์มแบคทีเรียทั้งหมด (Total Coliform Bacteria)	Memmert	INB400 / E411.1325	Technology Promotion Association (Thailand-Japan)	21TM1357	14 Jul 21	13 Jul 22	-
18	Incubator		Memmert	BE400 / e402.1032	Technology Promotion Association (Thailand-Japan)	21TM1358	15 Jul 21	14 Jul 22	-
19	Water Bath		Memmert	WNE 14 / L416.0606	Technology Promotion Association (Thailand-Japan)	22TM333	17 Feb 22	16 Feb 23	-
20	Water Bath		Memmert	WNE 14 / L416.0612	Technology Promotion Association (Thailand-Japan)	22TM334	17 Feb 22	16 Feb 23	-
21	Analytical Balance		Mettler-Toledo	MS603S / B0070110311	National Food Institute, Ministry of Industry, Thailand	2200705-001-01	24 Nov 21	23 Nov 22	-

รายการใบรับรองสอบเทียบ/ทวนสอบ เครื่องมือหลักประจำห้องปฏิบัติการวิเคราะห์

List of Certificate of Calibration for Laboratory Instruments.

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration	Remark
Laboratory Equipment for Water Analysis									
22	Autoclave	Total Kjeldahl Nitrogen (TKN)	ALP	CL-40L / 802664	Technology Promotion Association (Thailand-Japan)	22TM681	27 May 22	26 May 23	-
23	Digestor Unit		FOSS TECATOR	2520auto / 91794469	Thailand Institute Of Science And Technological Research (TISTR)	2202361-001-01	6 Apr 22	5 Apr 23	-
24	Digestor Unit		Velp	DKL20 / 213517	National Food Institute, Ministry of Industry, Thailand	2203368-001-01	24 Jun 22	23 Jun 23	-
25	Distillation Unit (Kjeldahl Method)		FOSS TECATOR	KT200 / 91790524	Sithiporn Associates Co.,Ltd.	MS63FOT0084B	30 Nov 21	29 Nov 22	-
26	Distillation Unit (Kjeldahl Method)		FOSS TECATOR	2100 / 520001424	Sithiporn Associates Co.,Ltd.	MS63FOT0084B	29 Nov 21	28 Nov 22	-

ใบสอบเทียบเครื่องมือวิเคราะห์

เครื่องมือตรวจวัดคุณภาพสิ่งแวดล้อม (ภาคสนาม)

การตรวจวัดคุณภาพอากาศในบรรยากาศโดยทั่วไป

Certificate of Calibration

Calibration Certification Information
Cal. Date: June 22, 2020

Rootsmeter S/N: 438320

Ta: 296

°K
Operator: Jim Tisch

Pa: 748.3

mm Hg
Calibration Model #: TE-5025A

Calibrator S/N: 158M

Run	Vol. Init (m3)	Vol. Final (m3)	ΔVol. (m3)	ΔTime (min)	ΔP (mm Hg)	ΔH (in H2O)
1	1	2	1	1.3270	3.2	2.00
2	3	4	1	0.9450	6.4	4.00
3	5	6	1	0.8470	7.9	5.00
4	7	8	1	0.8040	8.7	5.50
5	9	10	1	0.6640	12.7	8.00

Data Tabulation

Vstd (m3)	Qstd (x-axis)	$\sqrt{\Delta H \left(\frac{Pa}{Pstd} \right) \left(\frac{Tstd}{Ta} \right)}$ (y-axis)	Va	Qa (x-axis)	$\sqrt{\Delta H \left(\frac{Ta}{Pa} \right)}$ (y-axis)
0.9870	0.7438	1.4080	0.9957	0.7504	0.8895
0.9828	1.0400	1.9912	0.9914	1.0492	1.2579
0.9808	1.1579	2.2262	0.9894	1.1682	1.4064
0.9797	1.2185	2.3349	0.9884	1.2293	1.4750
0.9744	1.4675	2.8160	0.9830	1.4805	1.7789
QSTD	m=	1.94592	QA	m=	1.21850
	b=	-0.03494		b=	-0.02207
	r=	0.99995		r=	0.99995

Calculations

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

Standard Conditions
Tstd: 298.15 °K

Pstd: 760 mm Hg

Key
ΔH: calibrator manometer reading (in H2O)

ΔP: rootsmeter manometer reading (mm Hg)

Ta: actual absolute temperature (°K)

Pa: actual barometric pressure (mm Hg)

b: intercept

m: slope

RECALIBRATION

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



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

Certificate of Calibration

Certificate No. : 21P445
Page : 1 of 2

Equipment : U Tube Manometer

Manufacturer: Dwyer

Model : 1221-36-W/M

Serial No.: -

ID No.: UAE.EFM.179/2561

Condition As-Received: Used Item

Received Date: 01 February 2021

Calibration Date: 09 February 2021

Reference: 2102-0083WSC

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

Ambient Temperature: (23 ± 2) °C

Relative Humidity: (50 ± 15) %

Atmospheric Pressure: 1012 mbar

This certificate may not be reproduced other than in full,
except with the prior written approval of the head of
Corporate Services 3: Equipment Calibration and Testing Services.

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

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

Condition of this result of calibration

1.Reference standards instruments :

<u>Instrument</u>	<u>Model</u>	<u>Serial No.</u>	<u>Certificate No.</u>	<u>Due Date</u>
1) Pressure Calibrator	PC106P	1189	MP-0113-20	14 Jul 2021

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

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

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

5.This instrument was installed in vertical orientation and center of connector was used as the reference level.

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

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

-National Institute of Metrology Thailand (NIMT)

Calibrated by : Nopparat Phongam
Issue Date : 11 February 2021

Approved Signatory : Attapol P.
[] Phalinee Prabpaipal
[] Sura Suwannasri
[x] Attapol Panurach

เอกสารไม่ควบคุม
B 0250403



Cert.No.: 21P445

Page: 2 of 2

Result of calibration:- Without adjustment

Function:- Pressure Measurement

Increasing Pressure

Range : 0 inH₂O to 36 inH₂O

Scale Interval : 0.1 inH₂O(The Fifth Estimate)

<u>Applied Pressure</u> (inH ₂ O)	<u>UUC Indication</u>		<u>ΔP</u> (inH ₂ O)	<u>Error</u> (inH ₂ O)
	<u>High-port side</u> (inH ₂ O)	<u>Low-port side</u> (inH ₂ O)		
0.00	0.00	0.00	0.00	0.00
2.00	1.00	-0.98	1.98	-0.02
4.00	2.00	-1.98	3.98	-0.02
6.00	3.00	-2.98	5.98	-0.02
8.00	4.00	-3.96	7.96	-0.04
10.00	5.02	-4.96	9.98	-0.02
12.00	6.02	-5.96	11.98	-0.02
14.00	7.04	-6.98	14.02	0.02
16.00	8.04	-7.96	16.00	0.00
18.00	9.08	-8.96	18.04	0.04
20.00	10.08	-9.98	20.06	0.06
22.00	11.10	-10.98	22.08	0.08
24.00	12.14	-11.98	24.12	0.12
26.00	13.14	-12.98	26.12	0.12
28.00	14.18	-13.98	28.16	0.16
30.00	15.16	-14.96	30.12	0.12
32.00	16.18	-15.98	32.16	0.16
34.00	17.18	-16.98	34.16	0.16
35.50	17.96	-17.72	35.68	0.18

The uncertainty of measurement was ± 0.11 inH₂O

* UUC = Unit Under Calibration

* ΔP = High-port side - Low-port side

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

-o0o-

Attapol P.

เอกสารไม่ควบคุม
a 1037940

Certificate of Calibration

Customer

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

Certificate No : 21-AFM-096

Request No : Req-2021-0988

Unit Under Calibration Details

Measurement Item : Air Flow Meter
Manufacturer : BGI
Model : deltaCal DC1
Serial Number : 160491
ID : UAE.EFM.175/2561
Location of Calibration : LAB 4 AIR VELOCITY METER

Calibration Environment and Details

Temperature : $23^{\circ}\text{C} \pm 3^{\circ}\text{C}$
Humidity : $55\% \text{RH} \pm 20\% \text{RH}$
Barometric Pressure : $1013 \text{ hPa} \pm 10 \text{ hPa}$
Received Date : 22 July 2021
Calibration Date : 31 August 2021
Calibration Procedure : In-house method CP-AFM-01 by Comparison technique with Standard Primary Flow Calibrator


Reference Standard	Model	Serial Number	Traceble	Due Calibration
Air Flow Meter	Gilibrator 3 High flow	18501012012	Sensidyne	21 May 2022


Traceability :

This certificate provides traceability of measurement to recognized national standard, and to the realization of the international System of Units (SI)

Note :

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

Calibration By : 
Mr. Noppadon Luangart
Service Calibration Engineer

Approved By : 
Mr. Pacit Mathavorn
Calibration Engineer Supervisor

Issue Date : 1 September 2021

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

FM-708-AFM-01 Rev.00 Issue date 01/07/19

เอกสารไม่ควบคุม

Certificate No : 21-AFM-096

Request No : Req-2021-0988

Result of Calibration :

Flow Setting	STD Flow Reading	UUC Flow Reading	Correction Flow	Uncertainty
LPM	LPM	LPM	LPM	LPM
14.5	14.507	14.51	-0.003	0.21
15.0	15.004	14.94	0.064	0.22
15.8	15.805	15.72	0.085	0.23
16.6	16.607	16.50	0.107	0.24
18.3	18.305	18.19	0.115	0.26

Note

STD : Standard

UUC : Unit Under Calibration

* Indicates non accredited

End of Certificate

Certificate of Calibration

Customer

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

Certificate No : 21-RHM-063

Request No : Req-2021-0988

Unit Under Calibration Details

Measurement Item	: Air Flow Meter	Resolution : 0.1 (°C)
Manufacturer	: BGI	Sensor Model : 2182 (Tf)
Model	: deltaCal DC1	Sensor SN. : MRG/030469-002
Serial Number	: 160491	Sensor ID. : UAE.EFM.175/2561
ID	: UAE.EFM.175/2561	Intrument Status : Used

Calibration Environment and Details

Temperature : 25 °C ± 5 °C
Humidity : 55 %RH ± 20 %RH
Received Date : 22 July 2021
Calibration Date : 31 August 2021
Calibration By : Mr. Sittichok Jirapukdeesakun
Location of Calibration : LAB 2 Temperature
Calibration Method : In-house method CP-THM-01 by Comparison With Standard Relative Humidity Meter and Standard Thermometer with RTD Probe in Humidity / Temperature Chamber

Reference Standard

Standard Thermometer Model: GT11, S/N: 12000077, Which was calibration on 30 March 2021, Calibration of Certificate No. : QR21-0719
and Relative Humidity Meter, Model: HP23-A, S/N: 61629979, Which was calibration on 28 September 2020, Calibration of Certificate No. : QR20-1651


Traceability

This Certificate is traceable to SI Unit through Quality Reborn Co., Ltd., NSC-ONSC Accreditation No. Calibration 0293

Note

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

Calibrated By : _____
Service Calibration Engineer

Approved By :  _____
Mr. Pacit Mathavorn
Calibration Engineer Supervisor
Issue Date : 1 September 2021

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

Certificate No : 21-RHM-063

Request No : Req-2021-0988

Calibration Results : Without Adjustment

Temperature Calibration : Filter Temperature (Tf)

Temperature Range (°C)	Without Adjustment (°C)			Uncertainty (°C)
	STD Reading (°C)	UUC Reading (°C)	Correction (°C)	
20	19.999	20.2	-0.201	0.10
25	24.997	25.2	-0.203	0.10
30	30.000	30.2	-0.200	0.10
35	35.003	35.2	-0.197	0.10
40	40.004	40.3	-0.296	0.10

Temperature Calibration : Ambient Temperature (Ta)

Temperature Range (°C)	Without Adjustment (°C)			Uncertainty (°C)
	STD Reading (°C)	UUC Reading (°C)	Correction (°C)	
20	19.999	20.2	-0.201	0.10
25	24.997	25.1	-0.103	0.10
30	30.000	30.0	0.000	0.10
35	35.003	34.9	0.103	0.10
40	40.004	39.9	0.104	0.10

End of Certificate

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

FM-708-THM-01 Rev.00 Issue date 01/07/19

เอกสารไม่ควบคุม



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



Certificate of Calibration

Certificate No. : 21P2499

Page : 1 of 2

Equipment : Aneroid Barometer
Manufacturer: Barigo
Model : -
Serial No.: -
ID No.: UAE.ANV.122/2550

This certificate may not be reproduced other than in full,
except with the prior written approval of the head of
Corporate Services 3: Equipment Calibration and Testing Services.

Condition As-Received: Used Item

Received Date: 20 July 2021

Calibration Date: 21 July 2021

Reference: 2107-0570WSC

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

Ambient Temperature: (23 \pm 2) °C

Relative Humidity: (50 \pm 15) %

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

Atmospheric Pressure: 1009 mbar

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

Condition of this result of calibration

1.Reference standards instruments :

<u>Instrument</u>	<u>Model</u>	<u>Serial No.</u>	<u>Certificate No.</u>	<u>Due Date</u>
1) Standard Barometer	DPI142	1422505046	MP-0053-21	08 Apr 2022

2.This instrument was installed in vertical orientation and center of the dial was used as the reference level.

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

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

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

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

-National Institute of Metrology Thailand (NIMT)

Calibrated by : Suwit Aussarree
Issue Date : 22 July 2021

Approved Signatory :

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

เอกสารไม่ควบคุม

B 0264462



Cert.No.: 21P2499

Page: 2 of 2

Result of calibration:- Without adjustment

Range : 960 hPa to 1030 hPa

Function:- Absolute Pressure Measurement

Scale Interval : 1 hPa(The Fifth Estimate)

Increasing Pressure

Applied Pressure (hPa)	957.66	969.27	980.15	990.48	1000.69	1010.75	1020.58	1029.49
UUC* Indication (hPa)	960.0	970.0	980.0	990.0	1000.0	1010.0	1020.0	1030.0
Error (hPa)	2.34	0.73	-0.15	-0.48	-0.69	-0.75	-0.58	0.51

Decreasing Pressure

Applied Pressure (hPa)	1029.61	1020.69	1010.80	1000.75	990.59	980.30	969.41	957.79
UUC* Indication (hPa)	1030.0	1020.0	1010.0	1000.0	990.0	980.0	970.0	960.0
Error (hPa)	0.39	-0.69	-0.80	-0.75	-0.59	-0.30	0.59	2.21

The uncertainty of measurement was ± 0.30 hPa

* UUC = Unit Under Calibration

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

-o0o-

Attapol P.
เอกสารไม่ควบคุม
a 1062243



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



Certificate of Calibration

Certificate No. : 21H804

Page : 1 of 2

Equipment : Dial Thermo-Hygrometer

Manufacturer: Barigo

Model : -

Serial No.: -

ID No.: UAE.ANV.129/2550

Condition As-Received: Used Item

Received Date: 29 March 2021

Calibration Date: 31 March 2021
to 08 April 2021

Reference: 2103-1189WSC

Ambient Temperature: (25 ± 3) °C

Relative Humidity: (50 ± 20) %

This certificate may not be reproduced other than in full,
except with the prior written approval of the head of
Corporate Services 3: Equipment Calibration and Testing Services.

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

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

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

Condition of this result of calibration

1.Reference standards instruments :

<u>Instrument</u>	<u>Model</u>	<u>Serial No.</u>	<u>Certificate No.</u>	<u>Due Date</u>
1) Standard Chilled Mirror Hygrometer Sensor	Dew Prime II	31863	18540	28 Jul 2021
2) Handheld Thermometer With Sensor	1521	A5A339	201968	10 Aug 2021

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

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

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

Calibrated by : Kraipop Onrat
Issue Date : 20 April 2021

Approved Signatory :

- [✓] Chakrit Waewanjua
[] Pornthippa Tameyakul
[] Pitak Srimongkol

เอกสารไม่ควบคุม

B 0258331



Cert. No.: 21H804

Page.: 2 of 2

Result of Calibration:-

Without Adjustment

Function:

Humidity measurement.

<u>Reference</u> <u>Temperature</u> (°C)	<u>Standard</u> <u>Humidity</u> (%R.H.)	<u>UUC*</u> <u>Reading</u> (%R.H.)	<u>Error</u> (%R.H.)	<u>Uncertainty</u> <u>of Measurement</u> (±%R.H.)
25.0	40.1	42	1.9	1.6
25.0	60.0	60	0.0	1.8
25.0	80.0	76	-4.0	1.9

Result of Calibration:-

Without Adjustment

Function:

Temperature measurement.

<u>Standard</u> <u>Temperature</u> (°C)	<u>UUC*</u> <u>Reading</u> (°C)	<u>Error</u> (°C)	<u>Uncertainty</u> <u>of Measurement</u> (±°C)
20.011	20.0	-0.011	0.72
30.019	30.0	-0.019	0.72
34.989	34.5	-0.489	0.72
40.006	39.0	-1.006	0.72

UUC* : Unit Under Calibration

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

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a 1051238

CERTIFICATE OF ANALYSIS

Grade of Product: EPA Protocol

Part Number:	E04NI99E15A01QC	Reference Number:	160-401526192-1
Cylinder Number:	CC159599	Cylinder Volume:	144.4 CF
Laboratory:	124 - Plumsteadville - PA	Cylinder Pressure:	2015 PSIG
PGVP Number:	A12019	Valve Outlet:	660
Gas Code:	CO,NO,NOX,SO2,BALN	Certification Date:	Jul 30, 2019

Expiration Date: Jul 30, 2022

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 600/R-12/531, using the assay procedures listed. Analytical Methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a volume/volume basis unless otherwise noted.

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

ANALYTICAL RESULTS

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
NOX	45.00 PPM	44.76 PPM	G1	+/- 0.8% NIST Traceable	07/23/2019, 07/30/2019
NITRIC OXIDE	45.00 PPM	44.76 PPM	G1	+/- 0.8% NIST Traceable	07/23/2019, 07/30/2019
SULFUR DIOXIDE	45.00 PPM	45.35 PPM	G1	+/- 1% NIST Traceable	07/23/2019, 07/30/2019
CARBON MONOXIDE	1000 PPM	1007 PPM	G1	+/- 0.4% NIST Traceable	07/23/2019
NITROGEN	Balance				

CALIBRATION STANDARDS

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	18060121	KAL004215	249.9 PPM NITRIC OXIDE/NITROGEN	+/- 0.4%	Nov 08, 2023
NTRM	052411	KAL004307	50.03 PPM NITRIC OXIDE/NITROGEN	+/-0.80%	Mar 12, 2024
NTRM	18060121	KAL004215	250.0 PPM NOx/NITROGEN	+/- 0.4%	Nov 08, 2023
NTRM	052411	KAL004307-NOX	50.03 PPM NOx/NITROGEN	+/-0.80%	Mar 12, 2024
NTRM	0141709	KAL003190	49.67 PPM SULFUR DIOXIDE/NITROGEN	+/- 1.0%	Jun 20, 2022
NTRM	072508	KAL004570	970.0 PPM CARBON MONOXIDE/NITROGEN	+/- 0.4%	May 14, 2021

ANALYTICAL EQUIPMENT

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
CO MKS FTIR 000929062	FTIR	Jul 19, 2019
NO MKS FTIR 000929062	FTIR	Jul 22, 2019
NO MKS FTIR 000929062	FTIR	Jul 22, 2019
SO2 MKS FTIR 000929062	FTIR	Jul 22, 2019

Triad Data Available Upon Request

NOTES: RAN# 51319-CM03
PO# 5219002210
GROSS WEIGHT: 28.6 KG
NET WEIGHT: 4.1 KG



Signature on file
Approved for Release

MULTI-POINT GAS TEST REPORT

Test Date : Feb 10, 2021

Equipment : Gas Analyzer (NO₂)

Model : 42i

Manufacturer : Thermo Scientific

Serial Number : 1180540064

Standard Gas Concentration

Sulphur Dioxide (SO₂)

44.75

PPM

Nitric Oxide (NO)

45.35

PPM

Methane (CH₄)

-

PPM

Carbon Monoxide (CO)

1007

Cylinder No. :

CC159599

Expiration Date :

Jul 30, 2022

Dilutor Detail

Manufacturer :

Thermo Scientific

Model :

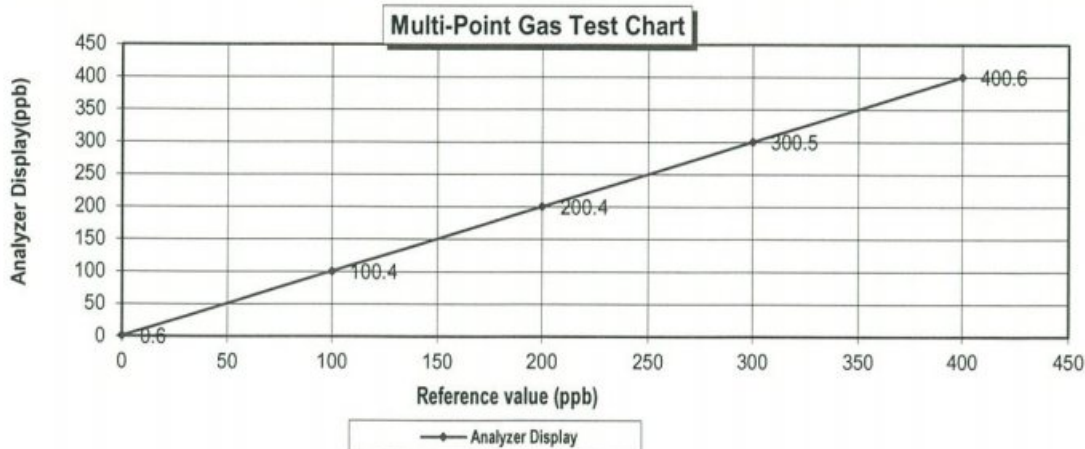
146i

Serial Number :

1180540071

Multi-point gas test data

	Reference Value (ppb)		Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	0.6	0.60	0.60	0.60
Level 2	20.00%	100.0	100.4	0.40	0.40	0.40
Level 3	40.00%	200.0	200.4	0.40	0.20	0.20
Level 4	60.00%	300.0	300.5	0.50	0.17	0.17
Level 5	80.00%	400.0	400.6	0.60	0.15	0.15
Remark : Measuring Range			500.0 ppb	Average Difference (%)		0.30
:Acceptable Limit $\pm 5\%$						



Calculate by

Sirichai Gungow
11 / Feb / 2021

Approve by

Witthorn N
11 / Feb / 2021

MULTI-POINT GAS TEST REPORT

Test Date : Feb 24, 2021

Equipment : Gas Analyzer (NO₂)

Model : 42i

Manufacturer : Thermo Scientific

Serial Number : 1182920006

Standard Gas Concentration

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

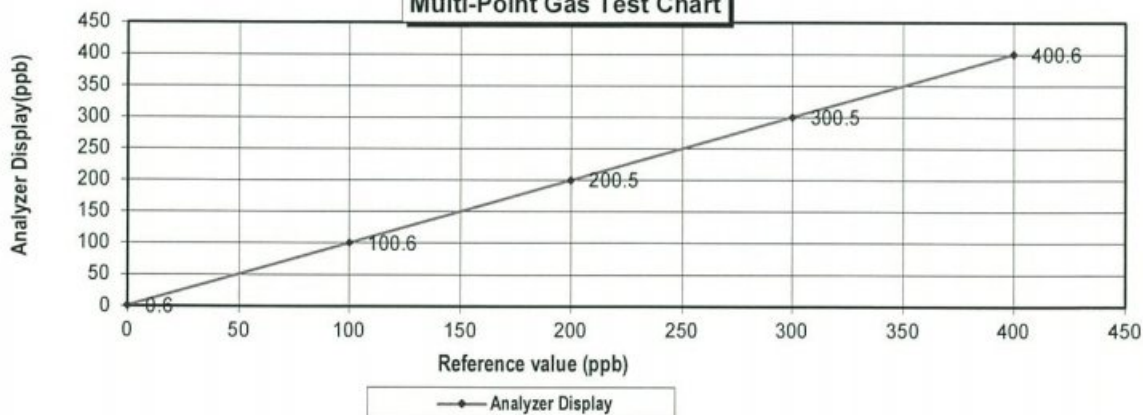
Dilutor Detail

Manufacturer : Thermo Scientific
Model : 146i
Serial Number : 1180540071

Multi-point gas test data

Reference Value (ppb)			Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	0.6	0.60	0.60	0.60
Level 2	20.00%	100.0	100.6	0.60	0.60	0.60
Level 3	40.00%	200.0	200.5	0.50	0.25	0.25
Level 4	60.00%	300.0	300.5	0.50	0.17	0.17
Level 5	80.00%	400.0	400.6	0.60	0.15	0.15
Remark : Measuring Range 500.0 ppb			Average Difference (%)		0.35	

Multi-Point Gas Test Chart



Calculate by

Sirichai Yongsawat
26 Feb 2021

Approve by

P. S. S. S. S.
26 Feb 2021

MULTI-POINT GAS TEST REPORT

Test Date : Nov 25, 2021

Equipment : Gas Analyzer (NO₂)

Model : 42i

Manufacturer : Thermo Scientific

Serial Number : 1182920009

Standard Gas Concentration

Sulphur Dioxide (SO ₂)	44.75
Nitric Oxide (NO)	45.35
Methane (CH ₄)	-
Carbon Monoxide (CO)	1007
Cylinder No. :	CC159599
Expiration Date :	Jul 30, 2022

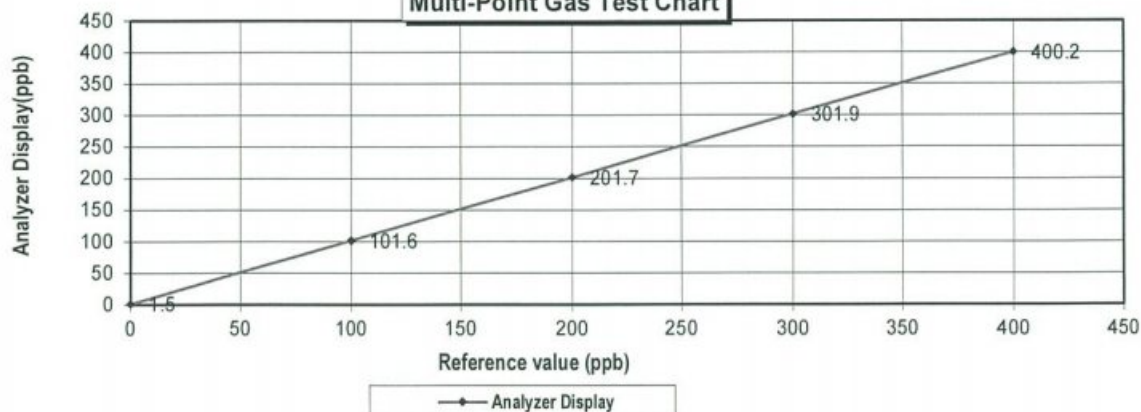
Dilutor Detail

Manufacturer :	Thermo Scientific
Model :	146i
Serial Number :	1180540071

Multi-point gas test data

Reference Value (ppb)			Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	1.5	1.50	1.50	1.50
Level 2	20.00%	100.0	101.6	1.60	1.57	1.57
Level 3	40.00%	200.0	201.7	1.70	0.84	0.84
Level 4	60.00%	300.0	301.9	1.90	0.63	0.63
Level 5	80.00%	400.0	400.2	0.20	0.05	0.05
Remark : Measuring Range 500.0 ppb				Average Difference (%)		0.92

Multi-Point Gas Test Chart



Calculate by

Sirichai Y.
25 / 11 / 64

Approve by

Patana N.
25 Nov, 2021

MULTI-POINT GAS TEST REPORT

Test Date : Nov 4, 2021

Equipment : Gas Analyzer (NO₂)

Model : 42i

Manufacturer : Thermo Scientific

Serial Number : 1191503038

Standard Gas Concentration

Sulphur Dioxide (SO ₂)	44.75
Nitric Oxide (NO)	45.35
Methane (CH ₄)	-
Carbon Monoxide (CO)	1007
Cylinder No. :	CC159599
Expiration Date :	Jul 30, 2022

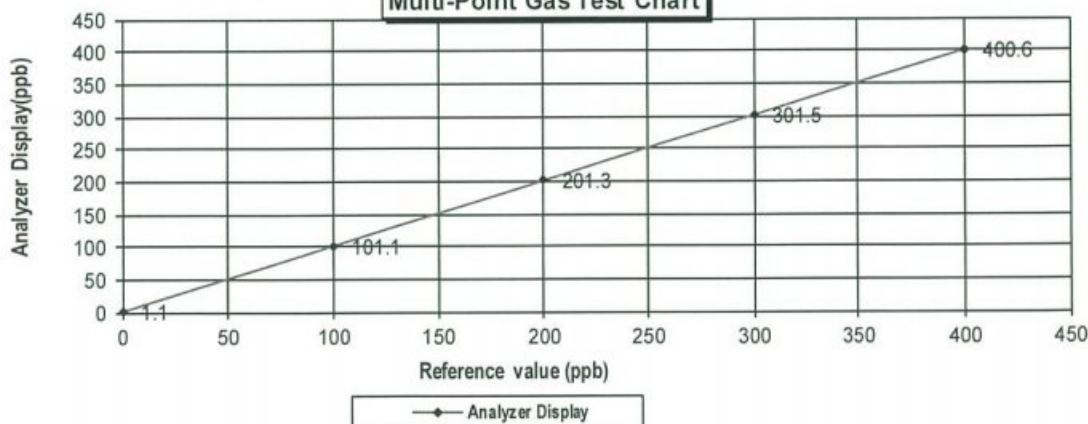
Dilutor Detail

Manufacturer :	Thermo Scientific
Model :	146i
Serial Number :	1180540071

Multi-point gas test data

Reference Value (ppb)			Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	1.1	1.10	1.10	1.10
Level 2	20.00%	100.0	101.1	1.10	1.09	1.09
Level 3	40.00%	200.0	201.3	1.30	0.65	0.65
Level 4	60.00%	300.0	301.5	1.50	0.50	0.50
Level 5	80.00%	400.0	400.6	0.60	0.15	0.15
Remark : Measuring Range 500.0 ppb				Average Difference (%)		0.70

Multi-Point Gas Test Chart



Calculate by

Sinichai Y.
4 / 11 / 64

Approve by

Perawat W.
4 / Nov / 2021

MULTI-POINT GAS TEST REPORT

Test Date : June 14, 2021

Equipment : Gas Analyzer (SO₂)

Model : 43i

Manufacturer : Thermo Scientific

Serial Number : 1201778111

Standard Gas Concentration

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

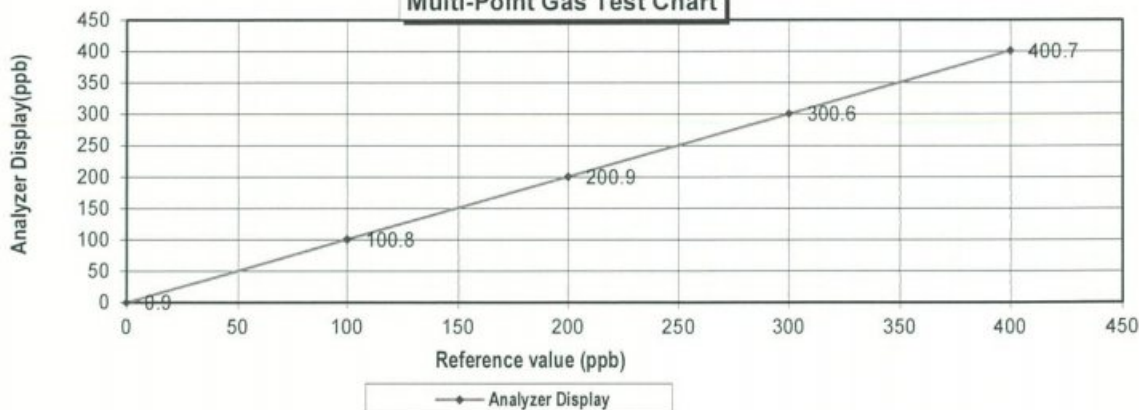
Dilutor Detail

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

Multi-point gas test data

Reference Value (ppb)			Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	0.9	0.90	0.90	0.90
Level 2	20.00%	100.0	100.8	0.80	0.79	0.79
Level 3	40.00%	200.0	200.9	0.90	0.45	0.45
Level 4	60.00%	300.0	300.6	0.60	0.20	0.20
Level 5	80.00%	400.0	400.7	0.70	0.17	0.17
Remark : Measuring Range 500.0 ppb				Average Difference (%)		0.50

Multi-Point Gas Test Chart



Calculate by

Schiehar y.
.....
14 / June 2021
.....

Approve by

Pachorn n.
.....
14 / June 2021
.....

MULTI-POINT GAS TEST REPORT

Test Date : June 14, 2021

Equipment : Gas Analyzer (SO₂) **Model :** 43i
Manufacturer : Thermo SCIENTIFIC **Serial Number :** 1201778112

Standard Gas Concentration

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

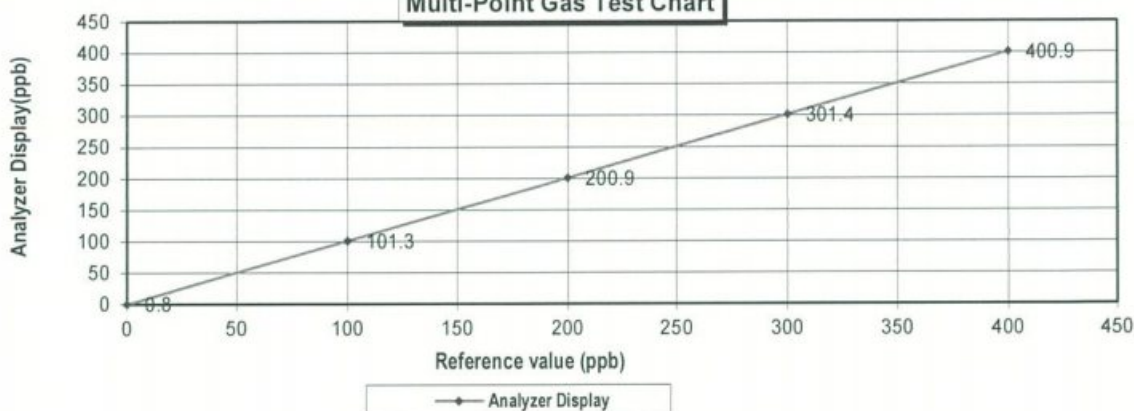
Dilutor Detail

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

Multi-point gas test data

Reference Value (ppb)			Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	0.8	0.80	0.80	0.80
Level 2	20.00%	100.0	101.3	1.30	1.28	1.28
Level 3	40.00%	200.0	200.9	0.90	0.45	0.45
Level 4	60.00%	300.0	301.4	1.40	0.46	0.46
Level 5	80.00%	400.0	400.9	0.90	0.22	0.22
Remark : Measuring Range 500.0 ppb			Average Difference (%)			0.64

Multi-Point Gas Test Chart



Calculate by

Strichai y.
14 / June / 2021

Approve by

Pat Kork u
14 / June / 2021

MULTI-POINT GAS TEST REPORT

Test Date : June 9, 2021

Equipment : Gas Analyzer (SO₂) **Model :** 43i
Manufacturer : Thermo SCIENTIFIC **Serial Number :** 1201778114

Standard Gas Concentration

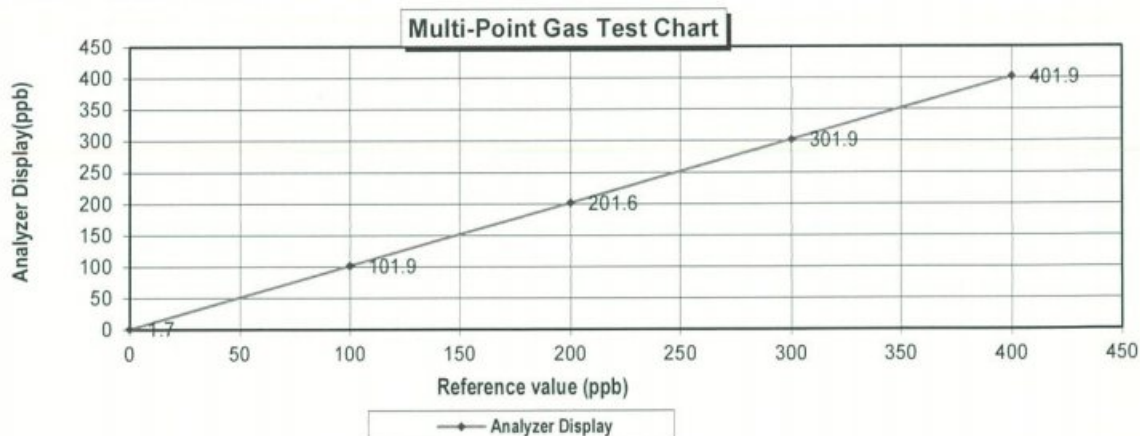
Sulphur Dioxide (SO₂) 44.75
Nitric Oxide (NO) 45.35
Methane (CH₄) -
Carbon Monoxide (CO) 1007
Cylinder No. : CC159599
Expiration Date : Jul 30, 2022

Dilutor Detail

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

Multi-point gas test data

	Reference Value (ppb)		Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	1.7	1.70	1.70	1.70
Level 2	20.00%	100.0	101.9	1.90	1.86	1.86
Level 3	40.00%	200.0	201.6	1.60	0.79	0.79
Level 4	60.00%	300.0	301.9	1.90	0.63	0.63
Level 5	80.00%	400.0	401.9	1.90	0.47	0.47
Remark : Measuring Range 500.0 ppb				Average Difference (%)		1.09
:Acceptable Limit $\pm 5\%$						



Calculate by

Srichar Y.
9 June 2021

Approve by

Polvor h. h.
10 June 2021

MULTI-POINT GAS TEST REPORT

Test Date : June 9, 2021

Equipment : Gas Analyzer (SO₂) **Model** : 43i
Manufacturer : Thermo SCIENTIFIC **Serial Number** : 1201778116

Standard Gas Concentration

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

Dilutor Detail

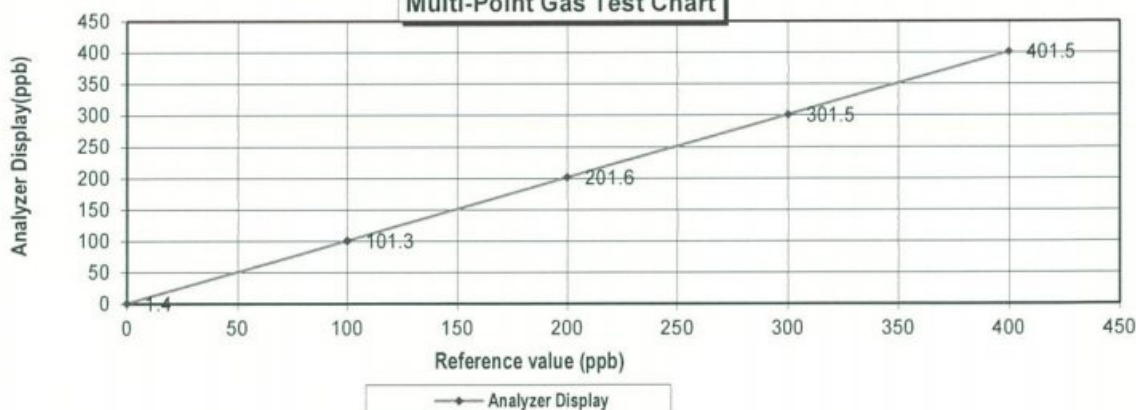
Manufacturer : Thermo SCIENTIFIC
Model : 146i
Serial Number : 1201778116

Multi-point gas test data

	Reference Value (ppb)		Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	1.4	1.40	1.40	1.40
Level 2	20.00%	100.0	101.3	1.30	1.28	1.28
Level 3	40.00%	200.0	201.6	1.60	0.79	0.79
Level 4	60.00%	300.0	301.5	1.50	0.50	0.50
Level 5	80.00%	400.0	401.5	1.50	0.37	0.37
Remark : Measuring Range 500.0 ppb				Average Difference (%)		0.87

:Acceptable Limit $\pm 5\%$

Multi-Point Gas Test Chart



Calculate by

Sirichan Y.
10 June 2021

Approve by

Patirorn U.
10 June 2021



THAI METEOROLOGICAL DEPARTMENT

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

Calibration Certificate

Issued by : Calibration & Test Section : Meteorological Instruments Bureau

Date of Issue 20 May, 2021

Certification No. 275/21

Page : 1 of 2

Object : Wind speed and wind direction

Manufacturer : LSI

Type : Dato Logger E-LOG 305 wind speed and wind direction DNA 821

Serial No. : Dato Logger 20040002 wind speed and wind direction 20040162

ID No. : No.2/20

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

81 Soi Udomsuk 41, Sukhumvit Road,

Bangchak, Prakanong, Bangkok 10260.

Calibration Condition : Temperature 25.1 °C Barometric Pressure 1009.1 hPa

NATIONAL STANDARD WIND TUNNEL :

: Thermal Anemometer 642 S/N 91563

: HOOK GAGE NO 1425 Pitot Tube Theodor Friedrichs Type 0800.0000 serial 9023

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

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

Serial Number 110730029 (sensor 120629586)

JAPAN QUALITY ASSURANCE ORGANIZATION

Calibrated by :

Mr. Watcharapol Subwat

Mechanical Engineer

Signed :

Mr. Pisood Promsut



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THAI METEOROLOGICAL DEPARTMENT

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

The Result of Calibration

Certification No. 275/21

20 May, 2021

Page : 2 of 2

Standard Ultrasonic Anemometer m/sec	HOOK GAGE NO. 1425			TESTED ANEMOMETER	
	Pressure	Vacumm	Pressure	Velocity	Correction
	inches	inches	hPa	m/sec	m/sec
1.00	-	-	-	1.0	0.00
3.02	-	-	-	2.9	0.12
5.00	-	-	-	4.4	0.60
7.04	-	-	-	6.9	0.14
9.02	-	-	-	8.5	0.52
11.01	-	-	-	10.9	0.11
13.01	-	-	-	12.6	0.41
15.01	-	-	-	14.9	0.11
17.02	-	-	-	16.6	0.42
20.02	-	-	-	19.9	0.12

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

Calibrated by :

Watchapol

Mr. Watcharapol Subwat

Mechanical Engineer

Calibration & Test Section

Meteorological Instruments Bureau



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Certificate of Calibration

Customer

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

Certificate No : 21-ACT-187
Request No : Req-2021-0523

Unit Under Calibration Details

Measurement item : Acoustic Calibrator Class : 1
Manufacturer : SVANTEK Range : 94, 114 dB / 1000 Hz
Model : SV 35A Instrument Status : Used
Serial Number : 73249
ID : UAE.EFM.105/2561

Calibration Environment and Details


Temperature : (23 ±2 °C)
Humidity : (50 ± 20 %RH)
Barometric Pressure : (1013 ±10.0 hPa)
Received Date : 27 April 2021
Calibration Date : 28 May 2021
Location of Calibration : LAB 1 Acoustic
Calibration Procedure : In-house method CP-ACT-02 based on IEC 60942:2017 Electroacoustics - Sound calibrators


Reference Standard	Model	Serial Number	Traceable	Due Calibration
Sound Calibrator	SV 35A	58079	EEI	14 May 2022
THD Multimeter	2015	1047765	NIMT	22 January 2022

Traceability : This certificate provides traceability of measurement to recognized national standard, and to the realization of the international System of Units (SI).

Note

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

Calibrated By : 
Mr. Noppadon Luangart
Service Calibration Engineer

Approved By : 
Mr. Pacit Mathavorn
Calibration Engineer Supervisor

Issue Date : 28 May 2021

Certificate No : 21-ACT-187

Request No : Req-2021-0523

Sound pressure level

Calibration Results : Without Adjustment

Calibration Range (dB)	Without Adjustment (dB)		Adjustment (dB)		Uncertainty (± dB)	Acceptance limit Class 1 (± dB)
	Measured	Error	Measured	Error		
94 dB / 1000 Hz	93.81	-0.19	-	-	0.11	0.25
114 dB / 1000 Hz	113.83	-0.17	-	-	0.11	0.25

Frequency of Sound pressure level

Calibration Range (Hz)	Without Adjustment		Adjustment		Uncertainty (± %)	Acceptance limit Class 1 (± %)
	Measured (Hz)	Error (%)	Measured (Hz)	Error (%)		
94 dB / 1000 Hz	999.97	0.003	-	-	0.02	0.70
114 dB / 1000 Hz	999.98	0.002	-	-	0.02	0.70

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

Calibration Range (Hz)	Without Adjustment	Adjustment	Uncertainty (± %)	Acceptance limit Class 1 (± %)
	Measured (%)	Measured (%)		
94 dB / 1000 Hz	0.18	-	0.17	2.5
114 dB / 1000 Hz	0.04	-	0.17	2.5

Note :

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

End of Calibration

Calibration Certificate

Certificate Number 2021000493

Customer:

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

Model Number LxT2
Serial Number 0005403
Test Results Pass

Initial Condition As Manufactured
Description SoundTrack LxT Class 2
Class 2 Sound Level Meter
Firmware Revision: 2.404

Procedure Number D0001.8378
Technician Ron Harris
Calibration Date 15 Jan 2021
Calibration Due
Temperature 23.25 °C ± 0.25 °C
Humidity 53.7 %RH ± 2.0 %RH
Static Pressure 87.56 kPa ± 0.13 kPa

Evaluation Method Tested electrically using Larson Davis PRMLxT2C S/N 073809 and a 12.0 pF capacitor to simulate microphone capacitance. Data reported in dB re 20 µPa assuming a microphone sensitivity of 50.0 mV/Pa.

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

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

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

The quality system is registered to ISO 9001:2015.

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

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

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

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

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Certificate Number 2021000493

Standards Used			
Description	Cal Date	Cal Due	Cal Standard
Hart Scientific 2626-S Humidity/Temperature Sensor	2020-05-12	2021-05-12	006943
SRS DS360 Ultra Low Distortion Generator	2021-01-05	2022-01-05	007118

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716-684-0001



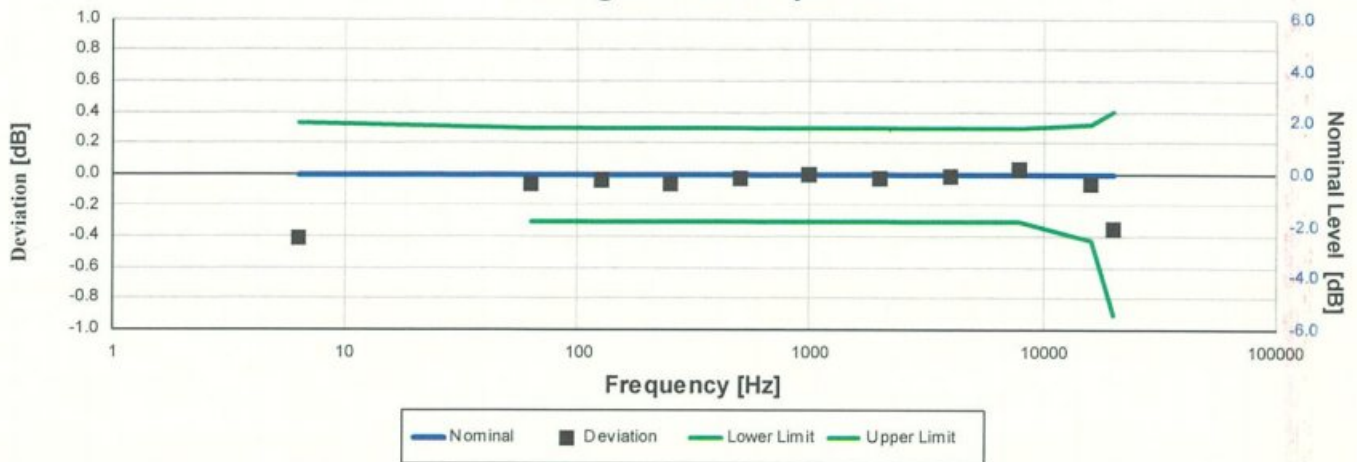
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Z-weight Filter Response



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

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

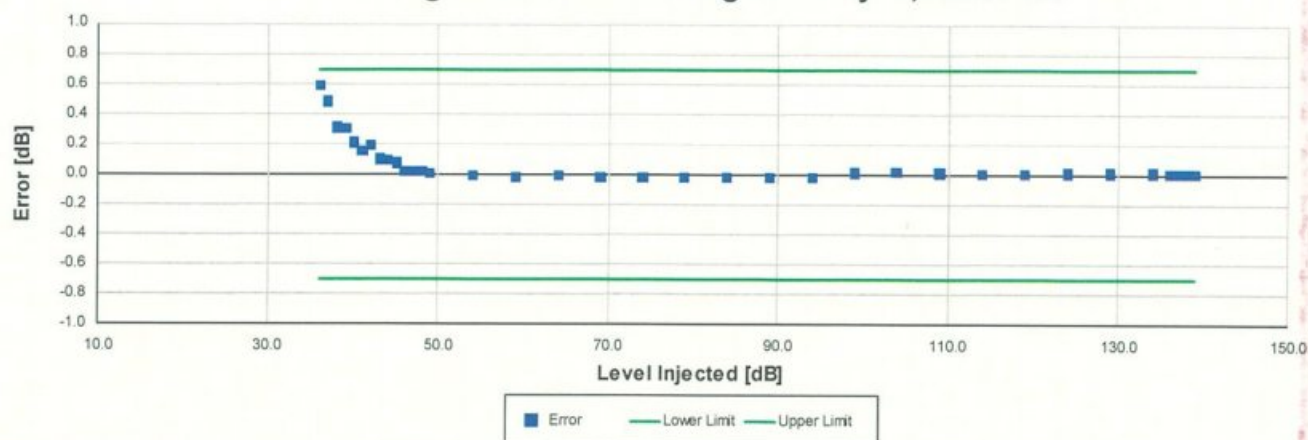
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A-weighted Broadband Log Linearity: 8,000.00 Hz



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

Level [dB]	Error [dB]	Lower limit [dB]	Upper limit [dB]	Expanded Uncertainty [dB]	Result
36.00	0.59	-0.70	0.70	0.16	Pass
37.00	0.49	-0.70	0.70	0.16	Pass
38.00	0.31	-0.70	0.70	0.16	Pass
39.00	0.31	-0.70	0.70	0.16	Pass
40.00	0.21	-0.70	0.70	0.16	Pass
41.00	0.15	-0.70	0.70	0.16	Pass
42.00	0.19	-0.70	0.70	0.16	Pass
43.00	0.10	-0.70	0.70	0.17	Pass
44.00	0.09	-0.70	0.70	0.17	Pass
45.00	0.07	-0.70	0.70	0.16	Pass
46.00	0.02	-0.70	0.70	0.16	Pass
47.00	0.02	-0.70	0.70	0.16	Pass
48.00	0.01	-0.70	0.70	0.16	Pass
49.00	0.00	-0.70	0.70	0.16	Pass
54.00	0.00	-0.70	0.70	0.16	Pass
59.00	-0.02	-0.70	0.70	0.16	Pass
64.00	-0.01	-0.70	0.70	0.16	Pass
69.00	-0.02	-0.70	0.70	0.16	Pass
74.00	-0.02	-0.70	0.70	0.16	Pass
79.00	-0.02	-0.70	0.70	0.16	Pass
84.00	-0.02	-0.70	0.70	0.16	Pass
89.00	-0.02	-0.70	0.70	0.16	Pass
94.00	-0.02	-0.70	0.70	0.16	Pass
99.00	0.01	-0.70	0.70	0.15	Pass
104.00	0.02	-0.70	0.70	0.15	Pass
109.00	0.01	-0.70	0.70	0.15	Pass
114.00	0.00	-0.70	0.70	0.15	Pass
119.00	0.00	-0.70	0.70	0.15	Pass
124.00	0.01	-0.70	0.70	0.15	Pass
129.00	0.01	-0.70	0.70	0.15	Pass
134.00	0.01	-0.70	0.70	0.15	Pass
136.00	0.01	-0.70	0.70	0.15	Pass
137.00	0.01	-0.70	0.70	0.15	Pass
138.00	0.00	-0.70	0.70	0.15	Pass
139.00	0.00	-0.70	0.70	0.15	Pass

-- End of measurement results--

Peak Rise Time

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

Amplitude [dB]	Duration [μs]		Test Result [dB]	Lower limit [dB]	Upper limit [dB]	Expanded Uncertainty [dB]	Result
136.95	40	Negative Pulse	134.73	133.25	135.25	0.15	Pass
		Positive Pulse	134.73	133.24	135.24	0.15	Pass
	30	Negative Pulse	133.51	133.25	135.25	0.15	Pass
		Positive Pulse	133.75	133.24	135.24	0.15	Pass
	-- End of measurement results--						

Positive Pulse Crest Factor

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

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

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

Negative Pulse Crest Factor

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

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

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

Gain

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

Measurement	Test Result [dB]	Lower limit [dB]	Upper limit [dB]	Expanded Uncertainty [dB]	Result
0 dB Gain	93.97	93.90	94.10	0.15	Pass
0 dB Gain, Linearity	40.29	39.40	40.80	0.16	Pass
OBA Low Range	94.00	93.90	94.10	0.15	Pass
OBA Normal Range	94.00	93.20	94.80	0.15	Pass
-- End of measurement results--					

Certificate Number 2021000493

Broadband Noise Floor

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

Measurement	Test Result [dB]	Upper limit [dB]	Result
A-weight Noise Floor	27.23	36.00	Pass
C-weight Noise Floor	26.45	35.00	Pass
Z-weight Noise Floor	32.10	39.00	Pass

-- End of measurement results--

Total Harmonic Distortion

Measured using 1/3-Octave filters

Measurement	Test Result [dB]	Lower Limit [dB]	Upper Limit [dB]	Expanded Uncertainty [dB]	Result
10 Hz Signal	135.30	134.15	135.75	0.15	Pass
THD	-65.87		-58.00	0.01 ‡	Pass
THD+N	-62.06		-58.00	0.01 ‡	Pass

-- End of measurement results--

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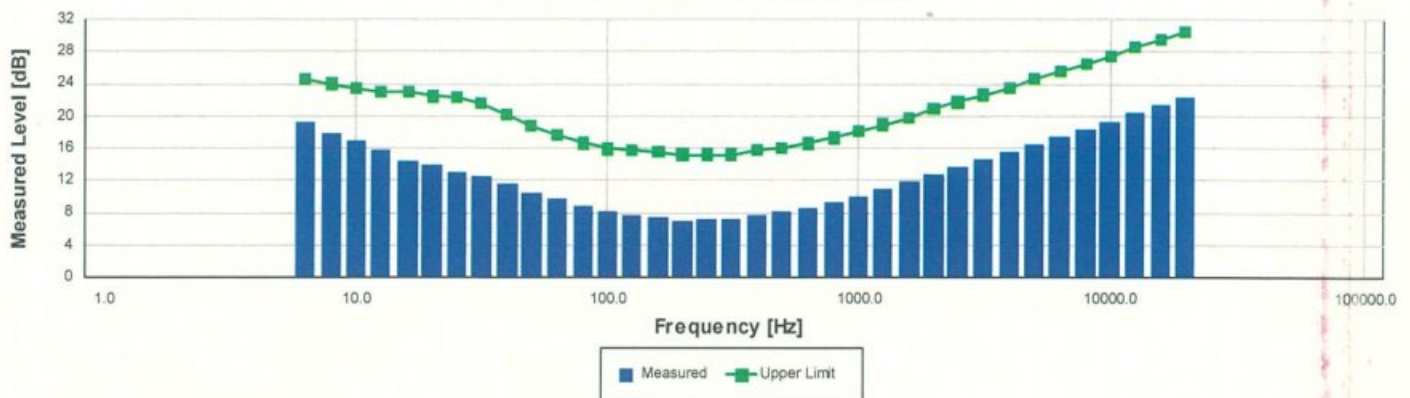
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1/3-Octave Self-Generated Noise



The SLM is set to low range.

Frequency [Hz]	Test Result [dB]	Upper limit [dB]	Result
6.30	19.29	24.60	Pass
8.00	17.93	24.00	Pass
10.00	16.87	23.50	Pass
12.50	15.86	23.00	Pass
16.00	14.44	22.90	Pass
20.00	13.94	22.40	Pass
25.00	12.98	22.30	Pass
31.50	12.42	21.50	Pass
40.00	11.54	20.20	Pass
50.00	10.41	18.80	Pass
63.00	9.67	17.60	Pass
80.00	8.79	16.60	Pass
100.00	8.14	15.90	Pass
125.00	7.76	15.70	Pass
160.00	7.47	15.50	Pass
200.00	7.03	15.20	Pass
250.00	7.10	15.20	Pass
315.00	7.20	15.20	Pass
400.00	7.56	15.70	Pass
500.00	8.07	16.00	Pass
630.00	8.67	16.60	Pass
800.00	9.35	17.30	Pass
1,000.00	9.98	18.10	Pass
1,250.00	11.01	18.90	Pass
1,600.00	11.80	19.80	Pass
2,000.00	12.71	20.80	Pass
2,500.00	13.68	21.70	Pass
3,150.00	14.56	22.60	Pass
4,000.00	15.50	23.50	Pass
5,000.00	16.44	24.50	Pass
6,300.00	17.41	25.50	Pass
8,000.00	18.39	26.50	Pass
10,000.00	19.32	27.40	Pass
12,500.00	20.34	28.50	Pass
16,000.00	21.26	29.50	Pass
20,000.00	22.26	30.40	Pass

-- End of measurement results--

Certificate Number 2021000493

-- End of Report--

Signatory: Ron Harris

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Calibration Certificate

Certificate Number 2021000495

Customer:

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

Model Number LxT2
Serial Number 0005402
Test Results Pass

Initial Condition As Manufactured

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

Procedure Number D0001.8378
Technician Ron Harris
Calibration Date 15 Jan 2021
Calibration Due
Temperature 22.94 °C ± 0.25 °C
Humidity 54 %RH ± 2.0 %RH
Static Pressure 87.56 kPa ± 0.13 kPa

Evaluation Method Tested electrically using Larson Davis PRMLxT2C S/N 073808 and a 12.0 pF capacitor to simulate microphone capacitance. Data reported in dB re 20 µPa assuming a microphone sensitivity of 50.0 mV/Pa.

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

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

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

The quality system is registered to ISO 9001:2015.

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

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

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

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

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Provo, UT 84601, United States
716-684-0001



Certificate Number 2021000495

Standards Used			
Description	Cal Date	Cal Due	Cal Standard
Hart Scientific 2626-S Humidity/Temperature Sensor	2020-05-12	2021-05-12	006943
SRS DS360 Ultra Low Distortion Generator	2020-08-19	2021-08-19	007167

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Provo, UT 84601, United States
716-684-0001



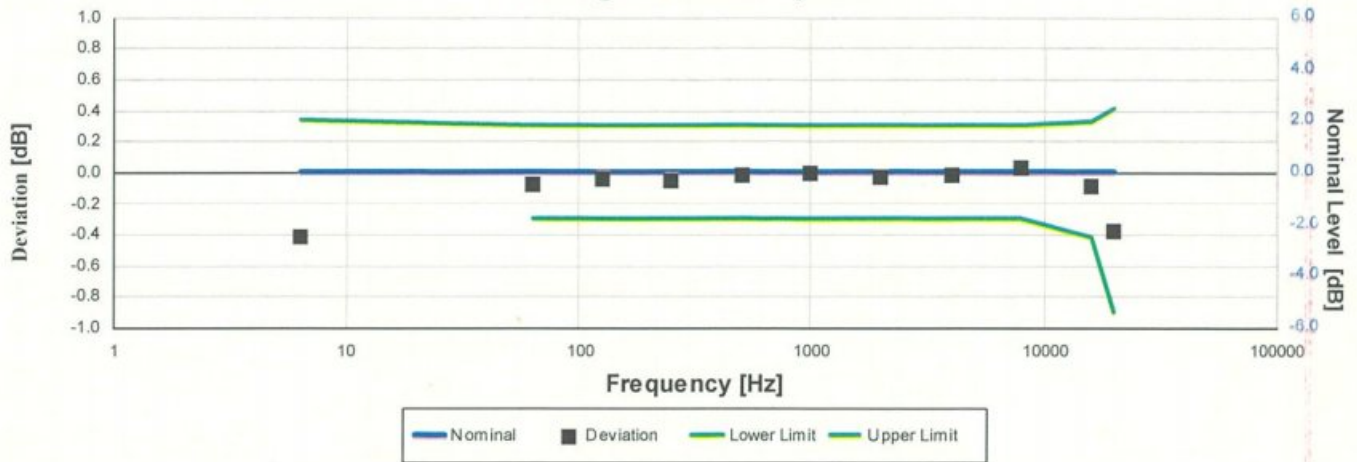
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Z-weight Filter Response



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

Frequency [Hz]	Test Result [dB]	Deviation [dB]	Lower limit [dB]	Upper limit [dB]	Expanded Uncertainty [dB]	Result
6.31	-0.41	-0.41	-1.11	0.33	0.15	Pass
63.10	-0.07	-0.07	-0.30	0.30	0.15	Pass
125.89	-0.04	-0.04	-0.30	0.30	0.15	Pass
251.19	-0.05	-0.05	-0.30	0.30	0.15	Pass
501.19	-0.02	-0.02	-0.30	0.30	0.15	Pass
1,000.00	0.00	0.00	-0.30	0.30	0.15	Pass
1,995.26	-0.03	-0.03	-0.30	0.30	0.15	Pass
3,981.07	-0.01	-0.01	-0.30	0.30	0.15	Pass
7,943.28	0.03	0.03	-0.30	0.30	0.15	Pass
15,848.93	-0.09	-0.09	-0.42	0.32	0.15	Pass
19,952.62	-0.38	-0.38	-0.91	0.41	0.15	Pass

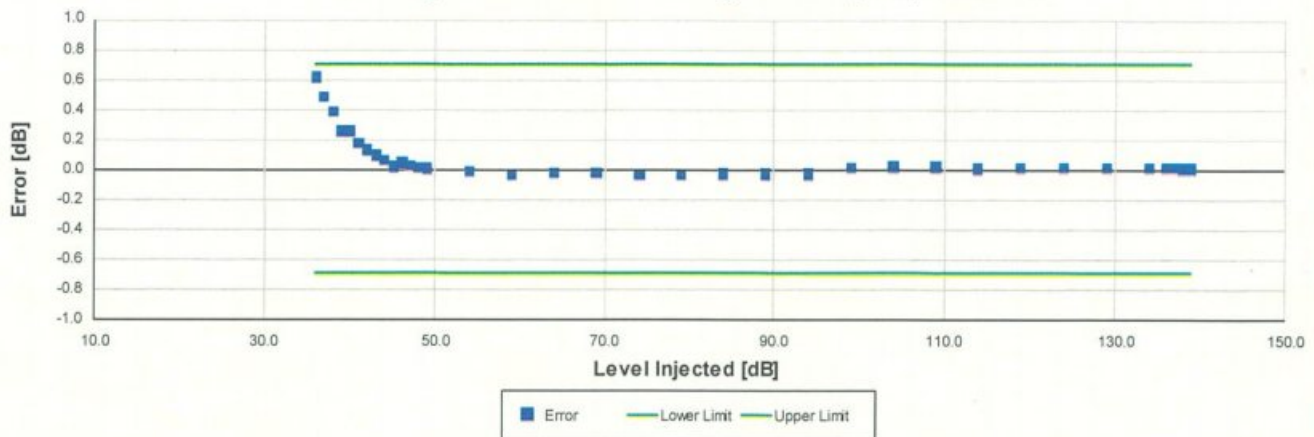
-- End of measurement results--

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716-684-0001



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A-weighted Broadband Log Linearity: 8,000.00 Hz



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

Level [dB]	Error [dB]	Lower limit [dB]	Upper limit [dB]	Expanded Uncertainty [dB]	Result
36.00	0.61	-0.70	0.70	0.16	Pass
37.00	0.48	-0.70	0.70	0.16	Pass
38.00	0.38	-0.70	0.70	0.16	Pass
39.00	0.25	-0.70	0.70	0.16	Pass
40.00	0.25	-0.70	0.70	0.16	Pass
41.00	0.17	-0.70	0.70	0.16	Pass
42.00	0.12	-0.70	0.70	0.16	Pass
43.00	0.09	-0.70	0.70	0.17	Pass
44.00	0.05	-0.70	0.70	0.17	Pass
45.00	0.01	-0.70	0.70	0.16	Pass
46.00	0.03	-0.70	0.70	0.16	Pass
47.00	0.01	-0.70	0.70	0.16	Pass
48.00	0.00	-0.70	0.70	0.16	Pass
49.00	0.00	-0.70	0.70	0.16	Pass
54.00	-0.02	-0.70	0.70	0.16	Pass
59.00	-0.05	-0.70	0.70	0.16	Pass
64.00	-0.03	-0.70	0.70	0.16	Pass
69.00	-0.04	-0.70	0.70	0.16	Pass
74.00	-0.05	-0.70	0.70	0.16	Pass
79.00	-0.04	-0.70	0.70	0.16	Pass
84.00	-0.04	-0.70	0.70	0.16	Pass
89.00	-0.04	-0.70	0.70	0.16	Pass
94.00	-0.04	-0.70	0.70	0.16	Pass
99.00	0.00	-0.70	0.70	0.15	Pass
104.00	0.01	-0.70	0.70	0.15	Pass
109.00	0.01	-0.70	0.70	0.15	Pass
114.00	0.00	-0.70	0.70	0.15	Pass
119.00	0.00	-0.70	0.70	0.15	Pass
124.00	0.01	-0.70	0.70	0.15	Pass
129.00	0.01	-0.70	0.70	0.15	Pass
134.00	0.01	-0.70	0.70	0.15	Pass
136.00	0.01	-0.70	0.70	0.15	Pass
137.00	0.01	-0.70	0.70	0.15	Pass
138.00	0.00	-0.70	0.70	0.15	Pass
139.00	0.00	-0.70	0.70	0.15	Pass

-- End of measurement results--

Peak Rise Time

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

Amplitude [dB]	Duration [μs]		Test Result [dB]	Lower limit [dB]	Upper limit [dB]	Expanded Uncertainty [dB]	Result
136.95	40	Negative Pulse	134.91	133.44	135.44	0.15	Pass
		Positive Pulse	134.90	133.43	135.43	0.15	Pass
	30	Negative Pulse	133.96	133.44	135.44	0.15	Pass
		Positive Pulse	133.95	133.43	135.43	0.15	Pass
		-- End of measurement results--					

Positive Pulse Crest Factor**200 μs pulse tests at 2.0, 12.0, 22.0, 32.0 dB below Overload Limit**

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

Amplitude [dB]	Crest Factor		Test Result [dB]	Limits [dB]	Expanded Uncertainty [dB]	Result
135.95	3		OVLD	± 1.00	0.15 ‡	Pass
	5		OVLD	± 1.00	0.15 ‡	Pass
125.95	3		-0.13	± 1.00	0.15 ‡	Pass
	5		-0.12	± 1.00	0.16 ‡	Pass
115.95	3		-0.13	± 1.00	0.15 ‡	Pass
	5		-0.11	± 1.00	0.15 ‡	Pass
105.95	3		-0.13	± 1.00	0.15 ‡	Pass
	5		-0.11	± 1.00	0.15 ‡	Pass
-- End of measurement results--						

Negative Pulse Crest Factor**200 μs pulse tests at 2.0, 12.0, 22.0, 32.0 dB below Overload Limit**

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

Amplitude [dB]	Crest Factor		Test Result [dB]	Limits [dB]	Expanded Uncertainty [dB]	Result
135.95	3		OVLD	± 1.00	0.15 ‡	Pass
	5		OVLD	± 1.00	0.15 ‡	Pass
125.95	3		-0.12	± 1.00	0.15 ‡	Pass
	5		-0.11	± 1.00	0.15 ‡	Pass
115.95	3		-0.13	± 1.00	0.15 ‡	Pass
	5		-0.12	± 1.00	0.15 ‡	Pass
105.95	3		-0.12	± 1.00	0.15 ‡	Pass
	5		-0.13	± 1.00	0.15 ‡	Pass
-- End of measurement results--						

Gain

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

Measurement	Test Result [dB]	Lower limit [dB]	Upper limit [dB]	Expanded Uncertainty [dB]	Result
0 dB Gain	93.96	93.90	94.10	0.15	Pass
0 dB Gain, Linearity	40.25	39.40	40.80	0.16	Pass
OBA Low Range	94.00	93.90	94.10	0.15	Pass
OBA Normal Range	94.00	93.20	94.80	0.15	Pass
-- End of measurement results--					

Certificate Number 2021000495

Broadband Noise Floor

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

Measurement	Test Result [dB]	Upper limit [dB]	Result
A-weight Noise Floor	26.97	36.00	Pass
C-weight Noise Floor	26.77	35.00	Pass
Z-weight Noise Floor	32.96	39.00	Pass

-- End of measurement results--

Total Harmonic Distortion

Measured using 1/3-Octave filters

Measurement	Test Result [dB]	Lower Limit [dB]	Upper Limit [dB]	Expanded Uncertainty [dB]	Result
10 Hz Signal	135.46	134.15	135.75	0.15	Pass
THD	-63.97		-58.00	0.01 ‡	Pass
THD+N	-60.84		-58.00	0.01 ‡	Pass

-- End of measurement results--

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D0001.8407 Rev E

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1/3-Octave Self-Generated Noise



The SLM is set to low range.

Frequency [Hz]	Test Result [dB]	Upper limit [dB]	Result
6.30	20.44	24.60	Pass
8.00	19.59	24.00	Pass
10.00	18.63	23.50	Pass
12.50	17.52	23.00	Pass
16.00	15.93	22.90	Pass
20.00	15.53	22.40	Pass
25.00	14.27	22.30	Pass
31.50	13.26	21.50	Pass
40.00	12.60	20.20	Pass
50.00	11.67	18.80	Pass
63.00	10.68	17.60	Pass
80.00	9.97	16.60	Pass
100.00	9.19	15.90	Pass
125.00	8.50	15.70	Pass
160.00	8.26	15.50	Pass
200.00	7.87	15.20	Pass
250.00	7.69	15.20	Pass
315.00	7.68	15.20	Pass
400.00	8.01	15.70	Pass
500.00	8.30	16.00	Pass
630.00	8.81	16.60	Pass
800.00	9.40	17.30	Pass
1,000.00	10.16	18.10	Pass
1,250.00	11.00	18.90	Pass
1,600.00	11.80	19.80	Pass
2,000.00	12.71	20.80	Pass
2,500.00	13.57	21.70	Pass
3,150.00	14.57	22.60	Pass
4,000.00	15.54	23.50	Pass
5,000.00	16.48	24.50	Pass
6,300.00	17.43	25.50	Pass
8,000.00	18.43	26.50	Pass
10,000.00	19.46	27.40	Pass
12,500.00	20.43	28.50	Pass
16,000.00	21.40	29.50	Pass
20,000.00	22.41	30.40	Pass

-- End of measurement results--

Certificate Number 2021000495

-- End of Report--

Signatory: Ron Harris

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D0001.8407 Rev E

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ใบสอบเทียบเครื่องมือวิเคราะห์

เครื่องมือตรวจวัดคุณภาพสิ่งแวดล้อม (ภาคสนาม)

การตรวจวัดสภาพแวดล้อมในสถานประกอบการ

SITHIPHORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

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



Cert. No. : ACL21039

Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24
Serial No.: 00709670 / 188531 / 01221
ID No.: -

Condition As Found : GOOD

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


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

Received Date : 14 JANUARY 2021
Calibration Date : 18-20 JANUARY 2021
Date of Issue : 25 JANUARY 2021

Calibrated by :

Nathakorn Pisutpaisan

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.

Continuation of Calibration Certificate

Cert. No. : ACL21039
Job No. : VC64AC0036
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

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

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

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

Condition of this result of calibration :

1. Reference Standard Instruments :

<u>Instrument</u>	<u>Model</u>	<u>Serial No.</u>	<u>Cert. No.</u>	<u>Due Date</u>
Waveform Generator	33210A	MY48017076	EF-0009-20	03-Feb-21
Waveform Generator	33511B	MY52302742	EF-0008-20	03-Feb-21
Digital Multimeter	33461A	MY53220104	EEL.BP. 199/0163	05-Feb-21
Digital Multimeter	33461A	MY53220076	EEL.BP. 200/0163	02-Feb-21
Digital Multimeter	33461A	MY53220116	EEL.BP. 201/0163	06-Feb-21
Programmable Attenuator	MAT-1070	00119	EF-0010-20	04-Feb-21
Condenser Microphone	4180	2977900	AA-1007-20	04-Feb-21
Measuring Amplifier	NA-42KAI	34560495	AA-3005-20	06-Feb-21

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

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

3.1 National Institute of Metrology (Thailand).

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

Continuation of Calibration Certificate

Cert. No. : ACL21039

Job No. : VC64AC0036

Pages : 3 of 8

Summary of Measurement Result :

Parameter	Pass	Fail	Uncertainty (dB)	Maximum-permitted uncertainty of measurement (dB)
1. Absolute sensitivity	✓	-	0.3	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	✓	-	0.1	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	✓	-	0.1	0.3
10. Peak C sound level	✓	-	0.1	0.35
11. Overload indication	✓	-	0.1	0.25
12. High level stability	✓	-	0.1	0.1

Continuation of Calibration Certificate

Cert. No. : ACL21039

Job No. : VC64AC0036

Pages : 4 of 8

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

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limit (dB)
93.9 (93.97)	93.9	0.0	±0.3

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
14.6

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

Frequency Weighting	Measured value (dB)
A - weight	10.8
C - weight	16.9
Flat	22.6

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.1	0.1	0.1	± 1.5
1000	0.0	0.0	0.0	± 1.0
8000	0.5	0.6	0.6	±5.0

Continuation of Calibration Certificate

Cert. No. : ACL21039

Job No. : VC64AC0036

Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

Continuation of Calibration Certificate

Cert. No. : ACL21039

Job No. : VC64AC0036

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	134.1	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	30.0	0.0	± 1.1
29.0	29.0	0.0	± 1.1
28.0	28.0	0.0	± 1.1
27.0	27.0	0.0	± 1.1
26.0	26.0	0.0	± 1.1
25.0	25.0	0.0	± 1.1

Continuation of Calibration Certificate

Cert. No. : ACL21039

Job No. : VC64AC0036

Pages : 7 of 8

8. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Auto	94.0	94.0	0.0	±0.5

9. Tone burst response

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

10. Peak C sound level

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

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

Continuation of Calibration Certificate

Cert. No. : ACL21039

Job No. : VC64AC0036

Pages : 8 of 8

11. Overload indication

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

12. High level stability

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

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

End of Calibration Certificate

SITHIPHORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

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



Cert. No. : ACL21040

Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24
Serial No.: 00709682 / 187256 / 01233
ID No.: -

Condition As Found : GOOD

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

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

Received Date : 14 JANUARY 2021
Calibration Date : 18-20 JANUARY 2021
Date of Issue : 25 JANUARY 2021

Calibrated by :

Nathakorn Pisutpaisan

Approved by :


(Thanakul Petchurai)

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Continuation of Calibration Certificate

Cert. No. : ACL21040
Job No. : VC64AC0036
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

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

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

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

Condition of this result of calibration :

1. Reference Standard Instruments :

<u>Instrument</u>	<u>Model</u>	<u>Serial No.</u>	<u>Cert. No.</u>	<u>Due Date</u>
Waveform Generator	33210A	MY48017076	EF-0009-20	03-Feb-21
Waveform Generator	33511B	MY52302742	EF-0008-20	03-Feb-21
Digital Multimeter	33461A	MY53220104	EEL.BP. 199/0163	05-Feb-21
Digital Multimeter	33461A	MY53220076	EEL.BP. 200/0163	02-Feb-21
Digital Multimeter	33461A	MY53220116	EEL.BP. 201/0163	06-Feb-21
Programmable Attenuator	MAT-1070	00119	EF-0010-20	04-Feb-21
Condenser Microphone	4180	2977900	AA-1007-20	04-Feb-21
Measuring Amplifier	NA-42KAI	34560495	AA-3005-20	06-Feb-21

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

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

3.1 National Institute of Metrology (Thailand).

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

Continuation of Calibration Certificate

Cert. No. : ACL21040

Job No. : VC64AC0036

Pages : 3 of 8

Summary of Measurement Result :

Parameter	Pass	Fail	Uncertainty (dB)	Maximum-permitted uncertainty of measurement (dB)
1. Absolute sensitivity	✓	-	0.3	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	✓	-	0.1	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	✓	-	0.1	0.3
10. Peak C sound level	✓	-	0.1	0.35
11. Overload indication	✓	-	0.1	0.25
12. High level stability	✓	-	0.1	0.1

Continuation of Calibration Certificate

Cert. No. : ACL21040

Job No. : VC64AC0036

Pages : 4 of 8

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

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limit (dB)
93.9 (93.97)	93.9	0.0	±0.3

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
14.2

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

Frequency Weighting	Measured value (dB)
A - weight	9.9
C - weight	16.5
Flat	22.3

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	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	0.8	0.9	0.9	±5.0

Continuation of Calibration Certificate

Cert. No. : ACL21040

Job No. : VC64AC0036

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	0.0	0.0	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.1	0.0	±2.0
4000	0.0	0.0	0.0	±3.0
8000	0.0	0.1	0.1	±5.0

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

Frequency Weighting	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

Continuation of Calibration Certificate

Cert. No. : ACL21040
Job No. : VC64AC0036
Pages : 6 of 8

7. Level linearity on the reference level range

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

Continuation of Calibration Certificate

Cert. No. : ACL21040

Job No. : VC64AC0036

Pages : 7 of 8

8. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Auto	94.0	94.0	0.0	±0.5

9. Tone burst response

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

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, Lcpeak (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
One	136.4	135.9	-0.5	±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

Continuation of Calibration Certificate

Cert. No. : ACL21040

Job No. : VC64AC0036

Pages : 8 of 8

11. Overload indication

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

12. High level stability

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

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

End of Calibration Certificate

SITHIPHORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

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



Cert. No. : ACL21033

Pages : 1 of 8

Calibration Certificate

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

Condition As Found : GOOD

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

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

Received Date : 14 JANUARY 2021
Calibration Date : 18-20 JANUARY 2021
Date of Issue : 25 JANUARY 2021

Calibrated by :

Nathakorn Pisutpaisan

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.

Continuation of Calibration Certificate

Cert. No. : ACL21033

Job No. : VC64AC0036

Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

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

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

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

Condition of this result of calibration :

1. Reference Standard Instruments :

<u>Instrument</u>	<u>Model</u>	<u>Serial No.</u>	<u>Cert. No.</u>	<u>Due Date</u>
Waveform Generator	33210A	MY48017076	EF-0009-20	03-Feb-21
Waveform Generator	33511B	MY52302742	EF-0008-20	03-Feb-21
Digital Multimeter	33461A	MY53220104	EEL.BP. 199/0163	05-Feb-21
Digital Multimeter	33461A	MY53220076	EEL.BP. 200/0163	02-Feb-21
Digital Multimeter	33461A	MY53220116	EEL.BP. 201/0163	06-Feb-21
Programmable Attenuator	MAT-1070	00119	EF-0010-20	04-Feb-21
Condenser Microphone	4180	2977900	AA-1007-20	04-Feb-21
Measuring Amplifier	NA-42KAI	34560495	AA-3005-20	06-Feb-21

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

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

3.1 National Institute of Metrology (Thailand).

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

Continuation of Calibration Certificate

Cert. No. : ACL21033

Job No. : VC64AC0036

Pages : 3 of 8

Summary of Measurement Result :

Parameter	Pass	Fail	Uncertainty (dB)	Maximum-permitted uncertainty of measurement (dB)
1. Absolute sensitivity	✓	-	0.3	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	✓	-	0.1	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	✓	-	0.1	0.3
10. Peak C sound level	✓	-	0.1	0.35
11. Overload indication	✓	-	0.1	0.25
12. High level stability	✓	-	0.1	0.1

Continuation of Calibration Certificate

Cert. No. : ACL21033

Job No. : VC64AC0036

Pages : 4 of 8

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

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limit (dB)
93.9 (93.97)	93.9	0.0	±0.3

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
14.4

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

Frequency Weighting	Measured value (dB)
A - weight	9.9
C - weight	16.7
Flat	22.5

3. Acoustical signal tests of frequency weightings

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

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

Continuation of Calibration Certificate

Cert. No. : ACL21033

Job No. : VC64AC0036

Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

Frequency Weighting	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

Continuation of Calibration Certificate

Cert. No. : ACL21033
Job No. : VC64AC0036
Pages : 6 of 8

7. Level linearity on the reference level range

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

Continuation of Calibration Certificate

Cert. No. : ACL21033
Job No. : VC64AC0036
Pages : 7 of 8

8. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Auto	94.0	94.0	0.0	±0.5

9. Tone burst response

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

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, Lcpeak (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
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

Continuation of Calibration Certificate

Cert. No. : ACL21033

Job No. : VC64AC0036

Pages : 8 of 8

11. Overload indication

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

12. High level stability

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

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

End of Calibration Certificate

Certificate of Calibration

Customer

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

Certificate No : 21-AFM-052

Request No : Req-2021-522

Unit Under Calibration Details

Measurement Item : Mass flow meter
Manufacturer : TSI
Model : 4146
Serial Number : 41461922007
ID : UAE.EFM.223/2562
Location of Calibration : LAB 4 AIR VELOCITY METER

Calibration Environment and Details

Temperature : (23 \pm 3) °C
Humidity : (55 \pm 15) %RH
Barometric Pressure : (1010 \pm 10) hpa
Received Date : 27 April 2021
Calibration Date : 8 June 2021
Calibration Procedure : In-house method CP-AFM-01 by Comparison technique with Standard Primary Flow Calibrator

Reference Standard	Model	Serial Number	Traceble	Due Calibration
Air Flow Meter	Gilibrator 3 Standard flow	21151012015	Sensidyne	21 April 2022
Air Flow Meter	Gilibrator 3 High flow	18501012012	Sensidyne	21 April 2022

Traceability :

This certificate provides traceability of measurement to recognized national standard, and to the realization of the international System of Units (SI)

Note :

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

Calibration By : me
Mr. Noppadon Luangart
Service Calibration Engineer

Approved By : ๗๓๕๗
Mr. Pacit Mathavorn
Calibration Engineer Supervisor

Issue Date : 8 June 2021

Certificate No : 21-AFM-052

Request No : Req-2021-522

Result of Calibration :

Flow Setting	STD Flow Reading	UUC Flow Reading	Correction Flow	Uncertainty
LPM	LPM	LPM	LPM	LPM
0.02	0.02005	0.019	0.00105	0.00065
0.05	0.05006	0.047	0.00306	0.00092
0.1	0.1013	0.098	0.0033	0.0019
0.2	0.2006	0.198	0.0026	0.0031
0.5	0.5005	0.503	-0.0025	0.008
1.0	1.002	0.998	0.004	0.015
1.7	1.702	1.692	0.010	0.025
2.0	2.003	1.991	0.012	0.029

Note

STD : Standard

UUC : Unit Under Calibration

End of Certificate

เอกสารไม่ควบคุม

Certificate of Calibration

Customer

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

Certificate No : 21-AFM-073

Request No : Req-2021-0791

Unit Under Calibration Details

Measurement Item : Air flow meter
Manufacturer : TSI
Model : 4146
Serial Number : 41461813030
ID : UAE.EFM.102/2561
Location of Calibration : LAB 4 AIR VELOCITY METER

Calibration Environment and Details

Temperature : 23 °C ± 3 °C
Humidity : 55 %RH ± 20 %RH
Barometric Pressure : 1013 hPa ± 10 hPa
Received Date : 22 June 2021
Calibration Date : 23 July 2021
Calibration Procedure : In-house method CP-AFM-01 by Comparison technique with Standard Primary Flow Calibrator


Reference Standard	Model	Serial Number	Traceble	Due Calibration
Air Flow Meter	Gilibrator 3 Low flow	18501010006	Sensidyne	21 May 2022
Air Flow Meter	Gilibrator 3 Standard flow	19031011003	Sensidyne	20 May 2022


Traceability :

This certificate provides traceability of measurement to recognized national standard, and to the realization of the international System of Units (SI)

Note :

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

Calibration By : 
Mr. Noppadon Luangart
Service Calibration Engineer

Approved By : 
Mr. Pacit Mathavorn
Calibration Engineer Supervisor

Issue Date : 23 July 2021

Certificate No : 21-AFM-073

Request No : Req-2021-0791

Result of Calibration :

Flow Setting	STD Flow Reading	UUC Flow Reading	Correction Flow	Uncertainty
LPM	LPM	LPM	LPM	LPM
0.02	0.01919	0.022	-0.00307	0.00086
0.05	0.05084	0.053	-0.00216	0.00093
0.10	0.1047	0.102	0.0027	0.0019
0.20	0.2013	0.197	0.0043	0.0036
0.5	0.5020	0.493	0.0095	0.0073
1.0	1.008	1.002	0.006	0.017
1.7	1.699	1.679	0.020	0.024
2.0	2.006	1.999	0.007	0.031

Note

STD : Standard

UUC : Unit Under Calibration

* Indicates non accredited

End of Certificate



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



Certificate of Calibration

Certificate No. : 21P1156

Page : 1 of 2

Equipment : Aneroid Barometer
Manufacturer: Barigo
Model : 111MS
Serial No.: -
ID No.: UAE.EMA2.065/2552

Condition As-Received: Used Item
Received Date: 29 March 2021
Calibration Date: 31 March 2021

Reference: 2103-1188WSC
Ambient Temperature: (23 ± 2) °C
Relative Humidity: (50 ± 15) %
Atmospheric Pressure: 1007 mbar

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

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

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

Condition of this result of calibration

1.Reference standards instruments :

<u>Instrument</u>	<u>Model</u>	<u>Serial No.</u>	<u>Certificate No.</u>	<u>Due Date</u>
1) Standard Barometer	DPI142	1422505046	MP-0053-20	05 Apr 2021

2.This instrument was installed in vertical orientation and center of the dial was used as the reference level.

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

4.Scale and conversion factor is 1 kPa = 7.50062 mmHg

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

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

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

-National Institute of Metrology Thailand (NIMT)

Calibrated by : Suksan Khankaew
Issue Date : 31 March 2021

Approved Signatory : Attapol P.
[] Phalinee Prabpaipal
[] Sura Suwannasri
[x] Attapol Panurach

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B 0256510



Cert.No.: 21P1156

Page: 2 of 2

Result of calibration:- Without adjustment

Range : 720 mmHg to 770 mmHg

Function:- Absolute Pressure Measurement

Scale Interval : 1 mmHg(The Fifth Estimate)

Increasing Pressure

Applied Pressure (mmHg)	714.29	725.74	737.41	748.82	761.02	773.03
UUC* Indication (mmHg)	720.0	730.0	740.0	750.0	760.0	770.0
Error (mmHg)	5.71	4.26	2.59	1.18	-1.02	-3.03

Decreasing Pressure

Applied Pressure (mmHg)	772.94	760.65	748.21	737.18	725.53	714.45
UUC* Indication (mmHg)	770.0	760.0	750.0	740.0	730.0	720.0
Error (mmHg)	-2.94	-0.65	1.79	2.82	4.47	5.55

The uncertainty of measurement was ± 0.24 mmHg

* UUC = Unit Under Calibration

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

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Attapol P.

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



Certificate of Calibration

Certificate No. : 21H804

Page : 1 of 2

Equipment : Dial Thermo-Hygrometer

Manufacturer: Barigo

Model : -

Serial No.: -

ID No.: UAE.ANV.129/2550

Condition As-Received: Used Item

Received Date: 29 March 2021

Calibration Date: 31 March 2021
to 08 April 2021

Reference: 2103-1189WSC

Ambient Temperature: (25 ± 3) °C

Relative Humidity: (50 ± 20) %

This certificate may not be reproduced other than in full,
except with the prior written approval of the head of
Corporate Services 3: Equipment Calibration and Testing Services.

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

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

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

Condition of this result of calibration

1.Reference standards instruments :

<u>Instrument</u>	<u>Model</u>	<u>Serial No.</u>	<u>Certificate No.</u>	<u>Due Date</u>
1) Standard Chilled Mirror Hygrometer Sensor	Dew Prime II	31863	18540	28 Jul 2021
2) Handheld Thermometer With Sensor	1521	A5A339	201968	10 Aug 2021

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

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

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

Calibrated by : Kraipop Onrat
Issue Date : 20 April 2021

Approved Signatory :

- [✓] Chakrit Waewanjua
[] Pornthippa Tameyakul
[] Pitak Srimongkol

เอกสารไม่ควบคุม

B 0258331



Cert. No.: 21H804

Page.: 2 of 2

Result of Calibration:-

Without Adjustment

Function:

Humidity measurement.

<u>Reference</u> <u>Temperature</u> (°C)	<u>Standard</u> <u>Humidity</u> (%R.H.)	<u>UUC*</u> <u>Reading</u> (%R.H.)	<u>Error</u> (%R.H.)	<u>Uncertainty</u> <u>of Measurement</u> (±%R.H.)
25.0	40.1	42	1.9	1.6
25.0	60.0	60	0.0	1.8
25.0	80.0	76	-4.0	1.9

Result of Calibration:-

Without Adjustment

Function:

Temperature measurement.

<u>Standard</u> <u>Temperature</u> (°C)	<u>UUC*</u> <u>Reading</u> (°C)	<u>Error</u> (°C)	<u>Uncertainty</u> <u>of Measurement</u> (±°C)
20.011	20.0	-0.011	0.72
30.019	30.0	-0.019	0.72
34.989	34.5	-0.489	0.72
40.006	39.0	-1.006	0.72

UUC* : Unit Under Calibration

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

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Certificate of Calibration

Customer

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

Certificate No : 21-TPM-304

Request No : Req-2021-1403

Page : 1/2

Unit Under Calibration Details

Calibration Parameter	: Temperature	Range Calibration	: 20 °C to 60 °C
Instrument Name	: Thermal Environment Monitor	Type of Sensor	: RTD
Manufacturer	: 3M	Sensor Diameter (mm)	: 4.5
Model	: QT-32	Calibration Position (mm)	: 67.5
Serial Number	: TPS030004	Instrument Status	: Used
Resolution	: 0.1 °C		
ID Number	: -		

Calibration Environment and Details

Temperature : 23 °C ± 3 °C
Humidity : 55 %RH ± 15 %RH
Received Date : 29 October 2021
Calibrated Date : 9 November 2021
Calibration Procedure : In-house method CP-TPM-01 by Comparison with Standard Thermometer.

Reference Standard : Digital Thermometer with Sensor, Manufacturer: GINGO/GINGO, Model: GT11/ RTD100, SN: 12000077, ID: AR-TPM Which was calibrated on 30 March 2021, Calibration Certificate No. : QR21-0719

Traceability : This Certificate is traceable to SI Unit through Quality Reborn Co., Ltd., NSC-ONSC Accreditation No.: Calibration 0292

Note

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

Approved By :



Mr. Pacit Mathavorn

Calibration Engineer Supervisor

Issue Date :

11 November 2021

Calibration Note

UUC Adjustment : Not Adjust

Certificate No : 21-TPM-304

Request No : Req-2021-1403

Page : 2/2

Result of Calibration :

UUC Sensor	Standard Temperature (°C)	UUC Reading (°C)	Correction (°C)	Uncertainty (± °C)
WET	20.003	20.1	- 0.1	0.14
	25.003	25.1	- 0.1	0.14
	30.005	30.1	- 0.1	0.14
	35.004	35.1	- 0.1	0.14
	40.007	40.1	- 0.1	0.14
	45.005	45.1	- 0.1	0.14
	50.006	50.1	- 0.1	0.14
	60.005	60.1	- 0.1	0.14
DRY	20.006	20.1	- 0.1	0.14
	25.004	25.1	- 0.1	0.14
	30.003	30.1	- 0.1	0.14
	35.004	35.1	- 0.1	0.14
	40.005	40.1	- 0.1	0.14
	45.005	45.1	- 0.1	0.14
	50.006	50.1	- 0.1	0.14
	60.007	60.1	- 0.1	0.14
GLOBE	20.004	20.1	- 0.1	0.14
	25.007	25.1	- 0.1	0.14
	30.007	30.1	- 0.1	0.14
	35.005	35.1	- 0.1	0.14
	40.006	40.1	- 0.1	0.14
	45.007	45.1	- 0.1	0.14
	50.004	50.1	- 0.1	0.14
	60.003	60.1	- 0.1	0.14

End of Certificate

Calibrated By :



Mr. Sittichok Jirapukdeesakun

Certificate of Calibration

Customer

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

Certificate No : 21-TPM-303

Request No : Req-2021-1405

Page : 1/2

Unit Under Calibration Details

Calibration Parameter	: Temperature	Range Calibration	: 20 °C to 60 °C
Instrument Name	: Thermal Environment Monitor	Type of Sensor	: RTD
Manufacturer	: 3M	Sensor Diameter (mm)	: 4.5
Model	: QT-32	Calibration Position (mm)	: 67.5
Serial Number	: TPS030006	Intrument Status	: Used
Resolution	: 0.1 °C		
ID Number	: -		

Calibration Environment and Details

Temperature : 23 °C ± 3 °C
Humidity : 55 %RH ± 15 %RH
Received Date : 29 October 2021
Calibrated Date : 9 November 2021
Calibration Procedure : In-house method CP-TPM-01 by Comparison with Standard Thermometer.

Reference Standard : Digital Thermometer with Sensor, Manufacturer: GINGO/GINGO, Model: GT11/ RTD100, SN: 12000077, ID: AR-TPM
Which was calibrated on 30 March 2021, Calibration Certificate No. : QR21-0719

Traceability : This Certificate is traceable to SI Unit through Quality Reborn Co., Ltd., NSC-ONSC Accreditation No.: Calibration 0292

Note

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

Approved By :



Mr. Pacit Mathavorn

Calibration Engineer Supervisor

Issue Date :

11 November 2021

Calibration Note

UUC Adjustment : Not Adjust

Certificate No : 21-TPM-303

Request No : Req-2021-1405

Page : 2/2

Result of Calibration :

UUC Sensor	Standard Temperature (°C)	UUC Reading (°C)	Correction (°C)	Uncertainty (± °C)
WET	20.003	20.1	- 0.1	0.14
	25.004	25.1	- 0.1	0.14
	30.003	30.1	- 0.1	0.14
	35.003	35.1	- 0.1	0.14
	40.007	40.1	- 0.1	0.14
	45.005	45.1	- 0.1	0.14
	50.007	50.2	- 0.2	0.14
	60.007	60.2	- 0.2	0.14
DRY	20.007	20.2	- 0.2	0.14
	25.004	25.2	- 0.2	0.14
	30.007	30.2	- 0.2	0.14
	35.004	35.2	- 0.2	0.14
	40.007	40.2	- 0.2	0.14
	45.005	45.2	- 0.2	0.14
	50.005	50.2	- 0.2	0.14
	60.008	60.2	- 0.2	0.14
GLOBE	20.005	20.2	- 0.2	0.14
	25.006	25.2	- 0.2	0.14
	30.007	30.2	- 0.2	0.14
	35.006	35.2	- 0.2	0.14
	40.005	40.2	- 0.2	0.14
	45.004	45.2	- 0.2	0.14
	50.005	50.2	- 0.2	0.14
	60.005	60.2	- 0.2	0.14

End of Certificate

Calibrated By :



Mr. Sittichok Jirapukdeesakun

Certificate of Calibration

Customer

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

Certificate No : 21-LXM-029

Request No : Req-2021-0541

Page : 1/2

Unit Under Calibration Details

Instrument Name : Lux Meter
Manufacturer : EXTECH
Model : 407026
Serial Number : A052262
Resolution : 1 lx
ID Number : -

Range Calibration : 2000 , 20000 lx

Intrument Status : New

Calibration Environment and Details

Temperature : 25 °C ± 2 °C
Humidity : 50 %RH ± 20 %RH
Received Date : 10 May 2021
Calibrated Date : 11 May 2021

Calibration Procedure : The measurement was done in accordance with CP-LXM-01

Reference Standard : Photometer and Illuminance Sensor, Serial No.: 30662/2, 30592/2, which was calibrated on 20 October 2020,
Certificate No.: TP-1033-20

Traceability : This Certificate is traceable to International System of Unit (SI) Unit through National Institute of
Metrology (Thailand)

Note

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

Approved By :



Mr. Pacit Mathavorn

Calibration Engineer Supervisor

Issue Date :

11 May 2021

Calibration Note

UUC Adjustment : Zero adjustment before use

Certificate No : 21-LXM-029

Request No : Req-2021-0541

Page : 2/2

Result of Calibration :

UUC Range (lx)	Calibration Point	Standard (lx)	UUC Reading (lx)	Correction (lx)	Uncertainty (\pm lx)
2000	0	0	0	0	0.58
	50	50	50	0	1.8 % of Reading
	100	100	101	-1	
	200	201	202	-1	
	300	300	302	-2	
	400	401	403	-2	
	600	600	607	-7	
	800	801	808	-7	
	1000	1001	1009	-8	
	1200	1201	1213	-12	
	1400	1400	1413	-13	
	1600	1601	1616	-15	
	1800	1801	1817	-16	
	2000	2000	1977	23	
20000	3000	3000	2974	26	
	4000	3999	3971	28	
	5000	5000	4967	33	

End of Certificate

Calibrated By :

me

Mr. Noppadon Luangart

Certificate of Calibration

Customer

Name : UNITED ANALYST AND ENGINEERING

Certificate No : 21-ACT-188

CONSULTANT CO.,LTD.

Request No : Req-2021-0523

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

Unit Under Calibration Details

Measurement item : Acoustic Calibrator

Class : 1

Manufacturer : SVANTEK

Range : 94, 114 dB / 1000 Hz

Model : SV 35

Instrument Status : Used

Serial Number : 44792

ID : UAE.EFM.020/2559

Calibration Environment and Details

Temperature : (23 ±2 °C)

Humidity : (50 ± 20 %RH)

Barometric Pressure : (1013 ±10.0 hPa)

Received Date : 27 April 2021

Calibration Date : 28 May 2021

Location of Calibration : LAB 1 Acoustic

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

Reference Standard	Model	Serial Number	Traceable	Due Calibration
Sound Calibrator	SV 35A	58079	EEI	14 May 2022
THD Multimeter	2015	1047765	NIMT	22 January 2022

Traceability : This certificate provides traceability of measurement to recognized national standard, and to the realization of the international System of Units (SI).

Note

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

Calibrated By :

me

Mr. Noppadon Luangart
Service Calibration Engineer

Approved By :

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Mr. Pacit Mathavorn
Calibration Engineer Supervisor

Issue Date : 28 May 2021

Certificate No : 21-ACT-188

Request No : Req-2021-0523

Sound pressure level

Calibration Results : Without Adjustment

Calibration Range (dB)	Without Adjustment (dB)		Adjustment (dB)		Uncertainty (± dB)	Acceptance limit Class 1 (± dB)
	Measured	Error	Measured	Error		
94 dB / 1000 Hz	93.98	-0.02	-	-	0.11	0.25
114 dB / 1000 Hz	114.03	0.03	-	-	0.11	0.25

Frequency of Sound pressure level

Calibration Range (Hz)	Without Adjustment		Adjustment		Uncertainty (± %)	Acceptance limit Class 1 (± %)
	Measured (Hz)	Error (%)	Measured (Hz)	Error (%)		
94 dB / 1000 Hz	1000.00	0.00	-	-	0.02	0.70
114 dB / 1000 Hz	1000.00	0.00	-	-	0.02	0.70

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

Calibration Range (Hz)	Without Adjustment	Adjustment	Uncertainty (± %)	Acceptance limit Class 1 (± %)
	Measured (%)	Measured (%)		
94 dB / 1000 Hz	0.04	-	0.17	2.5
114 dB / 1000 Hz	0.02	-	0.17	2.5

Note :

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

End of Calibration

Certificate of Calibration

Customer

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

Certificate No : 21-ACT-393

Request No : Req-2021-1297

Unit Under Calibration Details

Measurement item :	Noise dosimeter	Microphone Class :	2
Manufacturer :	3M	Microphone Model :	-
Model :	NP-DL	Microphone S/N :	-
Serial Number :	NLE030011	Preamplifier Model :	-
ID :	UAE.ANV.014/2549	Preamplifier S/N :	-
Resolution :	0.1 dB	Instrument Status :	Used

Calibration Environment and Details


Temperature : 23 °C ± 2 °C
Humidity : 50 %RH ± 20 %RH
Barometric Pressure : 1013 hPa ± 10 hPa
Received Date : 1 October 2021
Calibrated Date : 22 October 2021
Calibration Procedure : In-house method CP-NDM-01 based on IEC 61252 : 2017
Location of Calibration : Lab Acoustic


Reference Standard

Instrument	Brand	Model	SN.	Due calibration	Traceability
Multifrequency Calibrator	Quest	Quest-cal	188272	14 June 2022	TSI
Standard Microphone	GRAS	40AN	188273	29 October 2021	GRAS
Sine Generator	Svantek	Svan401	131	18 October 2022	WK Electric
Timer	EXTECH	-	05-ACT	29 March 2022	TPA

Note

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

Calibrated By : 
Mr. Noppadon Luangart
Calibration Officer

Approved By : 
Mr. Pacit Mathavorn
Calibration Engineer Supervisor
Issue Date : 22 October 2021

Certificate No : 21-ACT-393

Request No : Req-2021-1297

1. Absolute acoustical sensitivity

UUC Setting	Time		Exposure Measurement			UNCERTAINTY	Tolerances Limit
FAST / A / 70-140	Ref	UUC	Ref	UUC	Error		
Calibrator Setting	(s)	(s)	(Pa ² h)	(Pa ² h)	(%)	(%)	(%)
1000 Hz 114 dB	120.00	120	3.63	3.55	-2.20	3.0	-21, +26

Note : Absolute sensitivity was established by the use of Sound Calibrator Brand 3M, Model AC-300, SN. AC-300001087

2. Frequency weightings

UUC Setting	Deviation from various Frequency Weighting		UNCERTAINTY	Tolerances Limit
FAST / 70-140	A	C	(± dB)	(± dB)
STD Setting	(dB)	(dB)		
*63 Hz	0.6	0.7	0.40	2.0
125 Hz	0.3	0.6	0.40	1.5
250 Hz	0.3	0.4	0.40	1.5
500 Hz	0.2	0.3	0.40	1.5
1000 Hz	0.0	0.0	0.40	-
2000 Hz	-0.4	-0.4	0.40	2.0
4000 Hz	-1.9	-1.9	0.40	3.0
8000 Hz	-3.3	-3.2	0.40	5.0

Certificate No : 21-ACT-393

Request No : Req-2021-1297

3. Linearity of response to steady signals

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

UUC Setting		FAST / A / High									
1000 Hz	Ref	(dB)	70.0	80.0	90.0	100.0	110.0	114.0	120.0	130.0	140.0
	Level A	(dB)	70.2	80.0	89.9	99.9	110.0	114.0	120.0	130.2	140.2
	Error	(dB)	0.2	0.0	-0.1	-0.1	0.0	0.0	0.0	0.2	0.2
8000 Hz	Ref	(dB)					88.9	98.9	108.9	112.9	118.9
	Level A	(dB)					89.0	99.0	108.9	112.9	118.9
	Error	(dB)					0.1	0.1	0.0	0.0	0.0
63 Hz	Ref	(dB)						87.8	93.8	103.8	113.8
	Level A	(dB)						87.8	93.7	103.7	113.8
	Error	(dB)						0.0	-0.1	-0.1	0.0
Tolerances Limit		(±dB)	1.0								
UNCERTAINTY		(±dB)	0.27								

b. Sound exposure meter linearity of error

UUC Setting	Time		Exposure Measurement			UNCERTAINTY	Tolerances
FAST / A / 70-140	Ref	UUC	Ref	UUC	Error		Limit
Calibrator Setting	(s)	(s)	(Pa ² h)	(Pa ² h)	(%)	(%)	(%)
1000 Hz 110 dB	27	27	0.30	0.30	0.00	4.3	-21, +26
1000 Hz 110 dB	45	45	0.50	0.50	0.00		
1000 Hz 110 dB	90	90	1.00	0.99	-1.00		
1000 Hz 110 dB	180	180	2.00	1.99	-0.50		
1000 Hz 120 dB	36	36	4.00	4.03	+0.75		
1000 Hz 120 dB	72	72	8.00	8.06	+0.75	3.8	
1000 Hz 120 dB	90	90	10.00	10.07	+0.70		
1000 Hz 120 dB	180	180	20.00	20.15	+0.75		
1000 Hz 120 dB	360	360	40.00	40.29	+0.72		
1000 Hz 120 dB	720	720	80.00	80.59	+0.74		

Request No : Req-2021-1297

Certificate of Calibration

Customer

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

Certificate No : 21-ACT-341
Request No : Req-2021-1173

Unit Under Calibration Details

Measurement item : Noise dosimeter
Manufacturer : 3M
Model : NP-DL
Serial Number : NLH030046
ID : UAE.ANV.215/2551
Resolution : 0.1 dB
Microphone Class : 2
Microphone Model : -
Microphone S/N : -
Preamplifier Model : -
Preamplifier S/N : -
Instrument Status : Used

Calibration Environment and Details


Temperature : 23 °C ± 2 °C
Humidity : 50 %RH ± 20 %RH
Barometric Pressure : 1013 hPa ± 10 hPa
Received Date : 30 August 2021
Calibrated Date : 2 September 2021
Calibration Procedure : In-house method CP-NDM-01 based on IEC 61252 : 2017
Location of Calibration : Lab Acoustic


Reference Standard

Instrument	Brand	Model	SN.	Due calibration	Traceability
Multifrequency Calibrator	Quest	Quest-cal	188272	14 June 2022	TSI
Standard Microphone	GRAS	40AN	188273	29 October 2021	GRAS
Sine Generator	Svantek	Svan401	131	30 September 2021	WK Electric
Timer	EXTECH	-	05-ACT	29 March 2022	TPA

Note

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

Calibrated By : 
Mr. Noppadon Luangart
Calibration Officer

Approved By : 
Mr. Pacit Mathavorn
Calibration Engineer Supervisor
Issue Date : 2 September 2021

Certificate No : 21-ACT-341

Request No : Req-2021-1173

1. Absolute acoustical sensitivity

UUC Setting	Time		Exposure Measurement			UNCERTAINTY	Tolerances Limit
	Ref	UUC	Ref	UUC	Error		
FAST / A / 70-140							
Calibrator Setting	(s)	(s)	(Pa ² h)	(Pa ² h)	(%)	(%)	(%)
1000 Hz 114 dB	120.00	120	3.63	3.65	+0.55	3.0	-21, +26

Note : Absolute sensitivity was established by the use of Sound Calibrator Brand 3M, Model AC-300, SN. AC-300001087

2. Frequency weightings

UUC Setting	Deviation from various Frequency Weighting		UNCERTAINTY	Tolerances Limit
	A	C		
FAST / 70-140				
STD Setting	(dB)	(dB)	(± dB)	(± dB)
*63 Hz	0.3	0.5	0.40	2.0
125 Hz	0.3	0.5	0.40	1.5
250 Hz	0.3	0.4	0.40	1.5
500 Hz	0.1	0.2	0.40	1.5
1000 Hz	0.0	0.0	0.40	-
2000 Hz	-0.3	-0.3	0.40	2.0
4000 Hz	-1.4	-1.4	0.40	3.0
8000 Hz	-2.9	-3.0	0.40	5.0

Certificate No : 21-ACT-341

Request No : Req-2021-1173

3. Linearity of response to steady signals

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

UUC Setting		FAST / A / High									
1000 Hz	Ref	(dB)	70.0	80.0	90.0	100.0	110.0	114.0	120.0	130.0	140.0
	Level A	(dB)	70.2	80.1	90.0	100.0	110.0	114.0	120.0	130.0	140.1
	Error	(dB)	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1
8000 Hz	Ref	(dB)			88.9	98.9	108.9	112.9	118.9	128.9	138.9
	Level A	(dB)			89.0	99.0	108.9	112.9	118.9	128.9	138.9
	Error	(dB)			0.1	0.1	0.0	0.0	0.0	0.0	0.0
63 Hz	Ref	(dB)						87.8	93.8	103.8	113.8
	Level A	(dB)						87.8	93.8	103.8	113.9
	Error	(dB)						0.0	0.0	0.0	0.1
Tolerances Limit		(±dB)	1.0								
UNCERTAINTY		(±dB)	0.27								

b. Sound exposure meter linearity of error

UUC Setting	Time		Exposure Measurement			UNCERTAINTY	Tolerances
FAST / A / 70-140	Ref	UUC	Ref	UUC	Error		Limit
Calibrator Setting	(s)	(s)	(Pa ² h)	(Pa ² h)	(%)		(%)
1000 Hz 110 dB	27	27	0.30	0.30	0.00	4.3	-21, +26
1000 Hz 110 dB	45	45	0.50	0.50	0.00		
1000 Hz 110 dB	90	90	1.00	0.99	-1.00		
1000 Hz 110 dB	180	180	2.00	1.99	-0.50		
1000 Hz 120 dB	36	36	4.00	3.99	-0.25		
1000 Hz 120 dB	72	72	8.00	7.99	-0.12	3.8	
1000 Hz 120 dB	90	90	10.00	9.99	-0.10		
1000 Hz 120 dB	180	180	20.00	19.97	-0.15		
1000 Hz 120 dB	360	360	40.00	39.94	-0.15		
1000 Hz 120 dB	720	720	80.00	79.92	-0.10		

Certificate No : 21-ACT-341

Request No : Req-2021-1173

4. Response to short duration

a. Response for sinusoidal signals - reference level

UUC Setting	Time		Exposure Measurement			UNCERTAINTY	Tolerances
FAST / A / 70-140	Ref	UUC	Ref	UUC	Error		
Calibrator Setting	(s)	(s)	(Pa ² h)	(Pa ² h)	(Pa ² h)	(Pa ² h)	Limit (Pa ² h)
4000 Hz 95 dB	2846	2846	1.00	1.00	0.00	0.01	-0.29 - 0.41

b. Sound exposure meter response for series of toneburst impulses

UUC Setting	Time		Exposure Measurement			UNCERTAINTY	Tolerances
FAST / A / 70-140	Ref	UUC	Ref	UUC	Error		
Calibrator Setting	(s)	(s)	(Pa ² h)	(Pa ² h)	(%)	(%)	Limit (%)
Burst 1 ms, 95 dB	2846	2846	1.00	1.00	0.00	3.0	-21 - +26
Burst 1 ms, 100 dB	900	900	1.00	1.00	0.00		-21 - +41
Burst 1 ms, 108 dB	143	143	1.00	1.00	0.00		-21 - +41

5. Response to unipolar pulse

UUC Setting	Time	Exposure Measurement		UNCERTAINTY	Tolerances
FAST / A / 70-140	UUC	UUC	Different		
Calibrator Setting	(s)	(Pa ² h)	(%)	(%)	Limit (%)
Continuous Rectangle +	6	10.36	+0.19	2.4	-21 - +26
Continuous Rectangle -		10.34			

End of Certificate

Certificate of Calibration

Customer

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

Certificate No : 21-ACT-270

Request No : Req-2021-0790

Unit Under Calibration Details

Measurement item :	Noise dosimeter	Microphone Class :	2
Manufacturer :	Quest Technologies	Microphone Model :	-
Model :	NP-DL	Microphone S/N :	-
Serial Number :	NLE030025	Preamplifier Model :	-
ID :	UAE.EMA2.020-2555	Preamplifier S/N :	-
Resolution :	0.1 dB	Instrument Status :	Used

Calibration Environment and Details


Temperature : 23 °C ± 2 °C
Humidity : 50 %RH ± 20 %RH
Barometric Pressure : 1013 hPa ± 10 hPa
Received Date : 22 June 2021
Calibrated Date : 23 July 2021
Calibration Procedure : In-house method CP-NDM-01 based on IEC 61252 : 2017
Location of Calibration : Lab Acoustic


Reference Standard

Instrument	Brand	Model	SN.	Due calibration	Traceability
Multifrequency Calibrator	Quest	Quest-cal	188272	14 June 2022	TSI
Standard Microphone	GRAS	40AN	188273	29 October 2021	GRAS
Sine Generator	Svantek	Svan401	131	30 September 2021	WK Electric
Timer	EXTECH	-	05-ACT	29 March 2022	TPA

Note

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

Calibrated By : 
Mr. Noppadon Luangart
Calibration Officer

Approved By : 
Mr. Pacit Mathavorn
Calibration Engineer Supervisor
Issue Date : 23 July 2021

Certificate No : 21-ACT-270

Request No : Req-2021-0790

1. Absolute acoustical sensitivity

UUC Setting	Time		Exposure Measurement			UNCERTAINTY	Tolerances Limit
FAST / A / 70-140	Ref	UUC	Ref	UUC	Error		
Calibrator Setting	(s)	(s)	(Pa ² h)	(Pa ² h)	(%)	(%)	(%)
1000 Hz 114 dB	120.00	120	3.63	3.65	+0.55	3.0	-21, +26

Note : Absolute sensitivity was established by the use of Sound Calibrator Brand 3M, Model AC-300, SN. AC-300001087

2. Frequency weightings

UUC Setting	Deviation from various Frequency Weighting		UNCERTAINTY	Tolerances Limit
FAST / 70-140	A	C	(± dB)	(± dB)
STD Setting	(dB)	(dB)		
*63 Hz	0.2	0.5	0.40	2.0
125 Hz	0.5	0.7	0.40	1.5
250 Hz	0.6	0.7	0.40	1.5
500 Hz	0.4	0.4	0.40	1.5
1000 Hz	0.0	0.0	0.40	-
2000 Hz	-1.2	-1.3	0.40	2.0
4000 Hz	-1.5	-1.7	0.40	3.0
8000 Hz	-1.8	-1.8	0.40	5.0

Certificate No : 21-ACT-270

Request No : Req-2021-0790

3. Linearity of response to steady signals

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

UUC Setting		FAST / A / High									
1000 Hz	Ref	(dB)	70.0	80.0	90.0	100.0	110.0	114.0	120.0	130.0	140.0
	Level A	(dB)	69.6	79.5	89.5	99.5	109.6	114.0	119.7	129.9	140.2
	Error	(dB)	-0.4	-0.5	-0.5	-0.5	-0.4	0.0	-0.3	-0.1	0.2
8000 Hz	Ref	(dB)					88.9	98.9	108.9	112.9	118.9
	Level A	(dB)					88.9	98.9	108.9	112.9	118.9
	Error	(dB)					0.0	0.0	0.0	0.0	0.1
63 Hz	Ref	(dB)						87.8	93.8	103.8	113.8
	Level A	(dB)						87.8	93.8	103.9	114.0
	Error	(dB)						0.0	0.0	0.1	0.2
Tolerances Limit		(±dB)	1.0								
UNCERTAINTY		(±dB)	0.27								

b. Sound exposure meter linearity of error

UUC Setting	Time		Exposure Measurement			UNCERTAINTY	Tolerances
FAST / A / 70-140	Ref	UUC	Ref	UUC	Error		Limit
Calibrator Setting	(s)	(s)	(Pa ² h)	(Pa ² h)	(%)	(%)	(%)
1000 Hz 110 dB	27	27	0.30	0.30	0.00	4.3	-21, +26
1000 Hz 110 dB	45	45	0.50	0.50	0.00		
1000 Hz 110 dB	90	90	1.00	1.00	0.00		
1000 Hz 110 dB	180	180	2.00	1.99	-0.50		
1000 Hz 120 dB	36	36	4.00	4.00	0.00		
1000 Hz 120 dB	72	72	8.00	8.00	0.00	3.8	
1000 Hz 120 dB	90	90	10.00	10.00	0.00		
1000 Hz 120 dB	180	180	20.00	19.99	-0.05		
1000 Hz 120 dB	360	360	40.00	39.99	-0.02		
1000 Hz 120 dB	720	720	80.00	79.98	-0.02		

Certificate No : 21-ACT-270

Request No : Req-2021-0790

4. Response to short duration

a. Response for sinusoidal signals - reference level

UUC Setting	Time		Exposure Measurement			UNCERTAINTY	Tolerances
FAST / A / 70-140	Ref	UUC	Ref	UUC	Error		
Calibrator Setting	(s)	(s)	(Pa ² h)	(Pa ² h)	(Pa ² h)	(Pa ² h)	Limit (Pa ² h)
4000 Hz 95 dB	2846	2846	1.00	0.97	-0.03	0.01	-0.29 - 0.41

b. Sound exposure meter response for series of toneburst impulses

UUC Setting	Time		Exposure Measurement			UNCERTAINTY	Tolerances
FAST / A / 70-140	Ref	UUC	Ref	UUC	Error		
Calibrator Setting	(s)	(s)	(Pa ² h)	(Pa ² h)	(%)	(%)	Limit (%)
Burst 1 ms, 95 dB	2846	2846	1.00	0.97	-3.00	3.0	-21 - +26
Burst 1 ms, 100 dB	900	900	1.00	0.97	-3.00		-21 - +41
Burst 1 ms, 108 dB	143	143	1.00	1.00	0.00		-21 - +41

5. Response to unipolar pulse

UUC Setting	Time	Exposure Measurement		UNCERTAINTY	Tolerances
FAST / A / 70-140	UUC	UUC	Different		
Calibrator Setting	(s)	(Pa ² h)	(%)	(%)	Limit (%)
Continuous Rectangle +	6	10.19	0.00	2.4	-21 - +26
Continuous Rectangle -		10.19			

End of Certificate

Certificate of Calibration

Customer

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

Certificate No : 21-ACT-361
Request No : Req-2021-1241

Unit Under Calibration Details

Measurement item :	Noise dosimeter	Microphone Class :	2
Manufacturer :	SVANTEK	Microphone Model :	SV 27IS
Model :	SV 104IS	Microphone S/N :	68647
Serial Number :	67627	Preamplifier Model :	-
ID :	UAE.EFM.106/2561	Preamplifier S/N :	-
Resolution :	0.1 dB	Intrument Status :	Used

Calibration Environment and Details

Temperature : 23 °C ± 2 °C
Humidity : 50 %RH ± 20 %RH
Barometric Pressure : 1013 hPa ± 10 hPa
Received Date : 10 September 2021
Calibrated Date : 20 September 2021
Calibration Procedure : In-house method CP-NDM-01 based on IEC 61252 : 2017
Location of Calibration : Lab Acoustic

Reference Standard

Instrument	Brand	Model	SN.	Due calibration	Traceability
Multifrequency Calibrator	Quest	Quest-cal	188272	14 June 2022	TSI
Standard Microphone	GRAS	40AN	188273	29 October 2021	GRAS
Sine Generator	Svantek	Svan401	131	30 September 2021	WK Electric
Timer	EXTECH	-	05-ACT	29 March 2022	TPA

Note

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

Calibrated By : me
Mr. Noppadon Luangart
Calibration Officer

Approved By : พ.ศ. ๒๕๖๓
Mr. Pacit Mathavorn
Calibration Engineer Supervisor
Issue Date : 20 September 2021

Certificate No : 21-ACT-361

Request No : Req-2021-1241

1. Absolute acoustical sensitivity

UUC Setting	Time		Exposure Measurement			UNCERTAINTY	Tolerances Limit
FAST / A / 60-140	Ref	UUC	Ref	UUC	Error		
Calibrator Setting	(s)	(s)	(Pa ² h)	(Pa ² h)	(%)	(%)	(%)
1000 Hz 114 dB	120.00	120	3.23	3.20	-0.93	3.0	-21, +26

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

2. Frequency weightings

UUC Setting	Deviation from various Frequency Weighting		UNCERTAINTY	Tolerances Limit
FAST / 60-140	A	C	(± dB)	(± dB)
STD Setting	(dB)	(dB)		
*63 Hz	-1.0	-1.0	0.40	2.0
125 Hz	-0.4	-0.3	0.40	1.5
250 Hz	-0.1	-0.1	0.40	1.5
500 Hz	-0.1	0.0	0.40	1.5
1000 Hz	0.0	0.0	0.40	-
2000 Hz	0.0	0.1	0.40	2.0
4000 Hz	-0.8	-0.8	0.40	3.0
8000 Hz	-2.1	-2.1	0.40	5.0

Certificate No : 21-ACT-361

Request No : Req-2021-1241

3. Linearity of response to steady signals

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

UUC Setting		FAST / A / High									
1000 Hz	Ref	(dB)	60.0	80.0	90.0	100.0	110.0	114.0	120.0	130.0	140.0
	Level A	(dB)	60.6	80.3	90.0	100.0	110.0	114.0	120.0	130.0	140.0
	Error	(dB)	0.6	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8000 Hz	Ref	(dB)			88.9	98.9	108.9	112.9	118.9	128.9	138.9
	Level A	(dB)			88.9	98.9	108.9	112.9	118.9	128.8	138.8
	Error	(dB)			0.0	0.0	0.0	0.0	0.0	-0.1	-0.1
63 Hz	Ref	(dB)						87.8	93.8	103.8	113.8
	Level A	(dB)						87.8	93.8	103.8	113.8
	Error	(dB)						0.0	0.0	0.0	0.0
Tolerances Limit		(±dB)	1.0								
UNCERTAINTY		(±dB)	0.27								

b. Sound exposure meter linearity of error

UUC Setting	Time		Exposure Measurement			UNCERTAINTY	Tolerances
FAST / A / 60-140	Ref	UUC	Ref	UUC	Error		Limit
Calibrator Setting	(s)	(s)	(Pa ² h)	(Pa ² h)	(%)	(%)	(%)
1000 Hz 110 dB	27	27	0.30	0.30	0.00	4.3	-21, +26
1000 Hz 110 dB	45	45	0.50	0.50	0.00		
1000 Hz 110 dB	90	90	1.00	0.99	-1.00		
1000 Hz 110 dB	180	180	2.00	1.98	-1.00		
1000 Hz 120 dB	36	36	4.00	4.03	+0.75		
1000 Hz 120 dB	72	72	8.00	8.05	+0.63	3.8	
1000 Hz 120 dB	90	90	10.00	10.13	+1.30		
1000 Hz 120 dB	180	180	20.00	20.22	+1.10		
1000 Hz 120 dB	360	360	40.00	40.34	+0.85		
1000 Hz 120 dB	720	720	80.00	80.49	+0.61		

Certificate No : 21-ACT-361

Request No : Req-2021-1241

4. Response to short duration

a. Response for sinusoidal signals - reference level

UUC Setting	Time		Exposure Measurement			UNCERTAINTY	Tolerances Limit
FAST / A / 60-140	Ref	UUC	Ref	UUC	Error		
Calibrator Setting	(s)	(s)	(Pa ² h)	(Pa ² h)	(Pa ² h)	(Pa ² h)	(Pa ² h)
4000 Hz 95 dB	2846	2846	1.00	0.99	-0.01	0.01	-0.29 - 0.41

b. Sound exposure meter response for series of toneburst impulses

UUC Setting	Time		Exposure Measurement			UNCERTAINTY	Tolerances Limit
FAST / A / 60-140	Ref	UUC	Ref	UUC	Error		
Calibrator Setting	(s)	(s)	(Pa ² h)	(Pa ² h)	(%)	(%)	(%)
Burst 1 ms, 95 dB	2846	2846	1.00	0.99	-1.00	3.0	-21 - +26
Burst 1 ms, 100 dB	900	900	1.00	0.99	-1.00		-21 - +41
Burst 1 ms, 108 dB	143	143	1.00	0.99	-1.00		-21 - +41

5. Response to unipolar pulse

UUC Setting	Time	Exposure Measurement		UNCERTAINTY	Tolerances Limit
FAST / A / 60-140	UUC	UUC	Different		
Calibrator Setting	(s)	(Pa ² h)	(%)	(%)	(%)
Continuous Rectangle +	7	10.61	0.00	2.4	-21 - +26
Continuous Rectangle -		10.61			

End of Certificate

FACTORY CALIBRATION DATA OF THE SV 104 No. 91923

with microphone SVANTEK type SV27 No. 96604

1. CALIBRATION (acoustical)

Reference frequency: 1000Hz; Sound Pressure Level: 114.0 dB.

Characteristic	Correct value [dB]	Indication [dB]	Error [dB]
Z	113.85	113.77	-0.08
A	113.85	113.77	-0.08
C	113.85	113.77	-0.08

Calibration measured with the microphone SVANTEK type SV27 No. 96604. Calibration factor: 0.00 dB.

2. CALIBRATION* (electrical)

Characteristic: Z; Input: 5.62mV; f_{ref} : 1000Hz

	Correct value [dB]	Indication [dB]	Error [dB]
Dosimeter	114.0	114.0	-0.0
Octave meter	114.0	114.0	0.0

3. LINEARITY TEST* (electrical)

Characteristic: A; f_{ref} : 31.5 Hz

Nominal result LEQ [dB]	60.0	61.0	62.0	65.0	70.0	80.0	96.0
Error [dB]	0.2	0.1	0.1	0.1	0.0	0.0	0.0

Characteristic: A; f_{ref} : 1000 Hz

Nominal result LEQ [dB]	60.0	61.0	62.0	65.0	70.0	80.0	100.0	120.0	137.0
Error [dB]	0.2	0.1	0.1	0.1	-0.0	-0.0	-0.0	-0.0	-0.0

Characteristic: A; f_{ref} : 4000 Hz

Nominal result LEQ [dB]	60.0	61.0	62.0	65.0	70.0	80.0	100.0	120.0	137.0
Error [dB]	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	-0.0

Characteristic: A; f_{ref} : 8000 Hz

Nominal result LEQ [dB]	60.0	61.0	62.0	65.0	70.0	80.0	100.0	120.0	136.0
Error [dB]	0.1	0.1	0.1	0.0	-0.0	-0.0	0.0	-0.0	-0.1

4. TONE BURST RESPONSE*

Characteristic: A; f_{ref} : 4000 Hz; Burst duration: 2s

Steady level nominal result = 134dB

Result	Detector	Duration [ms]	1000	500	200	100	50	20	10	5	2	1	0.5	0.25
MAX	Fast	Indication [dB]	134.0	133.9	133.0	131.4	129.2	125.7	122.9	119.9	116.0	113.0	109.9	106.9
		Error [dB]	0.0	0.0	0.0	0.0	-0.0	-0.0	-0.0	0.0	-0.0	-0.0	-0.1	-0.1
	Slow	Indication [dB]	131.9	129.9	126.5	123.7	120.8	116.9	113.9	110.9	106.9	-	-	-
		Error [dB]	-0.1	-0.0	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-	-	-
SEL	-	Indication [dB]	134.0	131.0	127.0	124.0	121.0	117.0	114.0	111.0	107.0	104.0	100.9	97.9
		Error [dB]	-0.2	-0.0	0.0	-0.0	-0.0	0.0	-0.0	-0.0	-0.0	-0.0	-0.1	-0.1

Steady level nominal result = 74dB

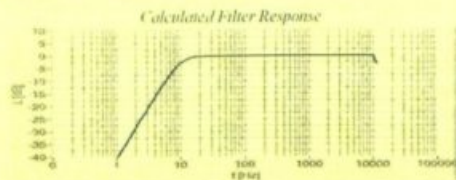
Result	Detector	Duration [ms]	1000	500	200	100
MAX	Fast	Indication [dB]	74.0	73.9	73.0	71.4
		Error [dB]	-0.0	-0.0	0.0	-0.0
	Slow	Indication [dB]	72.0	69.8	66.7	63.6
		Error [dB]	-0.1	-0.1	0.1	-0.2
SEL	-	Indication [dB]	74.0	71.0	67.0	64.1
		Error [dB]	-0.0	-0.0	0.0	0.0

Steady level nominal result = 70dB

Result	Detector	Duration [ms]	1000	500	200
MAX	Fast	Indication [dB]	70.0	69.9	69.0
		Error [dB]	0.0	0.0	0.0
	Slow	Indication [dB]	68.0	66.0	62.4
		Error [dB]	-0.1	0.1	-0.2
SEL	-	Indication [dB]	70.0	67.0	63.1
		Error [dB]	0.0	-0.0	0.1

5. FREQUENCY RESPONSE* (electrical)

Characteristic Z, Input: 56.2mV, Nominal result: 134dB



Measured Filter Response
(ω -frequency: 1-level)

f [Hz]	L [dB]
20	-0.2
1000	0.0
8000	0.1

All frequencies are nominal center values for the 1/3 octave bands

6. FREQUENCY RESPONSE (acoustical)

Characteristic Z, Input: 90 dB

Frequency [Hz]	20	31.5	63	125	250	500	1000	2000	4000	8000	10000
Pressure Response [dB]	0.3	0.2	-0.4	-0.6	-0.6	-0.6	-0.7	-0.7	-0.4	-3.3	-5.4
Free Field Response [dB]	0.3	0.2	-0.4	-0.6	-0.6	-0.5	0.0	-0.1	1.5	0.8	-0.6

7. INTERNAL NOISE LEVEL* (electrical - compensated)

	Characteristic	Z	A	C
Dosimeter	Indication [dB]	≤ 60	≤ 50	≤ 50
Octave meter	Indication [dB]	≤ 57	≤ 47	≤ 47

8. INTERNAL NOISE LEVEL (acoustical - compensated)

Characteristic A

Dosimeter	Indication [dB]	≤ 50
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Noise measured in special chamber

*/ Measured with microphone calibration and compensation switched off

ENVIRONMENTAL CONDITIONS

Temperature	Relative humidity	Atmospheric pressure
22 °C	30% _{rel}	995 hPa

TEST EQUIPMENT

Item	Manufacturer	Model	Serial no.	Description
1.	SVANTEK	SVAN 401	127	Signal generator
2.	SVANTEK	SVAN 912A	4369	Sound & Vibration Analyser
3.	RIGOL	DM3068	DM30155100773	Digital multimeter
4.	SVANTEK	SV33	93171	Acoustic calibrator
5.	G.R.A.S.	51AB	200368	Sound Intensity Calibrator
6.	G.R.A.S.	40BP	93296	1/4" Pressure Microphone
7.	G.R.A.S.	40AN	73421	1/2" Free Field Microphone
8.	SVANTEK	ST104	-	Microphone equivalent electrical impedance

CONFORMITY & TEST DECLARATION

1. Herewith Svantek company declares that this instrument has been calibrated and tested in compliance with the internal ISO9001 procedures and meets all specification given in the Manual(s) or respectively surpass them.
2. The acoustic calibration was performed using the Sound Calibrator and is traceable to the GUM (Central Office of Measures) reference standard - sound level calibrator type 4231 No 2292773.
3. The information appearing on this sheet has been compiled specifically for this instrument. This form is produced with advanced equipment & procedures which permit comprehensive quality assurance verification of all data supplied herein.
4. This calibration sheet shall not be reproduced except in full, without written permission of the SVANTEK Ltd.

Calibration specialist: Krzysztof Kubel

Kubel

Test date: 2021-02-23

เอกสารไม่ควบคุม

Certificate of Calibration

Customer

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

Certificate No : 21-ACT-187
Request No : Req-2021-0523

Unit Under Calibration Details

Measurement item : Acoustic Calibrator Class : 1
Manufacturer : SVANTEK Range : 94, 114 dB / 1000 Hz
Model : SV 35A Instrument Status : Used
Serial Number : 73249
ID : UAE.EFM.105/2561

Calibration Environment and Details


Temperature : (23 ±2 °C)
Humidity : (50 ± 20 %RH)
Barometric Pressure : (1013 ±10.0 hPa)
Received Date : 27 April 2021
Calibration Date : 28 May 2021
Location of Calibration : LAB 1 Acoustic
Calibration Procedure : In-house method CP-ACT-02 based on IEC 60942:2017 Electroacoustics - Sound calibrators


Reference Standard	Model	Serial Number	Traceable	Due Calibration
Sound Calibrator	SV 35A	58079	EEI	14 May 2022
THD Multimeter	2015	1047765	NIMT	22 January 2022

Traceability : This certificate provides traceability of measurement to recognized national standard, and to the realization of the international System of Units (SI).

Note

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

Calibrated By : 
Mr. Noppadon Luangart
Service Calibration Engineer

Approved By : 
Mr. Pacit Mathavorn
Calibration Engineer Supervisor

Issue Date : 28 May 2021

Certificate No : 21-ACT-187

Request No : Req-2021-0523

Sound pressure level

Calibration Results : Without Adjustment

Calibration Range (dB)	Without Adjustment (dB)		Adjustment (dB)		Uncertainty (± dB)	Acceptance limit Class 1 (± dB)
	Measured	Error	Measured	Error		
94 dB / 1000 Hz	93.81	-0.19	-	-	0.11	0.25
114 dB / 1000 Hz	113.83	-0.17	-	-	0.11	0.25

Frequency of Sound pressure level

Calibration Range (Hz)	Without Adjustment		Adjustment		Uncertainty (± %)	Acceptance limit Class 1 (± %)
	Measured (Hz)	Error (%)	Measured (Hz)	Error (%)		
94 dB / 1000 Hz	999.97	0.003	-	-	0.02	0.70
114 dB / 1000 Hz	999.98	0.002	-	-	0.02	0.70

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

Calibration Range (Hz)	Without Adjustment	Adjustment	Uncertainty (± %)	Acceptance limit Class 1 (± %)
	Measured (%)	Measured (%)		
94 dB / 1000 Hz	0.18	-	0.17	2.5
114 dB / 1000 Hz	0.04	-	0.17	2.5

Note :

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

End of Calibration

SITHIPHORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

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



Cert. No. : ACL21035

Pages : 1 of 8

Calibration Certificate

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

Condition As Found : GOOD

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

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

Received Date : 14 JANUARY 2021
Calibration Date : 18-20 JANUARY 2021
Date of Issue : 25 JANUARY 2021

Calibrated by : Nathakorn Pisutpaisan

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.

Continuation of Calibration Certificate

Cert. No. : ACL21035

Job No. : VC64AC0036

Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

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

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

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

Condition of this result of calibration :

1. Reference Standard Instruments :

<u>Instrument</u>	<u>Model</u>	<u>Serial No.</u>	<u>Cert. No.</u>	<u>Due Date</u>
Waveform Generator	33210A	MY48017076	EF-0009-20	03-Feb-21
Waveform Generator	33511B	MY52302742	EF-0008-20	03-Feb-21
Digital Multimeter	33461A	MY53220104	EEL.BP. 199/0163	05-Feb-21
Digital Multimeter	33461A	MY53220076	EEL.BP. 200/0163	02-Feb-21
Digital Multimeter	33461A	MY53220116	EEL.BP. 201/0163	06-Feb-21
Programmable Attenuator	MAT-1070	00119	EF-0010-20	04-Feb-21
Condenser Microphone	4180	2977900	AA-1007-20	04-Feb-21
Measuring Amplifier	NA-42KAI	34560495	AA-3005-20	06-Feb-21

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

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

3.1 National Institute of Metrology (Thailand).

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

Continuation of Calibration Certificate

Cert. No. : ACL21035

Job No. : VC64AC0036

Pages : 3 of 8

Summary of Measurement Result :

Parameter	Pass	Fail	Uncertainty (dB)	Maximum-permitted uncertainty of measurement (dB)
1. Absolute sensitivity	✓	-	0.3	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	✓	-	0.1	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	✓	-	0.1	0.3
10. Peak C sound level	✓	-	0.1	0.35
11. Overload indication	✓	-	0.1	0.25
12. High level stability	✓	-	0.1	0.1

Continuation of Calibration Certificate

Cert. No. : ACL21035

Job No. : VC64AC0036

Pages : 4 of 8

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

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limit (dB)
93.9 (93.97)	93.9	0.0	±0.3

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
17.7

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

Frequency Weighting	Measured value (dB)
A - weight	13.6
C - weight	20.3
Flat	26.1

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.3	0.4	0.4	± 1.5
1000	0.1	0.1	0.1	± 1.0
8000	0.9	1.0	1.0	±5.0

Continuation of Calibration Certificate

Cert. No. : ACL21035

Job No. : VC64AC0036

Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

Frequency Weighting	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

Continuation of Calibration Certificate

Cert. No. : ACL21035

Job No. : VC64AC0036

Pages : 6 of 8

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	± 1.1
136.0	136.0	0.0	± 1.1
135.0	135.0	0.0	± 1.1
134.0	134.0	0.0	± 1.1
133.0	132.9	-0.1	± 1.1
132.0	131.9	-0.1	± 1.1
131.0	130.9	-0.1	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.0	0.0	± 1.1
114.0	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.0	0.0	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	39.0	0.0	± 1.1
34.0	34.0	0.0	± 1.1
30.0	30.0	0.0	± 1.1
29.0	29.0	0.0	± 1.1
28.0	28.1	0.1	± 1.1
27.0	27.0	0.0	± 1.1
26.0	26.1	0.1	± 1.1
25.0	25.0	0.0	± 1.1

Continuation of Calibration Certificate

Cert. No. : ACL21035
Job No. : VC64AC0036
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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	±0.5

9. Tone burst response

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

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, Lcpeak (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
One	136.4	135.9	-0.5	±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

Continuation of Calibration Certificate

Cert. No. : ACL21035

Job No. : VC64AC0036

Pages : 8 of 8

11. Overload indication

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

12. High level stability

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

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

End of Calibration Certificate

Calibration Certificate

Certificate Number 2021000295

Customer:

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

Model Number LxT2
Serial Number 0005396
Test Results Pass

Initial Condition As Manufactured
Description SoundTrack LxT Class 2
Class 2 Sound Level Meter
Firmware Revision: 2.404

Procedure Number D0001.8378
Technician Ron Harris
Calibration Date 11 Jan 2021
Calibration Due
Temperature 23.55 °C ± 0.25 °C
Humidity 53.9 %RH ± 2.0 %RH
Static Pressure 87.37 kPa ± 0.13 kPa

Evaluation Method Tested electrically using Larson Davis PRMLxT2C S/N 071541 and a 12.0 pF capacitor to simulate microphone capacitance. Data reported in dB re 20 µPa assuming a microphone sensitivity of 50.0 mV/Pa.

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

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

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

The quality system is registered to ISO 9001:2015.

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

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

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

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

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



Certificate Number 2021000295

Standards Used			
Description	Cal Date	Cal Due	Cal Standard
Hart Scientific 2626-S Humidity/Temperature Sensor	2020-05-12	2021-05-12	006943
SRS DS360 Ultra Low Distortion Generator	2020-08-19	2021-08-19	007167

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Provo, UT 84601, United States
716-684-0001



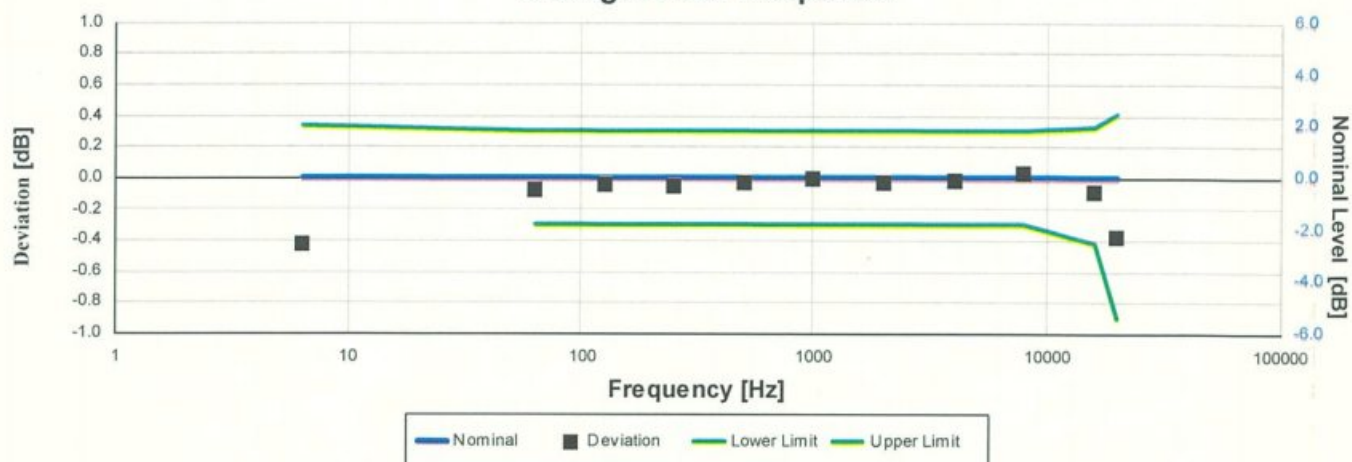
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D0001.8407 Rev E

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Z-weight Filter Response



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

Frequency [Hz]	Test Result [dB]	Deviation [dB]	Lower limit [dB]	Upper limit [dB]	Expanded Uncertainty [dB]	Result
6.31	-0.43	-0.43	-1.11	0.33	0.15	Pass
63.10	-0.07	-0.07	-0.30	0.30	0.15	Pass
125.89	-0.04	-0.04	-0.30	0.30	0.15	Pass
251.19	-0.05	-0.05	-0.30	0.30	0.15	Pass
501.19	-0.03	-0.03	-0.30	0.30	0.15	Pass
1,000.00	0.00	0.00	-0.30	0.30	0.15	Pass
1,995.26	-0.03	-0.03	-0.30	0.30	0.15	Pass
3,981.07	-0.01	-0.01	-0.30	0.30	0.15	Pass
7,943.28	0.03	0.03	-0.30	0.30	0.15	Pass
15,848.93	-0.09	-0.09	-0.42	0.32	0.15	Pass
19,952.62	-0.37	-0.37	-0.91	0.41	0.15	Pass

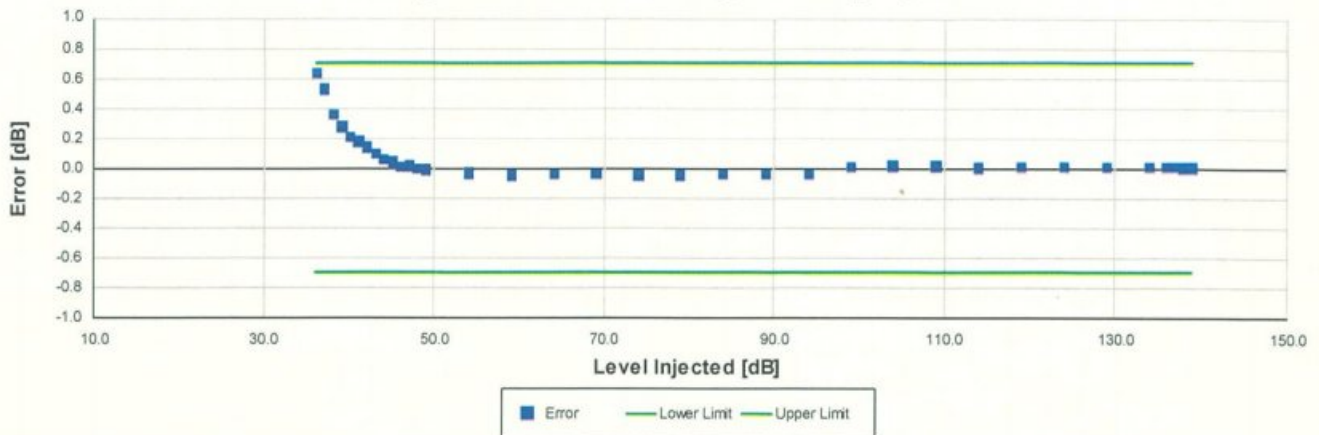
-- End of measurement results--

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1681 West 820 North
Provo, UT 84601, United States
716-684-0001



LARSON DAVIS
A PCB PIEZOTRONICS DIV.

A-weighted Broadband Log Linearity: 8,000.00 Hz



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

Level [dB]	Error [dB]	Lower limit [dB]	Upper limit [dB]	Expanded Uncertainty [dB]	Result
36.00	0.63	-0.70	0.70	0.16	Pass
37.00	0.52	-0.70	0.70	0.16	Pass
38.00	0.35	-0.70	0.70	0.16	Pass
39.00	0.27	-0.70	0.70	0.16	Pass
40.00	0.20	-0.70	0.70	0.16	Pass
41.00	0.17	-0.70	0.70	0.16	Pass
42.00	0.13	-0.70	0.70	0.16	Pass
43.00	0.09	-0.70	0.70	0.17	Pass
44.00	0.06	-0.70	0.70	0.17	Pass
45.00	0.04	-0.70	0.70	0.16	Pass
46.00	0.00	-0.70	0.70	0.16	Pass
47.00	0.01	-0.70	0.70	0.16	Pass
48.00	-0.01	-0.70	0.70	0.16	Pass
49.00	-0.01	-0.70	0.70	0.16	Pass
54.00	-0.04	-0.70	0.70	0.16	Pass
59.00	-0.05	-0.70	0.70	0.16	Pass
64.00	-0.04	-0.70	0.70	0.16	Pass
69.00	-0.05	-0.70	0.70	0.16	Pass
74.00	-0.05	-0.70	0.70	0.16	Pass
79.00	-0.05	-0.70	0.70	0.16	Pass
84.00	-0.04	-0.70	0.70	0.16	Pass
89.00	-0.05	-0.70	0.70	0.16	Pass
94.00	-0.05	-0.70	0.70	0.16	Pass
99.00	0.00	-0.70	0.70	0.15	Pass
104.00	0.01	-0.70	0.70	0.15	Pass
109.00	0.01	-0.70	0.70	0.15	Pass
114.00	0.00	-0.70	0.70	0.15	Pass
119.00	0.00	-0.70	0.70	0.15	Pass
124.00	0.01	-0.70	0.70	0.15	Pass
129.00	0.01	-0.70	0.70	0.15	Pass
134.00	0.01	-0.70	0.70	0.15	Pass
136.00	0.01	-0.70	0.70	0.15	Pass
137.00	0.01	-0.70	0.70	0.15	Pass
138.00	0.00	-0.70	0.70	0.15	Pass
139.00	0.00	-0.70	0.70	0.15	Pass

-- End of measurement results--

Peak Rise Time

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

Amplitude [dB]	Duration [μs]		Test Result [dB]	Lower limit [dB]	Upper limit [dB]	Expanded Uncertainty [dB]	Result
136.95	40	Negative Pulse	134.63	133.15	135.15	0.15	Pass
		Positive Pulse	134.59	133.15	135.15	0.15	Pass
	30	Negative Pulse	133.68	133.15	135.15	0.15	Pass
		Positive Pulse	133.70	133.15	135.15	0.15	Pass
		-- End of measurement results--					

Positive Pulse Crest Factor

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

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

Amplitude [dB]	Crest Factor	Test Result [dB]	Limits [dB]	Expanded Uncertainty [dB]	Result
135.95	3	OVLD	± 1.00	0.15 ‡	Pass
	5	OVLD	± 1.00	0.15 ‡	Pass
125.95	3	-0.13	± 1.00	0.15 ‡	Pass
	5	-0.12	± 1.00	0.16 ‡	Pass
115.95	3	-0.13	± 1.00	0.15 ‡	Pass
	5	-0.12	± 1.00	0.15 ‡	Pass
105.95	3	-0.12	± 1.00	0.15 ‡	Pass
	5	-0.11	± 1.00	0.15 ‡	Pass
-- End of measurement results--					

Negative Pulse Crest Factor

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

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

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

Gain

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

Measurement	Test Result [dB]	Lower limit [dB]	Upper limit [dB]	Expanded Uncertainty [dB]	Result
0 dB Gain	93.95	93.90	94.10	0.15	Pass
0 dB Gain, Linearity	40.25	39.40	40.80	0.16	Pass
OBA Low Range	94.00	93.90	94.10	0.15	Pass
OBA Normal Range	94.00	93.20	94.80	0.15	Pass
-- End of measurement results--					

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Broadband Noise Floor

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

Measurement	Test Result [dB]	Upper limit [dB]	Result
A-weight Noise Floor	26.92	36.00	Pass
C-weight Noise Floor	26.66	35.00	Pass
Z-weight Noise Floor	32.59	39.00	Pass

-- End of measurement results--

Total Harmonic Distortion

Measured using 1/3-Octave filters

Measurement	Test Result [dB]	Lower Limit [dB]	Upper Limit [dB]	Expanded Uncertainty [dB]	Result
10 Hz Signal	135.18	134.15	135.75	0.15	Pass
THD	-66.77		-58.00	0.01 ‡	Pass
THD+N	-62.56		-58.00	0.01 ‡	Pass

-- End of measurement results--

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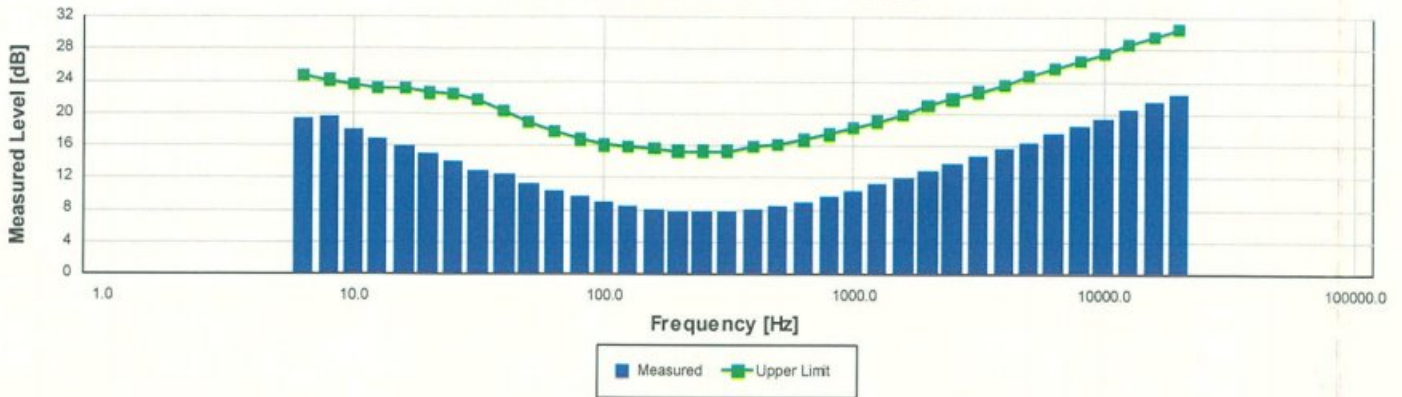
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1/3-Octave Self-Generated Noise



The SLM is set to low range.

Frequency [Hz]	Test Result [dB]	Upper limit [dB]	Result
6.30	19.25	24.60	Pass
8.00	19.60	24.00	Pass
10.00	17.94	23.50	Pass
12.50	16.63	23.00	Pass
16.00	15.76	22.90	Pass
20.00	14.97	22.40	Pass
25.00	13.94	22.30	Pass
31.50	12.87	21.50	Pass
40.00	12.19	20.20	Pass
50.00	11.04	18.80	Pass
63.00	10.28	17.60	Pass
80.00	9.59	16.60	Pass
100.00	8.90	15.90	Pass
125.00	8.35	15.70	Pass
160.00	7.80	15.50	Pass
200.00	7.77	15.20	Pass
250.00	7.59	15.20	Pass
315.00	7.74	15.20	Pass
400.00	8.01	15.70	Pass
500.00	8.35	16.00	Pass
630.00	8.94	16.60	Pass
800.00	9.57	17.30	Pass
1,000.00	10.28	18.10	Pass
1,250.00	11.10	18.90	Pass
1,600.00	11.87	19.80	Pass
2,000.00	12.78	20.80	Pass
2,500.00	13.64	21.70	Pass
3,150.00	14.54	22.60	Pass
4,000.00	15.45	23.50	Pass
5,000.00	16.34	24.50	Pass
6,300.00	17.39	25.50	Pass
8,000.00	18.37	26.50	Pass
10,000.00	19.31	27.40	Pass
12,500.00	20.32	28.50	Pass
16,000.00	21.30	29.50	Pass
20,000.00	22.30	30.40	Pass

-- End of measurement results--

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-- End of Report--

Signatory: Ron Harris

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Provo, UT 84601, United States
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