

ภาคผนวก ค  
เอกสารสอบเทียบเครื่องมือ

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รายการใบรับรองสอบเทียบ/ทวนสอบเครื่องมือประจำห้องปฏิบัติการสำหรับวิเคราะห์คุณภาพอากาศ

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration*	Remark
เครื่องมือหลักประจำห้องปฏิบัติการวิเคราะห์ สำหรับวิเคราะห์คุณภาพอากาศ									
1	Analytical Balance (Readability 0.1 mg)	ฝุ่นละอองขนาดเล็กไม่เกิน 10 ไมครอน (PM10) เฉลี่ย 24 ชั่วโมง	Mettler-Toledo	AB204-S / 1128312528	National Food Institute, Ministry of Industry, Thailand	2100856-001-02	8 Dec 20	7 Dec 21	-
2	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	-

Due Date of Calibration\* : กำหนดตามแผนการสอบเทียบประจำปี อย่างน้อยปีละ 1 ครั้ง

## Calibration Certificate

Substitute for Certificate No.: 2100856-001-01  
 Certificate No.: 2100856-001-02  
 Client name: UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.  
 Address: 3 Soi Udomsuk 41, Sukhumvit Road,  
 Bangchack, Prakhong, Bangkok 10260

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Equipment: Electronic Balance  
 Manufacturer: METTLER TOLEDO  
 Model: AB204-S  
 Serial No.: 1128312528  
 ID No.: UAE.AIR.019/2550  
 Order No.: 2100856  
 Operation No.: 2100856-001  
 Date of Receipt: 8 December 2020  
 Date of Calibration: 8 December 2020

Calibrated by Mr.Taveesak Seilee  
 Scientist  
 Approved by (Mr.Pheraphat Tuanjit)  
 Manager, Division of Calibration Laboratory  
 Responsible for the Technical Management Team  
 Date of Issue: 21 December 2020

The uncertainties are for a confidence probability of approximately 95%

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

F-CS-011 Revision: 00 Date: 14-12-61

Uncontrolled Document

## Calibration Report

Certificate No.: 2100856-001-02  
 Equipment: Electronic Balance  
 Model: AB204-S  
 Serial No.: 1128312528  
 Capacity: 220 g  
 Manufacturer: METTLER TOLEDO  
 Resolution: 0.0001 g  
 ID No.: UAE.AIR.019/2550

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Date of Calibration: 8 December 2020  
 Environment Condition: Ambient Temperature: 18.8 ± 0.3 °C Relative Humidity: 53 ± 2 %  
 Place of Calibration: Balance Room, UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.

Condition of Equipment: Good Condition

Condition of This Results of Calibration:

1. Calibration Method: NFI Method W-MA-001 In-House Method Based on UKAS LAB 14 Calibration of Weighing Machines : 2006

2. Reference Standards:

Reference Standard Model Serial No. Calibrated By Certificate No. Due Date

Standard Weight Class E2 1mg to 200g B505567572 TCS M20040405 9 April 2021

Instrument Model Serial No. Calibrated By Certificate No. Due Date

Thermo-Hygro Meter PMPPE 490 NFI.BTH 004/58 Quality Reborn QR20-0194 7 February 2021

3. This certificate is traceable to SI UNIT

4. This certificate was certified only for the instrument we calibrated.

5. This result of calibration was found accurate as shown on date and place of calibration only.

Calibration Results:

1. Repeatability of Reading:

Nominal Value ( g )	Standard Deviation of Reading ( g )
10	0.000048
20	0.000042

2. Off-Center Error:

A mass of 5 g was placed and moved to various position on pan.

The balance reading obtained is given in the table.

1	2	3	4	5	6	(Maximum Difference)
( g )	( g )	( g )	( g )	( g )	( g )	( g )
5.0000	5.0001	5.0000	5.0000	5.0000	5.0000	0.0001

F-CS-012 Revision: 00 Date: 14-12-61

Uncontrolled Document

## Calibration Report

Certificate No.: 2100856-001-02  
 Equipment: Electronic Balance  
 Model: AB204-S  
 Serial No.: 1128312528  
 Capacity: 220 g  
 Manufacturer: METTLER TOLEDO  
 Resolution: 0.0001 g  
 ID No.: UAE.AIR.019/2550

Date of Calibration: 8 December 2020 Page 3 of 5

Calibration Results: (Continued)

Calibration Range: 0 - 200 g

Calibration Adjustment: Internal Calibration

3. Departure from Nominal Value: (Test Weight by filter pan)

Nominal Value ( g )	Standard Value ( g )	Average Reading ( g )	Correction ( g )	Uncertainty ( # g )	Coverage Factor z
Unload	0.00000	0.0000	0.0000	0.000088	2.00
0.01	0.01000	0.0100	0.0000	0.000088	2.00
0.05	0.05000	0.0500	0.0000	0.000088	2.00
0.1	0.10001	0.1000	0.0000	0.000088	2.00
0.5	0.50001	0.5000	0.0000	0.000088	2.00
1	1.00001	1.0000	0.0000	0.000088	2.00
2	2.00002	2.0000	0.0000	0.000089	2.00
3	3.00003	3.0000	0.0000	0.000089	2.00
4	4.00004	4.0000	0.0000	0.000090	2.00
5	5.00002	5.0000	0.0000	0.000089	2.00
10	10.00001	9.9999	0.0001	0.000091	2.00
15	15.00003	14.9999	0.0001	0.000092	2.00
20	20.00003	19.9999	0.0001	0.000095	2.00

F-CS-012 Revision: 00 Date: 14-12-61

Uncontrolled Document

## Calibration Report

Certificate No.: 2100856-001-02  
 Equipment: Electronic Balance  
 Model: AB204-S  
 Serial No.: 1128312528  
 Capacity: 220 g  
 Manufacturer: METTLER TOLEDO  
 Resolution: 0.0001 g  
 ID No.: UAE.AIR.019/2550

Date of Calibration: 8 December 2020 Page 4 of 5

Environment Condition: Ambient Temperature: 18.8 ± 0.3 °C Relative Humidity: 53 ± 2 %

Place of Calibration: Balance Room, UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.

Condition of Equipment: Good Condition

Condition of This Results of Calibration:

1. Calibration Method: NFI Method W-MA-001 In-House Method Based on UKAS LAB 14 Calibration of Weighing Machines : 2006

2. Reference Standards:

Reference Standard Model Serial No. Calibrated By Certificate No. Due Date

Standard Weight Class E2 1mg to 200g B505567572 TCS M20040405 9 April 2021

Instrument Model Serial No. Calibrated By Certificate No. Due Date

Thermo-Hygro Meter PMPPE 490 NFI.BTH 004/58 Quality Reborn QR20-0194 7 February 2021

3. This certificate is traceable to SI UNIT

4. This certificate was certified only for the instrument we calibrated.

5. This result of calibration was found accurate as shown on date and place of calibration only.

Calibration Results:

1. Repeatability of Reading:

Nominal Value ( g )	Standard Deviation of Reading ( g )
100	0.000032
200	0.000032

2. Off-Center Error:

A mass of 50 g was placed and moved to various position on pan.

The balance reading obtained is given in the table.

1	2	3	4	5	6	(Maximum Difference)
( g )	( g )	( g )	( g )	( g )	( g )	( g )
49.9999	49.9998	49.9999	49.9999	49.9999	49.9999	0.0001

F-CS-012 Revision: 00 Date: 14-12-61

Uncontrolled Document

## Calibration Report

**Certificate No.:** 2100856-001-02  
**Equipment:** Electronic Balance  
**Model:** AB204-S  
**Serial No.:** 1128312528  
**Capacity:** 220 g  
**Manufacturer:** METTLER TOLEDO  
**Resolution:** 0.0001 g  
**ID No.:** UAE.AIR.019/2550

**Date of Calibration:** 8 December 2020 **Page 5 of 5**

**Calibration Results:** (Continued)  
**Calibration Range:** 0 - 200 g  
**Calibration Adjustment:** Internal Calibration

### 3. Departure from Nominal Value:

Nominal Value ( g )	Standard Value ( g )	Average Reading ( g )	Correction ( g )	Uncertainty ( ± g )	Coverage Factor k
Unload	0.00000	0.0000	0.0000	0.000085	2.00
0.1	0.10001	0.1000	0.0000	0.000085	2.00
0.5	0.50001	0.5000	0.0000	0.000085	2.00
1	1.00001	1.0000	0.0000	0.000085	2.00
5	5.00002	5.0000	0.0000	0.000086	2.00
10	10.00001	10.0000	0.0000	0.000088	2.00
20	20.00003	20.0000	0.0000	0.000093	2.00
50	50.00004	49.9999	0.0001	0.00011	2.00
70	70.00007	70.0000	0.0001	0.00013	2.00
100	100.00009	99.9999	0.0002	0.00016	2.00
150	150.00013	150.0000	0.0001	0.00021	2.00
200	200.00016	200.0001	0.0001	0.00028	2.00

Remark: Edited Calibration Results.

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

F-CS-012 Revision: 00 Date: 14-12-61

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## Calibration Certificate

**Certificate No.:** 2102572-001-01  
**Client name:** UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.  
**Address:** 3 Soi Udomsuk 41, Sukhumvit Road, Bangchack, Prakanong, Bangkok 10260

**Equipment:** Electronic Balance

**Manufacturer:** METTLER TOLEDO

**Model:** AB204-S/FACT

**Serial No.:** B108115858

**ID No.:** UAE.AIR.016/2555

**Order No.:** 2102572

**Operation No.:** 2102572-001

**Date of Receipt:** 26 April 2021

**Date of Calibration:** 26 April 2021

**Calibrated by** Mr.Manas Somsak  
**Expert**

**Approved by** ( Mr.Pheraphat Tuanjit )  
**Manager, Division of Calibration Laboratory**  
**Responsible for the Technical Management Team**

**Date of Issue:** 29 April 2021

The uncertainties are for a confidence probability of approximately 95%

This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation Scheme which has assessed the measurement capability of the laboratory and its traceability to recognized national standards and to the units of measurement realized at the corresponding national standards laboratory. This certificate is valid only for the purpose stated and in full except with the prior written approval of the National Food Institute.

F-CS-009 Revision: 00 Date: 14-12-61

เอกสารไม่ควบคุม

## Calibration Report

**Certificate No.:** 2102572-001-01  
**Equipment:** Electronic Balance  
**Model:** AB204-S/FACT  
**Serial No.:** B108115858  
**Capacity:** 220 g  
**Manufacturer:** METTLER TOLEDO  
**Resolution:** 0.0001 g  
**ID No.:** UAE.AIR.016/2555

**Date of Calibration:** 26 April 2021 **Page 2 of 5**

**Environment Condition:** Ambient Temperature: 22.0 ± 0.2 °C Relative Humidity: 48 ± 2 %

**Place of Calibration:** Balance Room (306), UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.

**Condition of Equipment:** Good Condition

### Condition of This Results of Calibration:

1. Calibration Method: NFI Method W-MA-001 In-House Method Based on UKAS LAB 34 Calibration of Weighing Machines : 2006

2. Reference Standards:

Reference Standard	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Standard Weight Class E2	1-500mg	15880	TCS	M20111955	28 November 2021
Standard Weight Class E2	1-500g	15882	TCS	M20111965	28 November 2021

Instrument	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Thermo-Hygro Meter	PONPE 490	NFI.BTH 004/18	Quality Return	QR21-0300	15 February 2022

3. This certification is traceable to SI UNIT

4. This certificate was certified only for the instrument we calibrated.

5. This result of calibration was found accurate as shown on date and place of calibration only.

### Calibration Results:

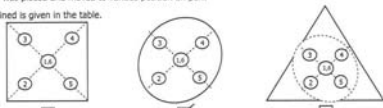
#### 1. Repeatability of Reading:

Nominal Value ( g )	Standard Deviation of Reading ( g )
100	0.000000
200	0.000042

#### 2. Off-Center Error:

A mass of 50 g was placed and moved to various position on pan.

The balance reading obtained is given in the table.



1	2	3	4	5	6	(Maximum Difference)
( g )	( g )	( g )	( g )	( g )	( g )	( g )
50.0001	50.0001	50.0001	50.0002	50.0002	50.0001	0.0001

F-CS-012 Revision: 00 Date: 14-12-61

เอกสารไม่ควบคุม

## Calibration Report

**Certificate No.:** 2102572-001-01  
**Equipment:** Electronic Balance  
**Model:** AB204-S/FACT  
**Serial No.:** B108115858  
**Capacity:** 220 g  
**Manufacturer:** METTLER TOLEDO  
**Resolution:** 0.0001 g  
**ID No.:** UAE.AIR.016/2555

**Date of Calibration:** 26 April 2021 **Page 3 of 5**

**Calibration Results:** (Continued)

**Calibration Range:** 0 - 200 g

**Calibration Adjustment:** Internal Calibration

### 3. Departure from Nominal Value:

Nominal Value ( g )	Standard Value ( g )	Average Reading ( g )	Correction ( g )	Uncertainty ( ± g )	Coverage Factor k
Unload	0.00000	0.0000	0.0000	0.000082	2.00
0.1	0.10000	0.1000	0.0000	0.000082	2.00
0.5	0.49999	0.5000	0.0000	0.000083	2.00
1	0.99999	1.0000	0.0000	0.000086	2.00
2	1.99999	2.0000	0.0000	0.000084	2.00
5	4.99998	5.0000	0.0000	0.000084	2.00
10	10.00003	10.0000	0.0000	0.00011	2.00
15	15.00001	15.0000	0.0000	0.00012	2.00
20	20.00004	20.0000	0.0000	0.00013	2.00
30	30.00006	30.0001	0.0001	0.00015	2.00
40	40.00000	40.0001	-0.0001	0.00014	2.00
50	49.99999	50.0002	-0.0002	0.00015	2.00
70	70.00003	70.0002	-0.0002	0.00019	2.00
100	99.99997	100.0003	-0.0003	0.00020	2.00
150	149.99997	150.0004	-0.0004	0.00027	2.00
200	199.99999	200.0005	-0.0005	0.00043	2.00

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

F-CS-012 Revision: 00 Date: 14-12-61

เอกสารไม่ควบคุม

## Calibration Report

**Certificate No.:** 2102572-001-01  
**Equipment:** Electronic Balance  
**Model:** AB204-S/FACT  
**Serial No.:** B108115858  
**Capacity:** 220 g  
**Manufacturer:** METTLER TOLEDO  
**Resolution:** 0.0001 g  
**ID No.:** UAE.AIR.016/2555

**Date of Calibration:** 26 April 2021 Page 4 of 5

**Environment Condition:** Ambient Temperature: 22.0 ± 0.2 °C Relative Humidity: 48 ± 2 %

**Place of Calibration:** Balance Room (306), UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.

**Condition of Equipment:** Good Condition

**Condition of This Results of Calibration:**

1. Calibration Method: NFI Method W-MA-001 In-House Method Based on UKAS LAB 14 Calibration of Weighing Machines : 2006

2. Reference Standards:

Reference Standard	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Standard Weight Class E2	1-500mg	15880	TCS	M20111955	28 November 2021
Standard Weight Class E2	1-500g	15882	TCS	M20111965	28 November 2021
Instrument	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Thermo-Hygro Meter	PONPE 490	NF1.8TH 004/18	Quality Reborn	QR21-0300	15 February 2022

3. This certification is traceable to SI UNIT

4. This certificate was certified only for the instrument we calibrated.

5. This result of calibration was found accurate as shown on date and place of calibration only.

**Calibration Results:** (Calibration with filter pan)

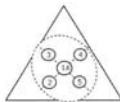
1. Repeatability of Reading:

Nominal Value ( g )	Standard Deviation of Reading ( g )
10	0.0000
20	0.0000

2. Off-Center Error:

A mass of 5 g was placed and moved to various position on pan.

The balance reading obtained is given in the table.



1 ( g )	2 ( g )	3 ( g )	4 ( g )	5 ( g )	6 ( g )	(Maximum Difference) ( g )
5.0000	5.0002	5.0001	5.0001	5.0000	5.0000	0.0002

F-CS-012 Revision: 00 Date: 14-12-61

เอกสารไม่ควบคุม

## Calibration Report

**Certificate No.:** 2102572-001-01  
**Equipment:** Electronic Balance  
**Model:** AB204-S/FACT  
**Serial No.:** B108115858  
**Capacity:** 220 g  
**Manufacturer:** METTLER TOLEDO  
**Resolution:** 0.0001 g  
**ID No.:** UAE.AIR.016/2555

**Date of Calibration:** 26 April 2021 Page 5 of 5

**Calibration Results:** (Continued)

**Calibration Range:** 0 - 200 g

**Calibration Adjustment:** Internal Calibration

3. Departure from Nominal Value: (Calibration with filter pan)

Nominal Value ( g )	Standard Value ( g )	Average Reading ( g )	Correction ( g )	Uncertainty ( ± g )	Coverage Factor k
Unload	0.00000	0.0000	0.0000	0.000082	2.00
0.01	0.01000	0.0100	0.0000	0.000082	2.00
0.05	0.05000	0.0500	0.0000	0.000082	2.00
0.1	0.10000	0.1000	0.0000	0.000082	2.00
0.5	0.49999	0.5000	0.0000	0.000083	2.00
1	0.99999	1.0000	0.0000	0.000086	2.00
2	1.99999	2.0000	0.0000	0.000084	2.00
3	2.99998	3.0000	0.0000	0.000087	2.00
4	3.99999	4.0000	0.0000	0.000085	2.00
5	4.99998	5.0000	0.0000	0.000084	2.00
10	10.00003	10.0000	0.0000	0.00011	2.00
15	15.00001	15.0000	0.0000	0.00012	2.00
20	20.00004	20.0000	0.0000	0.00013	2.00

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

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เอกสารไม่ควบคุม

F-CS-012 Revision: 00 Date: 14-12-61



## 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
<b>Ambient</b>									
1	Orifice Transfer Standard Calibrator	Particulate Matter < 10 µm (PM <sub>10</sub> )	Tisch Environmental, Inc.	TE-5025A 3540	Tisch Environmental, Inc.	19102020	19 Oct 20	18 Oct 22	-
2	U-Tube Manometer	Particulate Matter < 10 µm (PM <sub>10</sub> )	Dwyer	1221-36-W/M -	Technology Promotion Association (Thailand-Japan)	21P444	9 Feb 21	8 Feb 22	-
3	Aneroid Barometer	Particulate Matter < 10 µm (PM <sub>10</sub> )	Barigo, Germany	-	Technology Promotion Association (Thailand-Japan)	21P1158	31 Mar 21	30 Mar 22	-
4	Dial Thermo-Hygrometer	Particulate Matter < 10 µm (PM <sub>10</sub> )	Barigo, Germany	-	Technology Promotion Association (Thailand-Japan)	21H802	8 Apr 21	7 Apr 22	-
5	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Scientific	42i 1180540062	UAE Consultant Co., Ltd.	24102021	19 Jul 21	18 Jul 22	-
6	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Scientific	42i 1180540064	UAE Consultant Co., Ltd.	24102021	10 Feb 21	9 Feb 22	-
7	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Scientific	42i 1182920008	UAE Consultant Co., Ltd.	24102021	9 Jul 21	8 Jul 22	-
8	Standard Gases (Mixture)	Nitrogen Dioxide	Airgas	CC159599 2015PSIG	Airgas an Air Liquide company	E04N99E15A01QC	30 Jul 19	30 Jul 22	-
9	Carbon Monoxide Analyzer	Carbon Monoxide	Thermo	48C 48C-62011-333	UAE Consultant Co., Ltd.	09022021	9 Feb 21	8 Feb 22	-
10	Carbon Monoxide Analyzer	Carbon Monoxide	Thermo	48C 48C-69160-362	UAE Consultant Co., Ltd.	05032021	5 Mar 21	4 Mar 22	-
11	Carbon Monoxide Analyzer	Carbon Monoxide	Thermo	48C 48C-71185-368	UAE Consultant Co., Ltd.	14012021	14 Jan 21	13 Jan 22	-
12	Standard Gases (Mixture)	Carbon Monoxide	Airgas	CC159599 2015PSIG	Airgas an Air Liquide company	160-401526192-1	30 Jul 19	30 Jul 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
Ambient									
13	Sound Level Calibrator (Acoustic Calibrator)	Calibrate Sound Level Meter	SvanteK	SV36 107224	SvanteK	11022022	11 Feb 21	10 Feb 22	-
14	Sound Level Meter	$L_{Aeq\ 24\ hour}$ $L_{A90}$ $L_{Adn}$	Larson Davis	LxT2 0005407	Larson Davis-A PCB Piezotronics Div.	2021000734	21 Jan 21	20 Jan 22	-
15	Sound Level Meter	$L_{Aeq\ 24\ hour}$ $L_{A90}$ $L_{Adn}$	Larson Davis	LxT2 0005408	Larson Davis-A PCB Piezotronics Div.	2021000735	21 Jan 21	20 Jan 22	-
16	Sound Level Meter	$L_{Aeq\ 24\ hour}$ $L_{A90}$ $L_{Adn}$	Larson Davis	LxT2 0006614	Larson Davis-A PCB Piezotronics Div.	2021000746	21 Jan 21	20 Jan 22	-
17	Sound Level Meter	$L_{Aeq\ 24\ hour}$ $L_{A90}$ $L_{Adn}$	Larson Davis	LxT2 0006615	Larson Davis-A PCB Piezotronics Div.	2021000754	21 Jan 21	20 Jan 22	-
18	Sound Level Meter	$L_{Aeq\ 24\ hour}$ $L_{A90}$ $L_{Adn}$	Larson Davis	LxT2 0006616	Larson Davis-A PCB Piezotronics Div.	2021000753	21 Jan 21	20 Jan 22	-
19	Sound Level Meter	$L_{Aeq\ 24\ hour}$ $L_{A90}$ $L_{Adn}$	Larson Davis	LxT2 0006617	Larson Davis-A PCB Piezotronics Div.	2021000884	25 Jan 21	24 Jan 22	-
20	Sound Level Meter	$L_{Aeq\ 24\ hour}$ $L_{A90}$ $L_{Adn}$	Larson Davis	LxT2 0006618	Larson Davis-A PCB Piezotronics Div.	2021000796	22 Jan 21	21 Jan 22	-

# Certificate of Calibration

Calibration Certification Information				
Cal. Date:	October 19, 2020	Rootmeter S/N:	438320	Ta: 294 °K
Operator:	Jim Tisch	Pa:	752.3	mm Hg
Calibration Model #:	TE-5025A	Calibrator S/N:	3540	

Run	Vol. Init (m3)	Vol. Final (m3)	ΔVol. (m3)	ΔTime (min)	ΔP (mm Hg)	ΔH (in H2O)
1	1	2	1	1.3850	3.2	2.00
2	3	4	1	0.9780	6.4	4.00
3	5	6	1	0.8770	7.9	5.00
4	7	8	1	0.8370	8.8	5.50
5	9	10	1	0.6910	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)
0.9991	0.7214	1.4166	0.9957	0.7190	0.8841
0.9949	1.0172	2.0034	0.9915	1.0138	1.2502
0.9929	1.1321	2.2399	0.9895	1.1283	1.3978
0.9917	1.1848	2.3492	0.9883	1.1808	1.4660
0.9865	1.4276	2.8332	0.9831	1.4227	1.7681
m= 2.00891			m= 1.25795		
b= -0.03456			b= -0.02157		
r= 0.99998			r= 0.99998		

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

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

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

www.tisch-env.com  
TOLL FREE: (877)263-7610  
เอกสาร ไมคณคุณ 31467-9009



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

## Certificate of Calibration

Certificate No.: 21P444  
Page: 1 of 2

Equipment: U Tube Manometer  
Manufacturer: Dwyer  
Model: 1221-36-W/M

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.

Serial No.:  
ID No.: UAE.EFM.178/2561

Condition As-Received: Used Item  
Received Date: 01 February 2021  
Calibration Date: 09 February 2021

Reference: 2102-0083WSC  
Ambient Temperature: ( 23 ± 2 ) °C  
Relative Humidity: ( 50 ± 15 ) %  
Atmospheric Pressure: 1012 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-P04, using \* DKD-R 6-1 ; Calibration of Pressure Gauges, Edition 03/2014 \* as a guidelines.

### Condition of this result of calibration

1. Reference standards instruments:

Instrument	Model	Serial No.	Certificate No.	Due Date
1) Pressure Calibrator	PC106P	1189	MP-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 = 4.014623 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 Suwanasri  
✓ Attapol Panurach

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B 0250404



Cert.No.: 21P444  
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)

UUC Indication				
Applied Pressure (inH2O)	High-port side (inH2O)	Low-port side (inH2O)	ΔP (inH2O)	Error (inH2O)
0.00	0.00	0.00	0.00	0.00
2.00	0.98	-0.94	1.92	-0.08
4.00	2.02	-1.96	3.98	-0.02
6.00	3.02	-2.96	5.98	-0.02
8.00	4.02	-3.96	7.98	-0.02
10.00	5.02	-4.96	9.98	-0.02
12.00	6.02	-5.96	11.98	-0.02
14.00	7.06	-7.00	14.06	0.06
16.00	8.06	-7.98	16.04	0.04
18.00	9.06	-8.98	18.04	0.04
20.00	10.06	-9.98	20.04	0.04
22.00	11.06	-10.98	22.04	0.04
24.00	12.06	-11.98	24.04	0.04
26.00	13.08	-13.02	26.10	0.10
28.00	14.08	-14.02	28.10	0.10
30.00	15.08	-15.02	30.10	0.10
32.00	16.08	-16.04	32.12	0.12
34.00	17.10	-17.04	34.14	0.14
35.80	17.90	-17.84	35.74	-0.06

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 %.

-000-

Attapol P.  
เอกสาร ไมคณคุณ  
a 1037941



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

## Certificate of Calibration

Certificate No.: 21P1158  
Page: 1 of 2

Equipment: Aneroid Barometer  
Manufacturer: Barigo  
Model: 111MS

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.

Serial No.:  
ID No.: UAE.EMA2.109/2552

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:

Instrument	Model	Serial No.	Certificate No.	Due Date
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 Suwanasri  
✓ Attapol Panurach

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B 0256508





Cert.No.: 21P1158  
Page: 2 of 2

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

Range: 720 mmHg to 770 mmHg  
Scale Interval: 1 mmHg (The Fifth Estimate)

Increasing Pressure

Applied Pressure (mmHg)	718.84	728.94	739.19	749.76	760.18	770.97
UUC* Indication (mmHg)	720.0	730.0	740.0	750.0	760.0	770.0
Error (mmHg)	1.16	1.06	0.81	0.24	-0.18	-0.97

Decreasing Pressure

Applied Pressure (mmHg)	770.93	759.94	749.49	738.89	728.63	718.81
UUC* Indication (mmHg)	770.0	760.0	750.0	740.0	730.0	720.0
Error (mmHg)	-0.93	0.06	0.51	1.11	1.37	1.19

The uncertainty of measurement was  $\pm 0.24$  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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a 1046644



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
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534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG, BANGKOK 10250  
TEL. 0-2717-3000-24 FAX. 0-2719-9484



Certificate of Calibration

Certificate No.: 21H802  
Page: 1 of 2

Equipment: Dial Thermo-Hygrometer  
Manufacturer: Barigo  
Model: -  
Serial No.: -  
ID No.: UAE.ANV.003/2548  
Condition As-Received: Used Item  
Received Date: 29 March 2021  
Calibration Date: 31 March 2021  
Reference: 2103-1189WSC  
Ambient Temperature: ( 25  $\pm$  3 ) °C  
Relative Humidity: ( 50  $\pm$  20 ) %

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

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

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

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

Condition of this result of calibration

1. Reference standards instruments:

Instrument	Model	Serial No.	Certificate No.	Due Date
1) Standard Chilled Mirror Hygrometer Sensor	Dew Prime II	31863	18540	28 Jul 2021
2) Handheld Thermometer With Sensor	1521	ASA339	20198	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: Kraipon Onrat  
Issue Date: 20 April 2021

Approved Signatory:

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

เอกสารไมควคุม  
B 0258329



Cert. No.: 21H802  
Page: 2 of 2

Result of Calibration:-

Function: Humidity measurement.

Reference Temperature (°C)	Standard Humidity (%R.H.)	UUC* Reading (%R.H.)	Error (%R.H.)	Uncertainty of Measurement (±%R.H.)
25.0	40.1	39	-1.1	1.6
25.0	60.0	60	0.0	1.8
25.0	80.0	80	0.0	1.9

Result of Calibration:-

Function: Temperature measurement.

Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of Measurement (±°C)
20.011	20.0	-0.011	0.72
30.019	30.0	-0.019	0.72
34.989	35.0	0.511	0.72
40.006	40.0	-0.006	0.72

UUC\* : Unit Under Calibration

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

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a 1051240



United Analyst and Engineering Consultant Co., Ltd.  
3 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Phrakhanong, Bangkok 10260  
Tel. 0 2763 2828 Fax 0 2763 2800 www.uaeconsultant.com E-mail: uae@uaeconsultant.com

MULTI-POINT GAS TEST REPORT

Test Date: July 19, 2021

Equipment: Gas Analyzer (NO<sub>2</sub>) Model: 42i  
Manufacturer: Thermo Scientific Serial Number: 1180540062

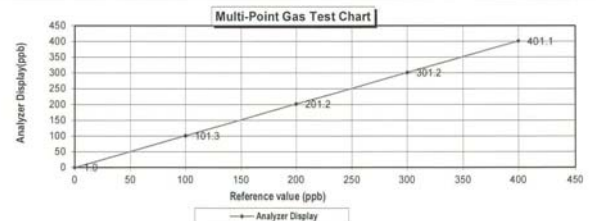
Standard Gas Concentration

Sulphur Dioxide (SO <sub>2</sub> )	44.75	PPM	Manufacturer:	Thermo Scientific
Nitric Oxide (NO)	45.35	PPM	Model:	146i
Methane (CH <sub>4</sub> )	-	PPM	Serial Number:	1180540071
Carbon Monoxide (CO)	1007			
Cylinder No.:	CC159599			
Expiration Date:	Jul 30, 2022			

Multi-point gas test data

Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1 Zero	0.0	1.00	1.00	1.00
Level 2 20.00%	101.3	1.30	1.28	1.28
Level 3 40.00%	201.2	1.20	0.60	0.60
Level 4 60.00%	301.2	1.20	0.40	0.40
Level 5 80.00%	401.1	1.10	0.27	0.27

Remark: Measuring Range 500.0 ppb  
Acceptable Limit  $\pm 5\%$   
Average Difference (%) 0.71



Calculate by  
Srinan Y.  
19/07/21

Approve by  
Rajin V. U.  
19/07/21

เอกสารไมควคุม

**MULTI-POINT GAS TEST REPORT**

Test Date : Feb 10, 2021

Equipment : Gas Analyzer (NO<sub>2</sub>) Model : 42i  
Manufacturer : Thermo Scientific Serial Number : 1180540064

**Standard Gas Concentration**

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

**Dilutor Detail**

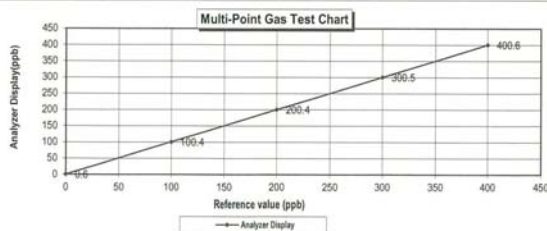
Manufacturer :	Thermo Scientific
Model :	146i
Serial Number :	1180540071

**Multi-point gas test data**

Level	Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.6	0.60	0.60	0.60
Level 2	20.00%	100.4	0.40	0.40	0.40
Level 3	40.00%	200.4	0.40	0.20	0.20
Level 4	60.00%	300.5	0.50	0.17	0.17
Level 5	80.00%	400.6	0.60	0.15	0.15

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

Average Difference (%) 0.30



Calculate by  
Sittichai Youngsai  
11 Feb 2021

Approve by  
P. Kerk N.  
11 Feb 2021

**MULTI-POINT GAS TEST REPORT**

Test Date : July 9, 2021

Equipment : Gas Analyzer (NO<sub>2</sub>) Model : 42i  
Manufacturer : Thermo Scientific Serial Number : 1182920008

**Standard Gas Concentration**

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

**Dilutor Detail**

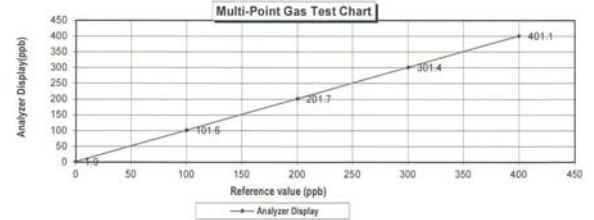
Manufacturer :	Thermo Scientific
Model :	146i
Serial Number :	1180540071

**Multi-point gas test data**

Level	Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1	Zero	1.9	1.90	1.90	1.90
Level 2	20.00%	101.6	1.60	1.57	1.57
Level 3	40.00%	201.7	1.70	0.84	0.84
Level 4	60.00%	301.4	1.40	0.46	0.46
Level 5	80.00%	401.1	1.10	0.27	0.27

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

Average Difference (%) 1.01



Calculate by  
Sittichai Youngsai  
9 July 2021

Approve by  
P. Kerk N.  
10 July 2021

## 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, NO<sub>2</sub>, SO<sub>2</sub>, 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 600/9-12/531, 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
NO <sub>x</sub>	45.00 PPM	44.76 PPM	G1	$\pm 0.8\%$ NIST Traceable	07/23/2019, 07/30/2019
NITRIC OXIDE	45.00 PPM	44.76 PPM	G1	$\pm 0.8\%$ NIST Traceable	07/23/2019, 07/30/2019
SULFUR DIOXIDE	45.00 PPM	45.35 PPM	G1	$\pm 1\%$ NIST Traceable	07/23/2019, 07/30/2019
CARBON MONOXIDE	1000 PPM	1007 PPM	G1	$\pm 0.4\%$ 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	$\pm 0.4\%$	Nov 08, 2023
NTRM	052411	KAL004307	50.03 PPM NITRIC OXIDE/NITROGEN	$\pm 0.80\%$	Mar 12, 2024
NTRM	18060121	KAL004215	250.0 PPM NO <sub>x</sub> /NITROGEN	$\pm 0.4\%$	Nov 08, 2023
NTRM	052411	KAL004307-NOX	50.03 PPM NO <sub>x</sub> /NITROGEN	$\pm 0.80\%$	Mar 12, 2024
NTRM	0141709	KAL003180	49.67 PPM SULFUR DIOXIDE/NITROGEN	$\pm 1.0\%$	Jun 20, 2022
NTRM	072508	KAL004570	970.0 PPM CARBON MONOXIDE/NITROGEN	$\pm 0.4\%$	May 14, 2021

**ANALYTICAL EQUIPMENT**

Instrument/Make/Model	Analytical Principle	Last Multi-point 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
SO <sub>2</sub> MKS FTIR 000929062	FTIR	Jul 22, 2019

Triad Data Available Upon Request

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



**MULTI-POINT GAS TEST REPORT**

Test Date : Feb 08, 2021

Equipment : Gas Analyzer (CO) Model : 48C  
Manufacturer : Thermo Environmental Instruments Serial Number : 48C-62011-333

**Standard Gas Concentration**

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

**Dilutor Detail**

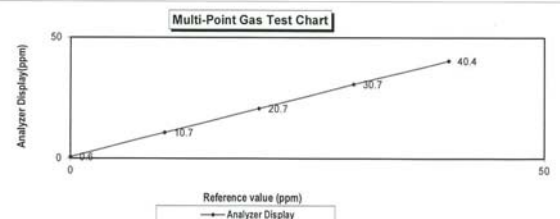
Manufacturer :	Thermo Scientific
Model :	146i
Serial Number :	1180540071

**Multi-point gas test data**

Level	Reference Value (ppm)	Analyzer Display (ppm)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.6	0.6	0.6	0.6
Level 2	20.00%	10.7	0.7	6.5	6.5
Level 3	40.00%	20.0	0.7	3.4	3.4
Level 4	60.00%	30.7	0.7	2.3	2.3
Level 5	80.00%	40.4	0.4	1.0	1.0

Remark : Measuring Range 50.0 ppm  
:Acceptable Limit  $\pm 5\%$

Average Difference (%) 2.76



Calculate by  
Sittichai Youngsai  
9 Feb 2021

Approve by  
P. Kerk N.  
9 Feb 2021



### MULTI-POINT GAS TEST REPORT

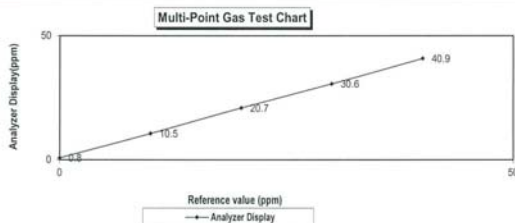
**Test Date** : Mar 05, 2021

**Equipment** : Gas Analyzer (CO) **Model** : 48C  
**Manufacturer** : Thermo Environmental Instruments **Serial Number** : 48C-69160-362

Standard Gas Concentration		Dilutor Detail	
Sulphur Dioxide (SO <sub>2</sub> )	44.75 PPM	Manufacturer :	Thermo Scientific
Nitric Oxide (NO)	45.35 PPM	Model :	146i
Methane (CH <sub>4</sub> )	- PPM	Serial Number :	1180540071
Carbon Monoxide (CO)	1007 PPM		
Cylinder No. :	CC159599		
Expiration Date :	Jul 30, 2022		

#### Multi-point gas test data

Reference Value (ppm)			Analyzer Display (ppm)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	0.8	0.8	0.8	0.8
Level 2	20.00%	10.0	10.5	0.5	4.8	4.8
Level 3	40.00%	20.0	20.7	0.7	3.4	3.4
Level 4	60.00%	30.0	30.6	0.6	2.0	2.0
Level 5	80.00%	40.0	40.9	0.9	2.2	2.2
Remark : Measuring Range			50.0 ppm	Average Difference (%)		2.62



Calculate by

Sirichai Sangsri  
5, 03, 64

Approve by

P. N. N.  
E, Mar 2021

Page 1 of 1

เอกสารไม่ควบคุม

### MULTI-POINT GAS TEST REPORT

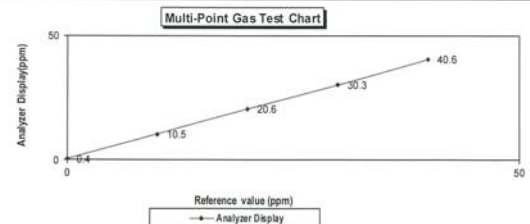
**Test Date** : Jan 13, 2021

**Equipment** : Gas Analyzer (CO) **Model** : 48C  
**Manufacturer** : Thermo Environmental Instruments **Serial Number** : 48C-71185-368

Standard Gas Concentration		Dilutor Detail	
Sulphur Dioxide (SO <sub>2</sub> )	44.75 PPM	Manufacturer :	Thermo Scientific
Nitric Oxide (NO)	45.35 PPM	Model :	146i
Methane (CH <sub>4</sub> )	- PPM	Serial Number :	1180540071
Carbon Monoxide (CO)	1007 PPM		
Cylinder No. :	CC159599		
Expiration Date :	Jul 30, 2022		

#### Multi-point gas test data

Reference Value (ppm)			Analyzer Display (ppm)	Difference Error	Percent Error	[% Error ]
Level 1	Zero	0.0	0.4	0.4	0.4	0.4
Level 2	20.00%	10.0	10.5	0.5	4.8	4.8
Level 3	40.00%	20.0	20.6	0.6	2.9	2.9
Level 4	60.00%	30.0	30.3	0.3	1.0	1.0
Level 5	80.00%	40.0	40.6	0.6	1.5	1.5
Remark : Measuring Range		50.0 ppm	Average Difference (%)		2.11	



Calculate by

Sirichai Sangsri  
16, 1, 10, 2021

Approve by

P. N. N.  
14, Jan 2021

Page 1 of 1

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Airgas Specialty Gases  
Airgas USA, LLC  
6441 Easton Road  
Bldg. 1  
Plumsteadville, PA 18949  
Airgas.com

### 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 600/9-12/531, 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.

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

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	18060121	KAL040215	249.9 PPM NITRIC OXIDE/NITROGEN	$\pm 0.4\%$	Nov 08, 2023
NTRM	052411	KAL040307	50.03 PPM NITRIC OXIDE/NITROGEN	$\pm 0.80\%$	Mar 12, 2024
NTRM	18060121	KAL040215	250.0 PPM NOx/NITROGEN	$\pm 0.4\%$	Nov 08, 2023
NTRM	052411	KAL040307-NOX	50.03 PPM NOx/NITROGEN	$\pm 0.80\%$	Mar 12, 2024
NTRM	0141709	KAL003180	49.67 PPM SULFUR DIOXIDE/NITROGEN	$\pm 1.0\%$	Jun 20, 2022
NTRM	072508	KAL040570	970.0 PPM CARBON MONOXIDE/NITROGEN	$\pm 0.4\%$	May 14, 2021

ANALYTICAL EQUIPMENT		
Instrument/Make/Model	Analytical Principle	Last Multi-point 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: RANW 51319-CM03  
POM 5219002210  
GROSS WEIGHT: 28.6 KG  
NET WEIGHT: 4.1 KG



Signature on file  
Approved for Release

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INNOVATIVE INSTRUMENT CALIBRATION LAB  
INNOVATIVE INSTRUMENT CO., LTD. HEAD OFFICE  
7/139 MOO 13, SOI SUSTINAKORN 11 TAMBON BANG KAO,  
AMPHOE BANG PHU SAMUT PRAKAN PROVINCE 10540 THAILAND  
TEL: 0600-2116-5800-1 FAX: 0600-2116-7140



### Certificate of Calibration

**Customer**  
Name : UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD. Certificate No : 21-ACT-326  
Address : 81 Soi Udomsuk 41, Sukhumvit Road, Bangkok, Prakanong, Bangkok 10260 Request No : Req-2021-0994

**Unit Under Calibration Details**  
Measurement item : Acoustic Calibrator Class : 1  
Manufacturer : SVANTEK Range : 94, 114 dB / 1000 Hz  
Model : SV36 Instrument Status : Used  
Serial Number : 107224  
ID : UAE.EFM.171/2564

**Calibration Environment and Details**  
Temperature : ( 23  $\pm$  2 °C )  
Humidity : ( 50  $\pm$  20 %RH )  
Barometric Pressure : ( 1013  $\pm$  10.0 hPa )  
Received Date : 22 July 2021  
Calibration Date : 24 August 2021  
Location of Calibration : LAB 1 Acoustic  
Calibration Procedure : In-house method CP-ACT-02 based on IEC 60942:2017 Electroacoustics - Sound calibrators

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

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

**Note**

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

Calibrated By : Mr. Noppadon Luangart  
Service Calibration Engineer

Approved By : Mr. Pacit Mathavorn  
Calibration Engineer Supervisor  
Issue Date : 24 August 2021

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

#### 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	94.08	0.08	-	-	0.11	0.25
114 dB / 1000 Hz	114.13	0.13	-	-	0.11	0.25

#### Frequency of Sound pressure level

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

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

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

#### Note :

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

End of Calibration

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

Certificate Number 2021000734

#### Customer:

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

#### Model Number

LxT2

#### Serial Number

0005407

#### 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

21 Jan 2021

#### Calibration Due

23.47 °C ± 0.25 °C

#### Temperature

52.8 %RH ± 2.0 %RH

#### Humidity

86.25 kPa ± 0.13 kPa

#### Static Pressure

#### Evaluation Method

Tested electrically using Larson Davis PRMLxT2C S/N 073802 and a 12.0 pF capacitor to simulate microphone capacitance. Data reported in dB re 20 µPa assuming a microphone sensitivity of 50.0 mV/Pa.

#### Compliance Standards

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

IEC 60651:2001 Type 2

IEC 60804:2000 Type 2

IEC 61252:2002

IEC 61672:2013 Class 2

IEC 61260:2001 Class 2

ANSI S1.4-2014 Class 2

ANSI S1.4 (R2006) Type 2

ANSI S1.25 (R2007)

ANSI S1.43 (R2007) Type 2

ANSI S1.11 (R2009) Class 2

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

The quality system is registered to ISO 9001:2015.

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

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

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Correction data from Larson Davis LxT Manual for SoundTrack LxT & SoundExpert LxT, 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 2021000734

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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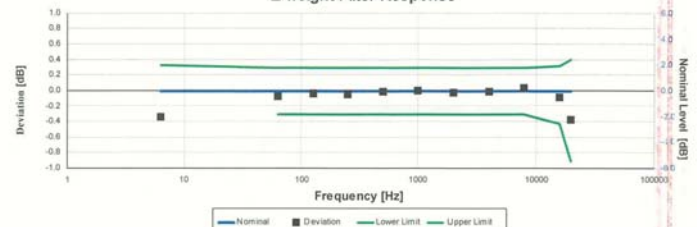
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Certificate Number 2021000734

#### 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	-0.34	-0.34	-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	-0.37	-0.37	-0.91	0.41	0.15	Pass

— End of measurement results—

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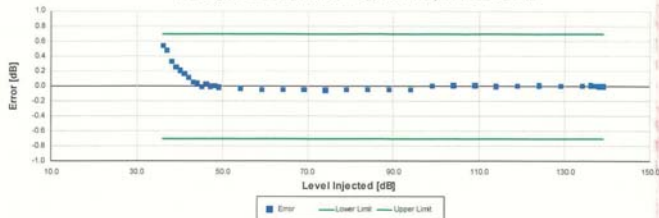
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## A-weighted Broadband Log Linearity: 8,000.00 Hz



Broadband level linearity performed according to IEC 61672-3:2013 16 and ANSI S1.4-2014 Part 3: 16 for compliance to IEC 61672-1:2013 5.6, IEC 60804-2000 6.2, IEC 61252-2002 8, ANSI S1.4 (R2006) 6.9, ANSI S1.4-2014 Part 1: 5.6, ANSI S1.4.3 (R2007) 6.2

Level [dB]	Error [dB]	Lower limit [dB]	Upper limit [dB]	Expanded Uncertainty [dB]	Result
36.00	0.54	-0.70	0.70	0.16	Pass
37.00	0.48	-0.70	0.70	0.16	Pass
38.00	0.33	-0.70	0.70	0.16	Pass
39.00	0.25	-0.70	0.70	0.16	Pass
40.00	0.21	-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	0.06	-0.70	0.70	0.17	Pass
44.00	0.04	-0.70	0.70	0.17	Pass
45.00	0.00	-0.70	0.70	0.16	Pass
46.00	0.03	-0.70	0.70	0.16	Pass
47.00	0.00	-0.70	0.70	0.16	Pass
48.00	0.00	-0.70	0.70	0.16	Pass
49.00	-0.01	-0.70	0.70	0.16	Pass
54.00	-0.03	-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	-0.04	-0.70	0.70	0.16	Pass
74.00	-0.05	-0.70	0.70	0.16	Pass
79.00	-0.05	-0.70	0.70	0.16	Pass
84.00	-0.04	-0.70	0.70	0.16	Pass
89.00	-0.05	-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
139.00	0.01	-0.70	0.70	0.15	Pass
144.00	0.00	-0.70	0.70	0.15	Pass
149.00	0.00	-0.70	0.70	0.15	Pass

-- End of measurement results--

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## Peak Rise Time

Peak rise time performed according to IEC 60651:2001 9.4.2 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	134.80	133.33	135.33	0.15	Pass	
		Positive Pulse	134.80	133.32	135.32	0.15	Pass	
	30	Negative Pulse	133.86	133.33	135.33	0.15	Pass	
		Positive Pulse	133.86	133.32	135.32	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	-0.12	± 1.00	0.15 ±	Pass
	5	-0.13	± 1.00	0.16 ±	Pass
115.95	3	-0.13	± 1.00	0.15 ±	Pass
	5	-0.13	± 1.00	0.15 ±	Pass
105.95	3	-0.12	± 1.00	0.15 ±	Pass
	5	-0.13	± 1.00	0.15 ±	Pass

## Negative Pulse Crest Factor

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

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	0.15 ±	Pass
115.95	3	-0.13	± 1.00	0.15 ±	Pass
	5	-0.12	± 1.00	0.15 ±	Pass
105.95	3	-0.13	± 1.00	0.15 ±	Pass
	5	-0.11	± 1.00	0.15 ±	Pass

## Gain

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

Measurement	Test Result [dB]	Lower limit [dB]	Upper limit [dB]	Expanded Uncertainty [dB]	Result
0 dB Gain	93.95	93.90	94.10	0.15	Pass
0 dB Gain, Linearity	40.26	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	26.88	36.00	Pass
C-weight Noise Floor	26.48	35.00	Pass
Z-weight Noise Floor	32.32	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	135.35	134.15	135.75	0.15	Pass
THD	-66.98	-58.00	-58.00	0.01 ±	Pass
THD+N	-62.82	-58.00	-58.00	0.01 ±	Pass

-- End of measurement results--

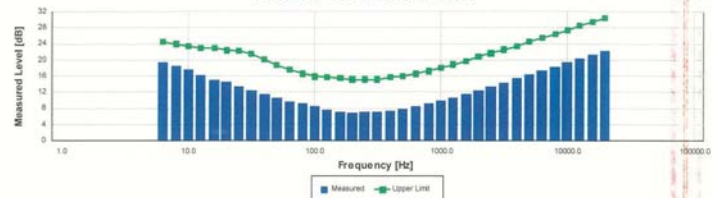
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## 1/3-Octave Self-Generated Noise



The SLM is set to low range.

Frequency [Hz]	Test Result [dB]	Upper limit [dB]	Result
6.30	19.52	24.60	Pass
8.00	18.49	24.00	Pass
10.00	17.75	23.50	Pass
12.50	16.32	23.00	Pass
16.00	15.18	22.90	Pass
20.00	14.71	22.40	Pass
25.00	13.51	22.30	Pass
31.50	12.54	21.50	Pass
40.00	11.63	20.20	Pass
50.00	10.78	18.80	Pass
63.00	9.83	17.60	Pass
80.00	9.18	16.60	Pass
100.00	8.49	15.90	Pass
125.00	7.73	15.70	Pass
160.00	7.20	15.50	Pass
200.00	7.05	15.20	Pass
250.00	7.13	15.20	Pass
315.00	7.15	15.20	Pass
400.00	7.49	15.70	Pass
500.00	7.97	16.00	Pass
630.00	8.48	16.60	Pass
800.00	9.24	17.30	Pass
1,000.00	10.02	18.10	Pass
1,250.00	10.78	18.90	Pass
1,600.00	11.71	19.80	Pass
2,000.00	12.58	20.80	Pass
2,500.00	13.53	21.70	Pass
3,150.00	14.46	22.60	Pass
4,000.00	15.47	23.50	Pass
5,000.00	16.42	24.50	Pass
6,300.00	17.41	25.50	Pass
8,000.00	18.36	26.50	Pass
10,000.00	19.39	27.40	Pass
12,500.00	20.38	28.50	Pass
16,000.00	21.36	29.50	Pass
20,000.00	22.35	30.40	Pass

-- End of measurement results--

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Signatory: Ron Harris

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# Calibration Certificate

Certificate Number 2021000735

Customer:

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

Model Number LxT2  
Serial Number 0005408  
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 21 Jan 2021

Calibration Due

Temperature 23.48 °C ± 0.25 °C

Humidity 52.8 %RH ± 2.0 %RH

Static Pressure 86.25 kPa ± 0.13 kPa

**Evaluation Method** Tested electrically using Larson Davis PRMLxT2C S/N 071534 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 60951:2001 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 2021000735

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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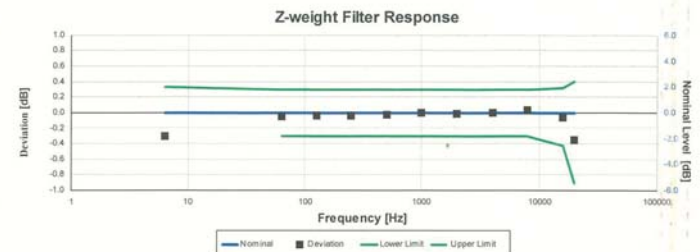


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D0001.8407 Rev E

Certificate Number 2021000735



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 60951:2001 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	-0.31	-0.31	-1.11	0.33	0.15	Pass
63.10	-0.05	-0.05	-0.30	0.30	0.15	Pass
125.89	-0.04	-0.04	-0.30	0.30	0.15	Pass
251.19	-0.04	-0.04	-0.30	0.30	0.15	Pass
501.19	-0.02	-0.02	-0.30	0.30	0.15	Pass
1,000.00	0.00	0.00	-0.30	0.30	0.15	Pass
1,995.26	-0.02	-0.02	-0.30	0.30	0.15	Pass
3,981.07	0.00	0.00	-0.30	0.30	0.15	Pass
7,943.28	0.04	0.04	-0.30	0.30	0.15	Pass
15,848.93	-0.07	-0.07	-0.42	0.32	0.15	Pass
19,952.62	-0.35	-0.35	-0.30	0.41	0.15	Pass

-- End of measurement results --

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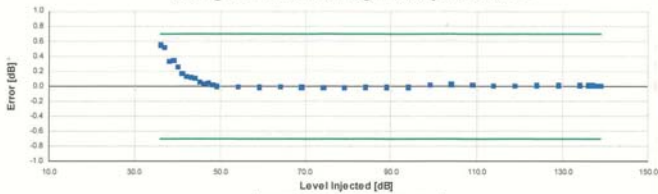
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## A-weighted Broadband Log Linearity: 8,000.00 Hz



Broadband level linearity performed according to IEC 61672-3:2013 16 and ANSI S1.4-2014 Part 3: 16 for compliance to IEC 61672-1:2013 5.6, IEC 60804:2000 6.2, IEC 61252:2002 8, ANSI S1.4 (R2006) 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	0.55	-0.70	0.70	0.16	Pass
37.00	0.52	-0.70	0.70	0.16	Pass
38.00	0.33	-0.70	0.70	0.16	Pass
39.00	0.34	-0.70	0.70	0.16	Pass
40.00	0.26	-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	0.12	-0.70	0.70	0.17	Pass
44.00	0.10	-0.70	0.70	0.17	Pass
45.00	0.06	-0.70	0.70	0.16	Pass
46.00	0.03	-0.70	0.70	0.16	Pass
47.00	0.05	-0.70	0.70	0.16	Pass
48.00	0.02	-0.70	0.70	0.16	Pass
49.00	0.00	-0.70	0.70	0.16	Pass
54.00	-0.01	-0.70	0.70	0.16	Pass
59.00	-0.01	-0.70	0.70	0.16	Pass
64.00	-0.01	-0.70	0.70	0.16	Pass
69.00	-0.01	-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	-0.01	-0.70	0.70	0.16	Pass
89.00	-0.01	-0.70	0.70	0.16	Pass
94.00	-0.01	-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	0.02	-0.70	0.70	0.15	Pass
114.00	0.00	-0.70	0.70	0.15	Pass
119.00	0.01	-0.70	0.70	0.15	Pass
124.00	0.01	-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	0.01	-0.70	0.70	0.15	Pass
139.00	0.00	-0.70	0.70	0.15	Pass

-- End of measurement results--

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## Peak Rise Time

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

Amplitude [dB]	Duration [μs]		Test Result [dB]	Lower limit [dB]	Upper limit [dB]	Expanded Uncertainty [dB]	Result
136.95	40	Negative Pulse	134.52	133.04	135.04	0.15	Pass
		Positive Pulse	134.51	133.03	135.03	0.15	Pass
	30	Negative Pulse	133.57	133.04	135.04	0.15	Pass
		Positive Pulse	133.58	133.03	135.03	0.15	Pass
-- End of measurement results--							

## Positive Pulse Crest Factor

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

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

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

## Negative Pulse Crest Factor

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

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

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

## Gain

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

Measurement	Test Result [dB]	Lower limit [dB]	Upper limit [dB]	Expanded Uncertainty [dB]	Result
0 dB Gain	93.97	93.90	94.10	0.15	Pass
0 dB Gain, Linearity	40.28	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	26.78	36.00	Pass
C-weight Noise Floor	26.37	35.00	Pass
Z-weight Noise Floor	32.21	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	135.08	134.15	135.75	0.15	Pass
THD	-66.85	-58.00	-58.00	0.01 ±	Pass
THD+N	-62.67	-58.00	-58.00	0.01 ±	Pass

-- End of measurement results--

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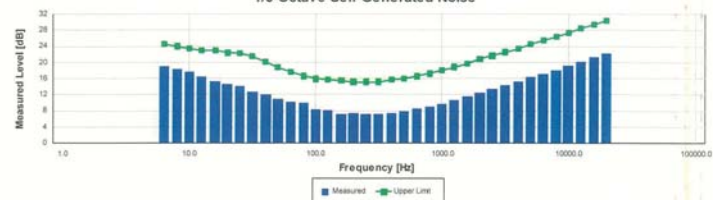
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## 1/3-Octave Self-Generated Noise



The SLM is set to low range.

Frequency [Hz]	Test Result [dB]	Upper limit [dB]	Result
6.30	18.99	24.60	Pass
8.00	18.35	24.00	Pass
10.00	17.55	23.50	Pass
12.50	16.37	23.00	Pass
16.00	15.28	22.90	Pass
20.00	14.72	22.40	Pass
25.00	14.08	22.30	Pass
31.50	12.80	21.50	Pass
40.00	12.16	20.20	Pass
50.00	10.99	18.80	Pass
63.00	10.11	17.60	Pass
80.00	9.87	16.60	Pass
100.00	8.44	15.90	Pass
125.00	8.10	15.70	Pass
160.00	7.30	15.50	Pass
200.00	7.36	15.20	Pass
250.00	7.24	15.20	Pass
315.00	7.19	15.20	Pass
400.00	7.44	15.70	Pass
500.00	7.92	16.00	Pass
630.00	8.49	16.60	Pass
800.00	9.12	17.30	Pass
1,000.00	9.85	18.10	Pass
1,250.00	10.74	18.90	Pass
1,600.00	11.54	19.80	Pass
2,000.00	12.45	20.80	Pass
2,500.00	13.35	21.70	Pass
3,150.00	14.31	22.60	Pass
4,000.00	15.36	23.50	Pass
5,000.00	16.40	24.50	Pass
6,300.00	17.24	25.50	Pass
8,000.00	18.19	26.50	Pass
10,000.00	19.30	27.40	Pass
12,500.00	20.20	28.50	Pass
16,000.00	21.24	29.50	Pass
20,000.00	22.23	30.40	Pass

-- End of measurement results--

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Signature: Ron Harris

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# Calibration Certificate

Certificate Number 2021000746

Customer:

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

Model Number LxT2

Serial Number 0006614

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 21 Jan 2021

Calibration Due

Temperature 23.57 °C ± 0.25 °C

Humidity 50.5 %RH ± 2.0 %RH

Static Pressure 86.21 kPa ± 0.13 kPa

**Evaluation Method** Tested electrically using Larson Davis PRMLxT2C S/N 073796 and a 12.0 pF capacitor to simulate microphone capacitance. Data reported in dB re 20 µPa assuming a microphone sensitivity of 50.0 mV/Pa.

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

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

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

The quality system is registered to ISO 9001:2015.

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

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

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

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

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

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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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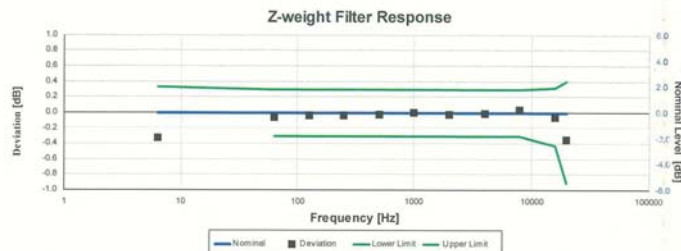
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Certificate Number 2021000746



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	-0.32	-0.32	-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	-0.04	-0.04	-0.30	0.30	0.15	Pass
501.19	-0.03	-0.03	-0.30	0.30	0.15	Pass
1,000.00	0.00	0.00	-0.30	0.30	0.15	Pass
1,995.26	-0.02	-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	-0.06	-0.06	-0.42	0.32	0.15	Pass
19,952.62	-0.35	-0.35	-0.91	0.41	0.15	Pass

-- End of measurement results --

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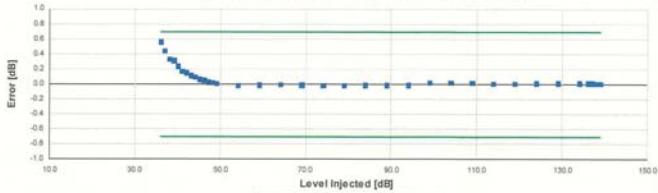
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## A-weighted Broadband Log Linearity: 8,000.00 Hz



Broadband level linearity performed according to IEC 61672-3:2013 16 and ANSI S1.4-2014 Part 3: 16 for compliance to IEC 61672-1:2013 5.6, IEC 60804:2000 6.2, IEC 61252:2002 8, ANSI S1.4 (R2006) 6.9, ANSI S1.4-2014 Part 1: 5.6, ANSI S1.4.3 (R2007) 6.2

Level [dB]	Error [dB]	Lower limit [dB]	Upper limit [dB]	Expanded Uncertainty [dB]	Result
36.00	0.58	-0.70	0.70	0.16	Pass
37.00	0.44	-0.70	0.70	0.16	Pass
38.00	0.33	-0.70	0.70	0.16	Pass
39.00	0.31	-0.70	0.70	0.16	Pass
40.00	0.24	-0.70	0.70	0.16	Pass
41.00	0.17	-0.70	0.70	0.16	Pass
42.00	0.15	-0.70	0.70	0.16	Pass
43.00	0.11	-0.70	0.70	0.17	Pass
44.00	0.09	-0.70	0.70	0.17	Pass
45.00	0.06	-0.70	0.70	0.16	Pass
46.00	0.05	-0.70	0.70	0.16	Pass
47.00	0.02	-0.70	0.70	0.16	Pass
48.00	0.02	-0.70	0.70	0.16	Pass
49.00	0.01	-0.70	0.70	0.16	Pass
54.00	-0.02	-0.70	0.70	0.16	Pass
59.00	-0.01	-0.70	0.70	0.16	Pass
64.00	-0.01	-0.70	0.70	0.16	Pass
69.00	-0.01	-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	-0.01	-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	0.01	-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	0.01	-0.70	0.70	0.15	Pass
139.00	0.00	-0.70	0.70	0.15	Pass

-- End of measurement results--

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## Peak Rise Time

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

Amplitude [dB]	Duration [μs]		Test Result [dB]	Lower limit [dB]	Upper limit [dB]	Expanded Uncertainty [dB]	Result
136.95	40	Negative Pulse	134.92	133.44	135.44	0.15	Pass
		Positive Pulse	134.92	133.44	135.44	0.15	Pass
	30	Negative Pulse	133.99	133.44	135.44	0.15	Pass
		Positive Pulse	133.85	133.44	135.44	0.15	Pass
-- End of measurement results--							

## Positive Pulse Crest Factor

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

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

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

## Negative Pulse Crest Factor

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

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

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

## Gain

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

Measurement	Test Result [dB]	Lower limit [dB]	Upper limit [dB]	Expanded Uncertainty [dB]	Result
0 dB Gain	93.97	93.90	94.10	0.15	Pass
0 dB Gain, Linearity	40.30	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	26.89	36.00	Pass
C-weight Noise Floor	27.12	35.00	Pass
Z-weight Noise Floor	32.69	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	135.49	134.15	135.75	0.15	Pass
THD	-57.14	-58.00	0.01 ±	0.01 ±	Pass
THD+N	-52.82	-58.00	0.01 ±	0.01 ±	Pass

-- End of measurement results--

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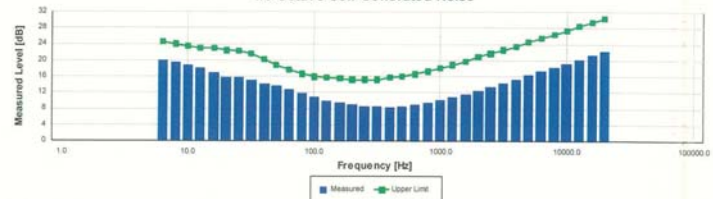
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## 1/3-Octave Self-Generated Noise



The SLM is set to low range.

Frequency [Hz]	Test Result [dB]	Upper limit [dB]	Result
6.30	19.87	24.50	Pass
8.00	19.45	24.00	Pass
10.00	18.70	23.50	Pass
12.50	18.00	23.00	Pass
16.00	16.94	22.90	Pass
20.00	15.77	22.40	Pass
25.00	15.75	22.30	Pass
31.50	15.19	21.50	Pass
40.00	14.10	20.20	Pass
50.00	13.75	18.80	Pass
63.00	12.71	17.60	Pass
80.00	11.73	16.60	Pass
100.00	10.80	15.90	Pass
125.00	10.01	15.70	Pass
160.00	9.51	15.50	Pass
200.00	9.17	15.20	Pass
250.00	8.62	15.20	Pass
315.00	8.49	15.20	Pass
400.00	8.47	15.70	Pass
500.00	8.63	16.00	Pass
630.00	8.98	16.60	Pass
800.00	9.55	17.30	Pass
1,000.00	10.15	18.10	Pass
1,250.00	10.85	18.90	Pass
1,600.00	11.70	19.80	Pass
2,000.00	12.51	20.80	Pass
2,500.00	13.47	21.70	Pass
3,150.00	14.45	22.60	Pass
4,000.00	15.40	23.50	Pass
5,000.00	16.38	24.50	Pass
6,300.00	17.34	25.50	Pass
8,000.00	18.29	26.50	Pass
10,000.00	19.33	27.40	Pass
12,500.00	20.29	28.50	Pass
16,000.00	21.28	29.50	Pass
20,000.00	22.27	30.40	Pass

-- End of measurement results--

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Signatory: *Ron Harris*

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# Calibration Certificate

Certificate Number 2021000754

Customer:

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

Model Number LxT2

Serial Number 0006615

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 21 Jan 2021

Calibration Due

Temperature 23.47 °C ± 0.25 °C

Humidity 52.7 %RH ± 2.0 %RH

Static Pressure 86.13 kPa ± 0.13 kPa

**Evaluation Method** Tested electrically using Larson Davis PRMLxT2C S/N 073797 and a 12.0 pF capacitor to simulate microphone capacitance. Data reported in dB re 20 µPa assuming a microphone sensitivity of 50.0 mV/Pa.

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

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

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

The quality system is registered to ISO 9001:2015.

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

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

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Correction data from Larson Davis LxT Manual for SoundTrack LxT & SoundExpert LxT, 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 2021000754

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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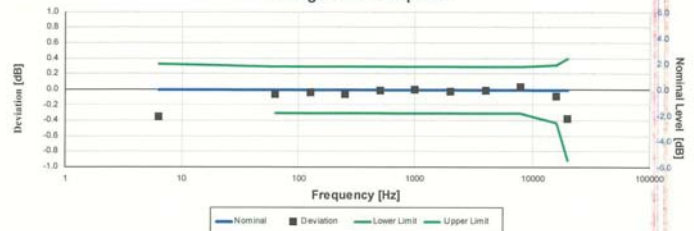


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Certificate Number 2021000754

## 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	-0.34	-0.34	-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	-0.01	-0.01	-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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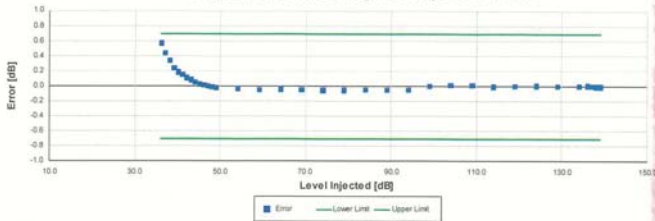
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## A-weighted Broadband Log Linearity: 8,000.00 Hz



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 60504-2000 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	0.57	-0.70	0.70	0.16	Pass
37.00	0.44	-0.70	0.70	0.16	Pass
38.00	0.34	-0.70	0.70	0.16	Pass
39.00	0.24	-0.70	0.70	0.16	Pass
40.00	0.19	-0.70	0.70	0.16	Pass
41.00	0.16	-0.70	0.70	0.16	Pass
42.00	0.11	-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	0.03	-0.70	0.70	0.16	Pass
46.00	0.02	-0.70	0.70	0.16	Pass
47.00	0.00	-0.70	0.70	0.16	Pass
48.00	-0.01	-0.70	0.70	0.16	Pass
49.00	-0.02	-0.70	0.70	0.16	Pass
54.00	-0.03	-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	-0.04	-0.70	0.70	0.16	Pass
74.00	-0.05	-0.70	0.70	0.16	Pass
79.00	-0.05	-0.70	0.70	0.16	Pass
84.00	-0.04	-0.70	0.70	0.16	Pass
89.00	-0.05	-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--

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## Peak Rise Time

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

Amplitude [dB]	Duration [μs]		Test Result [dB]	Lower limit [dB]	Upper limit [dB]	Expanded Uncertainty [dB]	Result
136.95	40	Negative Pulse	134.96	133.49	135.49	0.15	Pass
		Positive Pulse	134.97	133.49	135.49	0.15	Pass
	30	Negative Pulse	133.96	133.49	135.49	0.15	Pass
		Positive Pulse	134.04	133.49	135.49	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	-0.13	± 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

## 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	-0.13	± 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	-0.12	± 1.00	0.15 ±	Pass

## Gain

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

Measurement	Test Result [dB]	Lower limit [dB]	Upper limit [dB]	Expanded Uncertainty [dB]	Result
0 dB Gain	93.94	93.89	94.09	0.15	Pass
0 dB Gain, Linearity	40.25	39.39	40.79	0.16	Pass
OBA Low Range	93.99	93.89	94.09	0.15	Pass
OBA Normal Range	93.99	93.20	94.80	0.15	Pass

-- End of measurement results--

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## Broadband Noise Floor

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

Measurement	Test Result [dB]	Upper limit [dB]	Result
A-weight Noise Floor	26.87	36.00	Pass
C-weight Noise Floor	26.65	35.00	Pass
Z-weight Noise Floor	32.45	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	135.52	134.15	135.75	0.15	Pass
THD	-66.02	-58.00	-58.00	0.01 ±	Pass
THD+N	-62.17	-58.00	-58.00	0.01 ±	Pass

-- End of measurement results--

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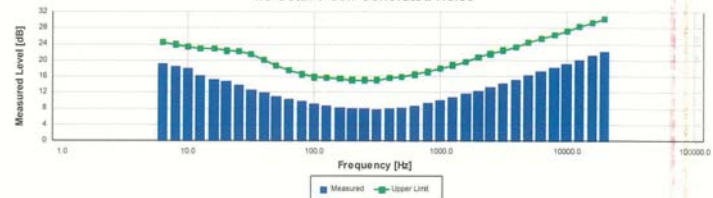
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## 1/3-Octave Self-Generated Noise



The SLM is set to low range.

Frequency [Hz]	Test Result [dB]	Upper limit [dB]	Result
6.30	19.29	24.60	Pass
8.00	18.56	24.00	Pass
10.00	18.13	23.50	Pass
12.50	16.35	23.00	Pass
16.00	15.38	22.90	Pass
20.00	14.80	22.40	Pass
25.00	13.96	22.30	Pass
31.50	12.84	21.50	Pass
40.00	12.10	20.20	Pass
50.00	11.07	18.80	Pass
63.00	10.43	17.60	Pass
80.00	10.01	16.60	Pass
100.00	9.29	15.90	Pass
125.00	8.85	15.70	Pass
160.00	8.48	15.50	Pass
200.00	8.15	15.20	Pass
250.00	8.05	15.20	Pass
315.00	7.93	15.20	Pass
400.00	8.09	15.70	Pass
500.00	8.40	16.00	Pass
630.00	8.83	16.60	Pass
800.00	9.46	17.30	Pass
1,000.00	10.13	18.10	Pass
1,250.00	10.96	18.90	Pass
1,600.00	11.79	19.80	Pass
2,000.00	12.61	20.80	Pass
2,500.00	13.49	21.70	Pass
3,150.00	14.48	22.60	Pass
4,000.00	15.43	23.50	Pass
5,000.00	16.36	24.50	Pass
6,300.00	17.31	25.50	Pass
8,000.00	18.33	26.50	Pass
10,000.00	19.28	27.40	Pass
12,500.00	20.28	28.50	Pass
16,000.00	21.27	29.50	Pass
20,000.00	22.27	30.40	Pass

-- End of measurement results--

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Signatory: *Ron Harris*

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## Calibration Certificate

Certificate Number 2021000753

Customer:

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

Model Number LxT2

Serial Number 0006616

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 21 Jan 2021

Calibration Due

Temperature 23.47 °C ± 0.25 °C

Humidity 52.7 %RH ± 2.0 %RH

Static Pressure 86.13 kPa ± 0.13 kPa

**Evaluation Method** Tested electrically using Larson Davis PRLxT2C S/N 073799 and a 12.0 pF capacitor to simulate microphone capacitance. Data reported in dB re 20 µPa assuming a microphone sensitivity of 50.0 mV/Pa.

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

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

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

The quality system is registered to ISO 9001:2015.

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

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

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

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

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Certificate Number 2021000753

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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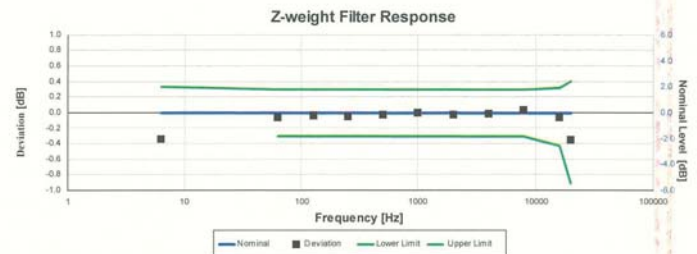


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Electrical signal test of frequency weighting performed according to IEC 61672-3:2013 13 and ANSI S1.4-2014 Part 3: 13 for compliance to IEC 61672-1:2013 5.5, IEC 60651:2001 6.1 and 9.2.2, IEC 60804:2000 5, ANSI S1.4:1993 (R2006) 5.1 and 8.2.1, ANSI 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	-0.33	-0.33	-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	-0.05	-0.05	-0.30	0.30	0.15	Pass
501.19	-0.03	-0.03	-0.30	0.30	0.15	Pass
1,000.00	0.00	0.00	-0.30	0.30	0.15	Pass
1,995.26	-0.02	-0.02	-0.30	0.30	0.15	Pass
3,981.07	-0.01	-0.01	-0.30	0.30	0.15	Pass
7,943.28	0.04	0.04	-0.30	0.30	0.15	Pass
15,948.93	-0.07	-0.07	-0.42	0.32	0.15	Pass
19,952.62	-0.35	-0.35	-0.91	0.41	0.15	Pass

-- End of measurement results--

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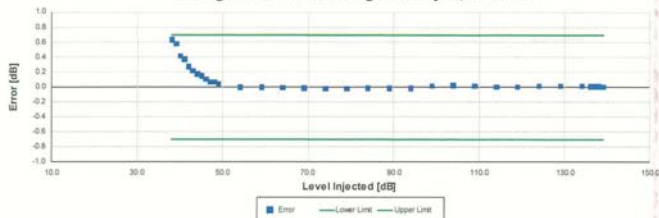
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## A-weighted Broadband Log Linearity: 8,000.00 Hz



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
38.00	0.63	-0.70	0.70	0.15	Pass
39.00	0.58	-0.70	0.70	0.16	Pass
40.00	0.42	-0.70	0.70	0.16	Pass
41.00	0.37	-0.70	0.70	0.16	Pass
42.00	0.27	-0.70	0.70	0.16	Pass
43.00	0.22	-0.70	0.70	0.17	Pass
44.00	0.17	-0.70	0.70	0.17	Pass
45.00	0.15	-0.70	0.70	0.16	Pass
46.00	0.10	-0.70	0.70	0.16	Pass
47.00	0.07	-0.70	0.70	0.16	Pass
48.00	0.07	-0.70	0.70	0.16	Pass
49.00	0.05	-0.70	0.70	0.16	Pass
54.00	0.00	-0.70	0.70	0.16	Pass
59.00	0.00	-0.70	0.70	0.16	Pass
64.00	0.00	-0.70	0.70	0.16	Pass
69.00	-0.01	-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	-0.01	-0.70	0.70	0.16	Pass
89.00	-0.01	-0.70	0.70	0.16	Pass
94.00	-0.01	-0.70	0.70	0.16	Pass
99.00	0.02	-0.70	0.70	0.15	Pass
104.00	0.02	-0.70	0.70	0.15	Pass
109.00	0.02	-0.70	0.70	0.15	Pass
114.00	0.01	-0.70	0.70	0.15	Pass
119.00	0.01	-0.70	0.70	0.15	Pass
124.00	0.01	-0.70	0.70	0.15	Pass
129.00	0.02	-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	0.01	-0.70	0.70	0.15	Pass
139.00	0.01	-0.70	0.70	0.15	Pass

-- End of measurement results--

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## Peak Rise Time

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

Amplitude [dB]	Duration [μs]		Test Result [dB]	Lower limit [dB]	Upper limit [dB]	Expanded Uncertainty [dB]	Result
136.95	40	Negative Pulse	134.45	132.96	134.96	0.15	Pass
		Positive Pulse	134.44	132.95	134.95	0.15	Pass
	30	Negative Pulse	133.51	132.96	134.96	0.15	Pass
		Positive Pulse	133.51	132.95	134.95	0.15	Pass
-- End of measurement results--							

## Positive Pulse Crest Factor

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

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

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

## Negative Pulse Crest Factor

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

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

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

## Gain

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

Measurement	Test Result [dB]	Lower limit [dB]	Upper limit [dB]	Expanded Uncertainty [dB]	Result
0 dB Gain	93.97	93.90	94.10	0.15	Pass
0 dB Gain, Linearity	40.35	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	29.14	36.00	Pass
C-weight Noise Floor	28.46	35.00	Pass
Z-weight Noise Floor	33.88	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	135.01	134.15	135.75	0.15	Pass
THD	-66.17	-58.00	-58.00	0.01 ±	Pass
THD+N	-62.31	-58.00	-58.00	0.01 ±	Pass

-- End of measurement results--

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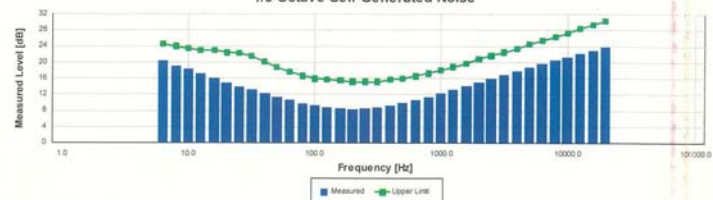


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## 1/3-Octave Self-Generated Noise



The SLM is set to low range.

Frequency [Hz]	Test Result [dB]	Upper limit [dB]	Result
6.30	20.44	24.60	Pass
8.00	19.10	24.00	Pass
10.00	18.28	23.50	Pass
12.50	17.23	23.00	Pass
16.00	16.01	22.90	Pass
20.00	14.95	22.40	Pass
25.00	14.00	22.30	Pass
31.50	13.31	21.50	Pass
40.00	12.38	20.20	Pass
50.00	11.33	18.80	Pass
63.00	10.64	17.60	Pass
80.00	9.85	16.60	Pass
100.00	9.23	15.90	Pass
125.00	8.84	15.70	Pass
160.00	8.52	15.50	Pass
200.00	8.45	15.20	Pass
250.00	8.57	15.20	Pass
315.00	8.90	15.20	Pass
400.00	9.35	15.70	Pass
500.00	9.98	16.00	Pass
630.00	10.67	16.60	Pass
800.00	11.44	17.30	Pass
1,000.00	12.22	18.10	Pass
1,250.00	13.18	18.90	Pass
1,600.00	14.04	19.80	Pass
2,000.00	14.98	20.80	Pass
2,500.00	15.96	21.70	Pass
3,150.00	16.91	22.60	Pass
4,000.00	17.84	23.50	Pass
5,000.00	18.76	24.50	Pass
6,300.00	19.68	25.50	Pass
8,000.00	20.62	26.50	Pass
10,000.00	21.45	27.40	Pass
12,500.00	22.32	28.50	Pass
16,000.00	23.07	29.50	Pass
20,000.00	23.81	30.40	Pass

-- End of measurement results--

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Signatory: *Ron Harris*

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# Calibration Certificate

Certificate Number 2021000884

Customer:

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

Model Number LxT2

Serial Number 0006617

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 25 Jan 2021

Calibration Due 23.21 °C ± 0.25 °C

Humidity 51.3 %RH ± 2.0 %RH

Static Pressure 84.93 kPa ± 0.13 kPa

**Evaluation Method** Tested electrically using Larson Davis PRMLxT2C S/N 073812 and a 12.0 pF capacitor to simulate microphone capacitance. Data reported in dB re 20 µPa assuming a microphone sensitivity of 50.0 mV/Pa.

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

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

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

The quality system is registered to ISO 9001:2015.

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

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

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

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

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

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Description	Standards Used	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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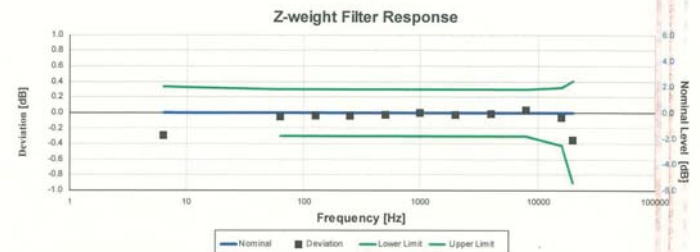


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Certificate Number 2021000884



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	-0.28	-0.28	-1.11	0.33	0.15	Pass
63.10	-0.05	-0.05	-0.30	0.30	0.15	Pass
125.89	-0.04	-0.04	-0.30	0.30	0.15	Pass
251.19	-0.04	-0.04	-0.30	0.30	0.15	Pass
501.19	-0.02	-0.02	-0.30	0.30	0.15	Pass
1,000.00	0.00	0.00	-0.30	0.30	0.15	Pass
1,995.26	-0.02	-0.02	-0.30	0.30	0.15	Pass
3,981.07	-0.01	-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	-0.06	-0.06	-0.42	0.32	0.15	Pass
19,952.62	-0.35	-0.35	-0.91	0.41	0.15	Pass

-- End of measurement results --

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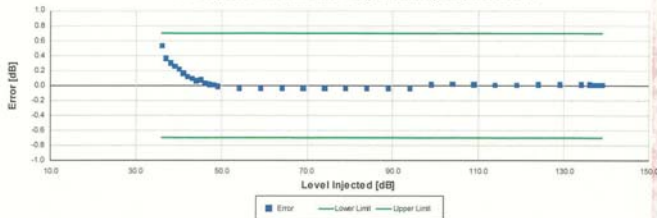
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## A-weighted Broadband Log Linearity: 8,000.00 Hz



Broadband level linearity performed according to IEC 61672-3:2013 16 and ANSI S1.4-2014 Part 3: 16 for compliance to IEC 61672-1:2013 5.6, IEC 60804:2000 6.2, IEC 61252:2002 8, ANSI S1.4 (R2006) 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	0.53	-0.70	0.70	0.16	Pass
37.00	0.36	-0.70	0.70	0.16	Pass
38.00	0.30	-0.70	0.70	0.16	Pass
39.00	0.25	-0.70	0.70	0.16	Pass
40.00	0.21	-0.70	0.70	0.16	Pass
41.00	0.16	-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	0.06	-0.70	0.70	0.17	Pass
45.00	0.07	-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	0.01	-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	-0.04	-0.70	0.70	0.16	Pass
74.00	-0.05	-0.70	0.70	0.16	Pass
79.00	-0.05	-0.70	0.70	0.16	Pass
84.00	-0.04	-0.70	0.70	0.16	Pass
89.00	-0.04	-0.70	0.70	0.16	Pass
94.00	-0.04	-0.70	0.70	0.16	Pass
99.00	0.01	-0.70	0.70	0.15	Pass
104.00	0.02	-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	0.01	-0.70	0.70	0.15	Pass

-- End of measurement results--

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## Peak Rise Time

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

Amplitude [dB]	Duration [μs]		Test Result [dB]	Lower limit [dB]	Upper limit [dB]	Expanded Uncertainty [dB]	Result
136.95	40	Negative Pulse	134.94	133.45	135.45	0.15	Pass
		Positive Pulse	134.93	133.44	135.44	0.15	Pass
	30	Negative Pulse	134.00	133.45	135.45	0.15	Pass
		Positive Pulse	134.00	133.44	135.44	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	-0.13	± 1.00	0.15 ±	Pass
105.95	3	-0.15	± 1.00	0.15 ±	Pass
	5	-0.14	± 1.00	0.15 ±	Pass

## Negative Pulse Crest Factor

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

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	-0.13	± 1.00	0.15 ±	Pass
115.95	3	-0.14	± 1.00	0.15 ±	Pass
	5	-0.12	± 1.00	0.15 ±	Pass
105.95	3	-0.15	± 1.00	0.15 ±	Pass
	5	-0.13	± 1.00	0.15 ±	Pass

## Gain

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

Measurement	Test Result [dB]	Lower limit [dB]	Upper limit [dB]	Expanded Uncertainty [dB]	Result
0 dB Gain	93.96	93.91	94.11	0.15	Pass
0 dB Gain, Linearity	40.21	39.41	40.81	0.16	Pass
OBA Low Range	94.02	93.91	94.11	0.15	Pass
OBA Normal Range	94.01	93.20	94.80	0.15	Pass

-- End of measurement results--

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## Broadband Noise Floor

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

Measurement	Test Result [dB]	Upper limit [dB]	Result
A-weight Noise Floor	26.85	36.00	Pass
C-weight Noise Floor	26.51	35.00	Pass
Z-weight Noise Floor	32.64	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	135.49	134.15	135.75	0.15	Pass
THD	-66.62	-58.00	-58.00	0.01 ±	Pass
THD+N	-62.47	-58.00	-58.00	0.01 ±	Pass

-- End of measurement results--

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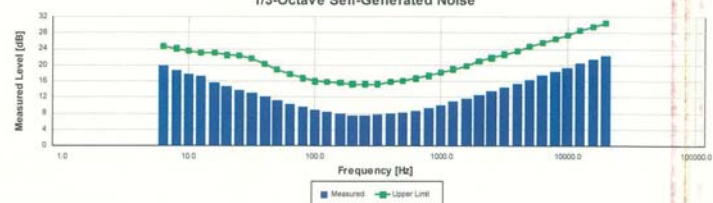
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## 1/3-Octave Self-Generated Noise



The SLM is set to low range.

Frequency [Hz]	Test Result [dB]	Upper limit [dB]	Result
6.30	19.73	24.60	Pass
8.00	16.64	24.00	Pass
10.00	17.54	23.50	Pass
12.50	17.22	23.00	Pass
16.00	15.49	22.90	Pass
20.00	14.67	22.40	Pass
25.00	13.59	22.30	Pass
31.50	12.90	21.50	Pass
40.00	12.05	20.20	Pass
50.00	11.23	18.80	Pass
63.00	10.17	17.60	Pass
80.00	9.52	16.80	Pass
100.00	8.89	15.90	Pass
125.00	8.37	15.70	Pass
160.00	7.85	15.50	Pass
200.00	7.54	15.20	Pass
250.00	7.36	15.20	Pass
315.00	7.62	15.20	Pass
400.00	7.89	15.70	Pass
500.00	8.21	16.00	Pass
630.00	8.65	16.80	Pass
800.00	9.33	17.30	Pass
1,000.00	10.07	18.10	Pass
1,250.00	10.86	18.90	Pass
1,600.00	11.72	19.80	Pass
2,000.00	12.62	20.80	Pass
2,500.00	13.49	21.70	Pass
3,150.00	14.42	22.60	Pass
4,000.00	15.37	23.50	Pass
5,000.00	16.33	24.50	Pass
6,300.00	17.34	25.50	Pass
8,000.00	18.31	26.50	Pass
10,000.00	19.31	27.40	Pass
12,500.00	20.32	28.50	Pass
16,000.00	21.29	29.50	Pass
20,000.00	22.31	30.40	Pass

-- End of measurement results--

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Signatory: Ron Harris

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# Calibration Certificate

Certificate Number 2021000796

Customer:

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

Model Number LXT2

Serial Number 0006618

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 22 Jan 2021

Calibration Due

Temperature 23.24 °C ± 0.25 °C

Humidity 52 %RH ± 2.0 %RH

Static Pressure 85.68 kPa ± 0.13 kPa

**Evaluation Method** Tested electrically using Larson Davis PRMLXT2C S/N 073798 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.

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

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

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

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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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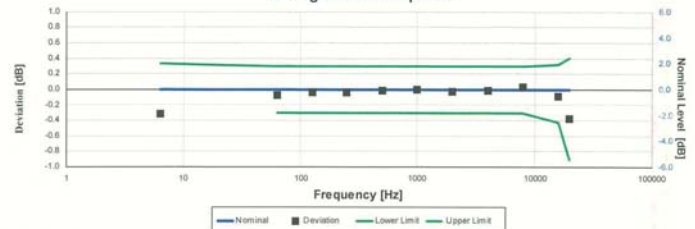


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## Z-weight Filter Response



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	-0.32	-0.32	-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	-0.04	-0.04	-0.30	0.30	0.15	Pass
501.19	-0.01	-0.01	-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	-0.08	-0.08	-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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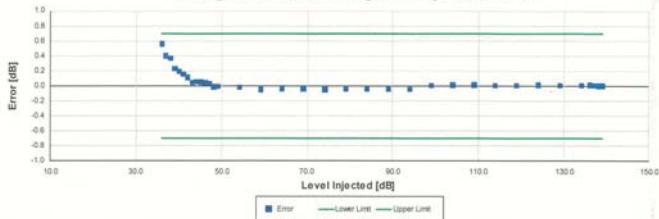
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## A-weighted Broadband Log Linearity: 8,000.00 Hz



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	0.56	-0.70	0.70	0.16	Pass
37.00	0.40	-0.70	0.70	0.16	Pass
38.00	0.37	-0.70	0.70	0.16	Pass
39.00	0.23	-0.70	0.70	0.16	Pass
40.00	0.19	-0.70	0.70	0.16	Pass
41.00	0.15	-0.70	0.70	0.16	Pass
42.00	0.11	-0.70	0.70	0.16	Pass
43.00	0.04	-0.70	0.70	0.17	Pass
44.00	0.06	-0.70	0.70	0.17	Pass
45.00	0.05	-0.70	0.70	0.16	Pass
46.00	0.04	-0.70	0.70	0.16	Pass
47.00	0.03	-0.70	0.70	0.16	Pass
48.00	-0.02	-0.70	0.70	0.16	Pass
49.00	-0.01	-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	-0.04	-0.70	0.70	0.16	Pass
69.00	-0.04	-0.70	0.70	0.16	Pass
74.00	-0.05	-0.70	0.70	0.16	Pass
79.00	-0.05	-0.70	0.70	0.16	Pass
84.00	-0.04	-0.70	0.70	0.16	Pass
89.00	-0.04	-0.70	0.70	0.16	Pass
94.00	-0.04	-0.70	0.70	0.16	Pass
99.00	0.00	-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
139.00	0.01	-0.70	0.70	0.15	Pass
144.00	0.00	-0.70	0.70	0.15	Pass
149.00	0.00	-0.70	0.70	0.15	Pass
154.00	0.00	-0.70	0.70	0.15	Pass
159.00	0.00	-0.70	0.70	0.15	Pass
-- End of measurement results--					

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## Peak Rise Time

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

Amplitude [dB]	Duration [μs]		Test Result [dB]	Lower limit [dB]	Upper limit [dB]	Expanded Uncertainty [dB]	Result
136.95	40	Negative Pulse	134.62	133.15	135.15	0.15	Pass
		Positive Pulse	134.62	133.14	135.14	0.15	Pass
	30	Negative Pulse	133.32	133.15	135.15	0.15	Pass
		Positive Pulse	133.55	133.14	135.14	0.15	Pass
-- End of measurement results--							

## Positive Pulse Crest Factor

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

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

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

## Negative Pulse Crest Factor

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

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

Amplitude [dB]	Crest Factor	Test Result [dB]	Limits [dB]	Expanded Uncertainty [dB]	Result
135.95	3	OVL	± 1.00	0.15 ±	Pass
	5	OVL	± 1.00	0.15 ±	Pass
125.95	3	-0.13	± 1.00	0.15 ±	Pass
	5	-0.13	± 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	-0.11	± 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	93.90	93.90	94.10	0.15	Pass
0 dB Gain, Linearity	40.27	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	26.91	36.00	Pass
C-weight Noise Floor	26.57	35.00	Pass
Z-weight Noise Floor	32.65	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	-65.82	-58.00	-58.00	0.01 ±	Pass
THD+N	-62.07	-58.00	-58.00	0.01 ±	Pass

-- End of measurement results--

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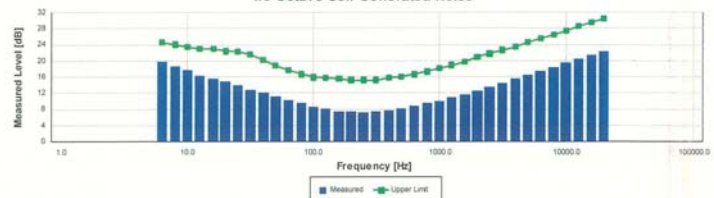
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## 1/3-Octave Self-Generated Noise



The SLM is set to low range.

Frequency [Hz]	Test Result [dB]	Upper limit [dB]	Result
6.30	19.99	24.60	Pass
8.00	18.50	24.00	Pass
10.00	17.62	23.50	Pass
12.50	16.21	23.00	Pass
16.00	15.60	22.90	Pass
20.00	14.97	22.40	Pass
25.00	14.03	22.30	Pass
31.50	12.86	21.50	Pass
40.00	12.03	20.20	Pass
50.00	11.08	18.80	Pass
63.00	10.24	17.60	Pass
80.00	9.57	16.60	Pass
100.00	8.65	15.90	Pass
125.00	8.13	15.70	Pass
160.00	7.38	15.50	Pass
200.00	7.43	15.20	Pass
250.00	7.31	15.20	Pass
315.00	7.42	15.20	Pass
400.00	7.89	15.70	Pass
500.00	8.09	16.00	Pass
630.00	8.71	16.60	Pass
800.00	9.45	17.30	Pass
1,000.00	10.09	18.10	Pass
1,250.00	10.87	18.90	Pass
1,600.00	11.72	19.80	Pass
2,000.00	12.64	20.80	Pass
2,500.00	13.56	21.70	Pass
3,150.00	14.50	22.60	Pass
4,000.00	15.47	23.50	Pass
5,000.00	16.45	24.50	Pass
6,300.00	17.42	25.50	Pass
8,000.00	18.41	26.50	Pass
10,000.00	19.39	27.40	Pass
12,500.00	20.39	28.50	Pass
16,000.00	21.37	29.50	Pass
20,000.00	22.37	30.40	Pass
-- End of measurement results--			

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