
ภาคผนวก ง

สำเนาใบรับรองการสอบเทียบเครื่องมือการตรวจวัด



บริษัท ไอเคเอสแอลโซลูชั่นส์ (ประเทศไทย) จำกัด
103566 ซอยอินทรี 15 แขวงคลองเตย เขตคลองเตย กรุงเทพฯ 10260
โทรศัพท์ 02-221852-54 โทรสาร 02-221852-55 E-Mail : info@iec.co.th

ISE CONSULTANT (THAILAND) CO., LTD.
103566 ซอยอินทรี 15 แขวงคลองเตย เขตคลองเตย กรุงเทพฯ 10260
Telephone 46-23221852-54 Fax 46-23221852 ext. 100

รายงานผลการปรับเทียบความถูกต้องแบบหลายระดับ

Multi-Point Calibration Report

Calibration Instrument

เครื่องมือตรวจวัด : Oxygen Primary

รุ่น : 734

ยี่ห้อ : Analytix Engineering, Inc.

ผู้ซื้อ : Customer

บริษัท แอสเท็ค (ประเทศไทย) จำกัด

100 ถนนสุขุมวิท แขวงคลองเตย เขตคลองเตย กรุงเทพฯ 10120

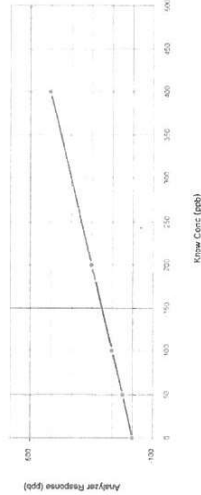
วันที่ปรับเทียบ :

Date of Calibration : 29 มิถุนายน 2564

Result of Calibration

CALIBRATOR SETTING			ANALYZER RESPONSE		
POINT NO	ZERO AIR FLOW (LPM)	GAS FLOW (CFPM)	ANALYZER (ppb)	DIFFERENCE (ppb)	PERCENT
ZERO	0.000	0.000	0.00	0.0	0.00
1	5.000	0.000	50.00	0.0	0.00
2	5.000	0.000	101.00	1.0	1.00
3	5.000	0.000	201.00	1.0	0.50
4	5.000	0.000	402.00	2.0	0.50
AVERAGE DIFFERENCE (%)					0.40
SLOP = 1.0050			INTERCEPT = 0.0500		
			CORRELATION COEFFICIENT = 1.0000		

Multi-Point Calibration Graph for Dynamic Calibration



Reference Standard Instrument

เครื่องมือมาตรฐาน : Oxygen concentration

รุ่น : 1008 PC

ยี่ห้อ : Analytix

หมายเลขเครื่อง : 6229

Serial No

ยี่ห้อ : DASIB

Manufacturer

เครื่องมือมาตรฐาน : Zero Air Generator

รุ่น : 1001

ยี่ห้อ : Analytix

หมายเลขเครื่อง : 11101714

Serial No

ยี่ห้อ : S&B

Manufacturer

บริษัท :

ชื่อ :

ตำแหน่ง :

ตำแหน่ง :

ตำแหน่ง :

ตำแหน่ง :

ตำแหน่ง :

Calibrated By :

Approved By :

Technician

Service Manager

Doc. No. :

Page 1 of 1



บริษัท ไคเนติกส์ คอร์ปอเรชั่น จำกัด

KINETICS CORPORATION LTD.

รายงานผลการซ่อมและปรับเทียบอุปกรณ์ตรวจวัดคุณภาพอากาศ

ลูกค้า / หน่วยงาน : SGS (Thailand) Co., Ltd

รายชื่ออุปกรณ์ / เครื่องมือ : SO₂ Analyzer

รุ่นของอุปกรณ์ / เครื่องมือ : T100

วันที่ : 9 กุมภาพันธ์ 2565

บริษัทผู้ผลิต : Teledyne API

หมายเลขอุปกรณ์ / เครื่องมือ : 1771

TEST VALUES		
API MODEL T100		
	BEFORE	AFTER
1 RANGE	50 - 20,000 PPB	500
2 STABILITY	≤ 1 PPB	0.0
3 PRESSURE	25 - 35 in - Hg-A	29.2
4 SAMPLE FLOW	650 ± 10% cc/min	445
5 PMT	mV	70.2
6 NORM PMT	mV	63.2
7 UV LAMP	1000 - 1800 mV	4135.2
8 LAMP RATIO	30 To 120 %	110.7
9 STRAY LIGHT	≤ 100 PPB	73.1
10 DARK PMT	-50 ± 200 % mV	47.5
11 DARK LAMP	-50 ± 200 % mV	4.6
12 SO ₂ SLOPE	1.0 ± 0.3	2.319
13 SO ₂ OFFSET	< 250 mV	63.1
14 HVPS	400 - 900 V	601
15 RX CELL TEMP	50 ± 1 °C	50.0
16 BOX TEMP	AMBIENT ± 5 °C	36.1
17 PMT TEMP	7 ± 2 °C	8.7
18 SO ₂ SAMPLE READING	PPB	0.1
19 OPTIC TEST	2000 ± 1000 mV	1123.8
20 ELECTRICAL TEST	2000 ± 1000 mV	1095.1
21 VOLTAGE TEST	+5 V +15 V -15 V	4.8 / 12.2 / 16.2 / -16.2
22 ZERO GAS	0.00 PPB	-55.8
23 SPAN GAS	400.00 PPB	1024.3

หมายเหตุ

- ทำการเปลี่ยน Sintered Filter 1 ชิ้น, O-ring 2 ชิ้น, Spring 1 ชิ้น

- ทำการเปลี่ยน เซลล์ CO₂ FILTER 330 NM 1 ชิ้น

- ทำการเปลี่ยน REBUILD KIT, PUMP 1 ชุด



บริษัท ไคเนติกส์ คอร์ปอเรชั่น จำกัด

ลงนามเจ้าหน้าที่ (Signature)

ต้องการข้อมูลเพิ่มเติมทางด้านเทคนิค กรุณาติดต่อ : คุณพรชัย ภาติชนรักษ์ โทรศัพท์ : 0-2515-8987
เลขที่ 388 ถนนรัชดาภิเษก แขวงจันทน์เกษม เขตจตุจักร กรุงเทพฯ 10900 โทรศัพท์ : 0-2515-8999 โทรสาร : 0-2515-8988 E-Mail : info@kinetics.co.th

CERTIFICATE OF ANALYSIS **Grade of Product: EPA Protocol**

Part Number: E04NI99E80A0041
Cylinder Number: LL193431
Laboratory: 124 - Plumsteadville - PA
PGVP Number: A12019
Gas Code: CO, NO, NOX, SO2, BALN
Reference Number: 160-401658125-1
Cylinder Volume: 83.4 CF
Cylinder Pressure: 2215 PSIG
Valve Outlet: 660
Certification Date: Dec 12, 2019
Expiration Date: Dec 12, 2022

Certification performed in accordance with EPA Testability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012), document EPA 600/R-12/031, 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 measure. All concentrations are on a molar 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	Assay Dates
NOX	45.00 PPM	44.57 PPM	G1	12/04/2019, 12/12/2019
NITRIC OXIDE	45.00 PPM	44.57 PPM	G1	12/04/2019, 12/12/2019
SULFUR DIOXIDE	45.00 PPM	46.33 PPM	G1	12/04/2019, 12/12/2019
CARBON MONOXIDE	4500 PPM	4539 PPM	G1	12/04/2019
NITROGEN	Balance			

CALIBRATION STANDARDS			
Type	Lot ID	Cylinder No	Expiration Date
NTRM	16060636	CC442637	Jun 27, 2020
NTRM	16060636	CC442637	Jun 27, 2020
NTRM	04170911	KAL003197	Jun 20, 2022
NTRM	10010804	KAL003099	Jun 20, 2022
NTRM	08012318	KAL004620	Jun 07, 2024

ANALYTICAL EQUIPMENT		
Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
MKS FTIR - CO2 - 000928781	FTIR	Nov 08, 2019
MKS FTIR - NO - 000928781	FTIR	Dec 12, 2019
MKS FTIR - NOx - 000928781	FTIR	Dec 12, 2019
MKS FTIR - SO2 - 000928781	FTIR	Nov 27, 2019

Triad Data Available Upon Request
NOTES: Gross Weight: 17.9 Kg. Net Weight: 2.4 Kg. PO# 5219005460.



RECALIBRATION
DUE DATE:
January 24, 2023



Certificate of Calibration

Calibration Certification Information			
Cal. Date:	January 24, 2022	Rootsmeier S/N:	438320
Operator:	Jim Tisch	Ta:	294 °K
Calibration Model #:	TE-5028A	Pa:	741.17 mm Hg
		Calibrator S/N:	1547

Run	Vol. Init (m3)	Vol. Final (m3)	ΔVol. (m3)	ΔTime (min)	ΔP (mm Hg)	ΔH (in H2O)
1	1	2	1	1.2590	4.3	1.50
2	3	4	1	0.9730	7.2	2.50
3	5	6	1	0.8860	8.6	3.00
4	7	8	1	0.8180	10.1	3.50
5	9	10	1	0.6210	17.2	6.00

Data Tabulation				
Vstd (m3)	Qstd (x-axis)	$\sqrt{\frac{\Delta H (Pa)}{Pstd} \left(\frac{Tstd}{Ta} \right)}$ (y-axis)	Va	Qa (x-axis)
0.9828	0.7806	1.2177	0.9942	0.7897
0.9789	1.0061	1.5720	0.9903	1.0178
0.9770	1.1027	1.7221	0.9884	1.1156
0.9750	1.1920	1.8600	0.9864	1.2058
0.9656	1.3548	2.4354	0.9768	1.5729
QSTD		m= 1.57206	QA	
		b= -0.01065		
		r= 0.99999		

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

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

VERIFIED

DATE 12/12/22

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



บริษัท ไคเนติกส์ คอร์ปอเรชั่น จำกัด

KINETICS CORPORATION LTD.

รายงานผลการตรวจสอบและปรับเทียบอุปกรณ์ตรวจวัดคุณภาพอากาศ

ลูกค้า / หน่วยงาน : SGS (Thailand) Co., Ltd วันที่ : 11 พฤษภาคม 2665

รายชื่ออุปกรณ์ / เครื่องมือ : NO_x Analyzer บริษัทผู้ผลิต : Teledyne API

รุ่นของอุปกรณ์ / เครื่องมือ : T200 หมายเลขอุปกรณ์ / เครื่องมือ : 1652

TEST VALUES			
API MODEL T200		BEFORE	AFTER
1 RANGE	50 - 20,000 PPB	500.0	500.0
2 STABILITY	≤ 1 PPB	0.2	0.3
3 SAMPLE FLOW	500 ± 10% cc/min	481	488
4 OZONE FLOW	80 ± 10% cc/min	79	79
5 PMT	mV	1157.2	119.2
6 NORM PMT	mV	1234.0	3.1
7 A ZERO	-20 To 150 MV	199.8	125.5
8 HPS	400 - 900 V	788	681
9 RX CELL TEMP	50 ± 1 °C	50.0	50.0
10 BOX TEMP	AMBIENT ± 5 °C	29.9	30.0
11 PMT TEMP	7 ± 2 °C	6.9	7.2
12 WOLY TEMP	315 ± 5 °C	316.7	314.6
13 RX CELL PRESSURE	<10 in - Hg-A	6.9	6.9
14 SAMPLE PRESSURE	25 - 35 in - Hg-A	291.0	28.7
15 NOX SLOPE	1.0 ± 0.3	0.426	0.969
16 NOX OFFSET	-50 To 150	-208.3	-0.7
17 NO SLOPE	1.0 ± 0.3	0.419	0.951
18 NO OFFSET	-50 To 150	-208.3	-1.7
19 NO SAMPLE READING	PPB	299.2	2.4
20 NO2 SAMPLE READING	PPB	15.5	16.6
21 NOX SAMPLE READING	PPB	314.7	20.8
22 OPTIC TEST	2000 ± 1000 mV	2695.8	1554.3
23 ELECTRICAL TEST	2000 ± 1000 mV	19661.0	1384.1
24 VOLTAGE TEST	+5 V +12 V +15 V -15 V	5.23 / 12.19 / 15.90 / -15.21	5.23 / 12.19 / 15.90 / -15.21
25 ZERO GAS	NO/NO _x 0.000.00 PPB	305.4 / 313.0	0.3 / 0.5
26 SPAN GAS	NO/NO _x 400.00/400.00 PPB	488.17 / 499.6	400.2 / 402.3

หมายเหตุ

-ทำการเปลี่ยน Sintered Filter 3 ชิ้น, O-ring 6 ชิ้น, Spring 3 ชิ้น

-ทำการเปลี่ยน หลอด CD PMT 1 ชิ้น

-ทำการเปลี่ยน VALVE AUTO ZERO 1 ชิ้น



บริษัท ไคเนติกส์ คอร์ปอเรชั่น จำกัด



ลงนามเจ้าหน้าที่ (Signature)

ต้องการข้อมูลเพิ่มเติมทางทีมเทคนิค กรุณาติดต่อ: คุณพรชัย ผาสุกันรักษ์ โทรศัพท์: 0-2515-8987

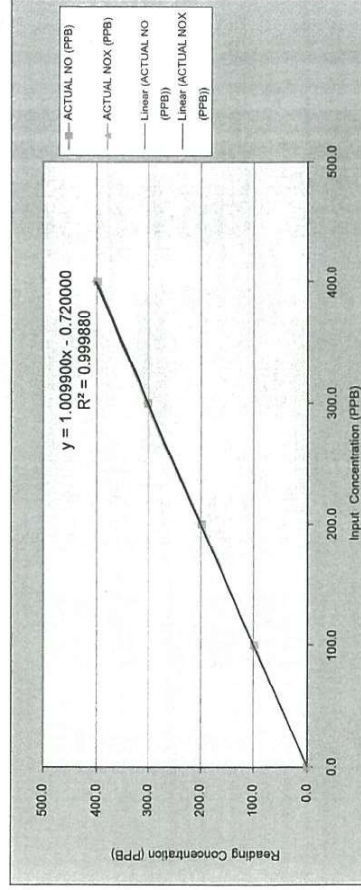
เลขที่ 388 ถนนรัชดาภิเษก แขวงจันทบุรี เขตจตุจักร กรุงเทพฯ 10900 โทรศัพท์: 0-2515-8999 โทรสาร: 0-2515-8998 E-Mail: info@kinetics.co.th

MULTI POINT CALIBRATION REPORT

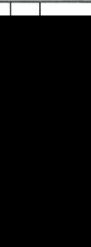
CUSTOMER NAME : SGS (Thailand) Co., Ltd		SERIAL NO : 1652	
EQUIPMENT NAME : NO _x Analyzer		CYLINDER NO : CG745169	
MANUFACTURER : Teledyne - API	MODEL : T200		
STANDARD GAS CONCENTRATION (PPM) : 53.40			
CYLINDER PRESSURE (psig) : 1900		CERTIFIED DATE : Mar 10, 2021	
CERTIFIED BY : ARGAS SPECIALTY GASES		EXPIRED DATE : Mar 10, 2029	

CALIBRATION RESULTS

CALIBRATION RESULTS							
POINT NO	IDEAL (PPB)	ACTUAL NO (PPB)	ERROR NO (PPB)	% ERROR NO	ACTUAL NO _x (PPB)	ERROR NO _x (PPB)	% ERROR NO _x
ZERO	0.0	0.3	0.3	-	0.5	0.5	-
1	100.0	98.8	-1.2	-1.2	98.3	-1.7	-1.7
2	200.0	199.1	-0.9	-0.45	200.6	0.6	0.3
3	300.0	301.9	1.9	0.6	304.6	4.6	1.5
4	400.0	400.2	0.2	-0.1	402.3	2.3	0.6
AVERAGE (%)							
1.0							



บริษัท ไคเนติกส์ คอร์ปอเรชั่น จำกัด



CALIBRATED BY : คุณพรชัย ผาสุกันรักษ์
ต้องการข้อมูลเพิ่มเติมทางทีมเทคนิค: คุณพรชัย ผาสุกันรักษ์ โทรศัพท์: 02-515-8987

เลขที่ 388 ถนนรัชดาภิเษก แขวงจันทบุรี เขตจตุจักร กรุงเทพฯ 10900 โทรศัพท์: 0-2515-8999 โทรสาร: 0-2515-8998 E-Mail: info@kinetics.co.th

CERTIFICATE OF ANALYSIS Grade of Product: EPA Protocol

Part Number: E04N99E15A0622
Cylinder Number: CC745169
Laboratory: 124 - Plumsteadville - PA
PGVP Number: A12021
Gas Code: CO, NO, NOX, SO2, BALN
Reference Number: 160-402045691-1
Cylinder Volume: 144.4 CF
Valve Pressure: 2015 PSIG
Valve Outlet: 660
Certification Date: Mar 10, 2021
Expiration Date: Mar 10, 2029

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 821-R-11-001, using the assay procedures listed. Analytical Methodology does not require correction for 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 mole/mole 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
NOX	53.00 PPM	53.40 PPM	G1	+/- 1.1% NIST Traceable
NITRIC OXIDE	53.00 PPM	53.40 PPM	G1	+/- 1.1% NIST Traceable
SULFUR DIOXIDE	53.00 PPM	53.75 PPM	G1	+/- 0.9% NIST Traceable
CARBON MONOXIDE	4500 PPM	4512 PPM	G1	+/- 0.6% NIST Traceable
NITROGEN	Balance			
ANALYTICAL DATES				
				03/03/2021, 03/10/2021
				03/03/2021, 03/10/2021
				03/03/2021, 03/10/2021
				03/04/2021
CALIBRATION STANDARDS				
Type	Lot ID	Cylinder No	Concentration	Uncertainty
NTRM	07060227	EB0079116	100.3 PPM NITRIC OXIDE/NITROGEN	+/- 1.0%
PRM	12986	D685025	9.91 PPM AIR/NITROGEN DIOXIDE	2.0%
GMIS	124206889	CC323707	4.028 PPM NITROGEN DIOXIDE/NITROGEN	2.1%
NTRM	16010203	KAL003087	97.69 PPM SULFUR DIOXIDE/NITROGEN	+/- 0.8%
NTRM	06012341	KAL004716	4857 PPM CARBON MONOXIDE/NITROGEN	+/- 0.6%
The SRM, PRM or RGM noted above is only in reference to the GMS used in the assay and not part of the analysis.				
ANALYTICAL EQUIPMENT				
Instrument/Make/Model	Analytical Principle			
SIEMENS ULTRAMAT 6 NIKD579	NDIR			
Nicolet ISO FTIR AUP2010245 NO	FTIR			
Nicolet ISO FTIR AUP2010245 NO2	FTIR			
Nicolet ISO FTIR AUP2010245 SO2	FTIR			
	Last Multipoint Calibration			
	Feb 26, 2021			
	Feb 11, 2021			
	Feb 22, 2021			
	Feb 16, 2021			

Triad Data Available Upon Request

NOTES:
Gross Weight: 28.1 Kg
Net Weight: 4.6 Kg



388 Ratchadapisek Rd. 32
Chadrasakem, Chatchak
Bangkok 10900 | Thailand
+66 (0) 2-515-8999
Env_Service@kinetics.co.th

Customer Name : SGS (Thailand) Co., Ltd	
Contact : คุณจิรภัทร 02-678-1813	
Description	
Manufacturer : Teledyne API	Model : T200
Equipment : NOx Analyzer	Serial No : 1652
Working Date : 11/05/2022	
Quotation : Q-B2-2022-112-SV	

Environmental Science Business Unit

Service Report

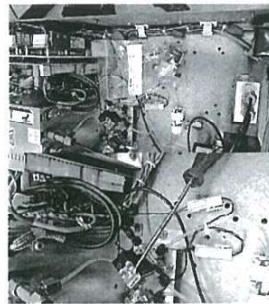
Physical Checking

ตรวจชิ้นเครื่องต้นทาง

- หลอด PMT เลื่อนสภาพ ส่งผลให้ไม่สามารถทำการ Calibrate ZERO และ SPAN ได้
- VALVE รั่ว ส่งผลให้ AUTO ZERO WARNING



รูป Assy PMT Low Dark Curr/Hi Gain Nox Ultra



รูป Assy, VALVE, VA59 W/DIODE, 5" LEADS

Correction Working

- ทำการทดสอบเปลี่ยน Assy PMT Low Dark Curr/Hi Gain Nox Ultra 1 ชิ้น
- ทำการทดสอบเปลี่ยน ASSY, VALVE, VA59 W/DIODE, 5" LEADS 1 ชิ้น
- จากการทดสอบการเปลี่ยนและไหลแล้วลองใช้งานเครื่อง *เครื่องสามารถทำงานปกติ

*รายการสินค้าเปลี่ยน
Sintered Filter 3 ชิ้น
O-ring 6 ชิ้น
Spring 3 ชิ้น

ต้องการการเปลี่ยนและไหลตามรายการที่ 1 - 2 เพื่อให้เครื่องใช้งานได้ปกติ

Recommendation

MULTI POINT CALIBRATION REPORT

CUSTOMER NAME : SGS (Thailand) Co., Ltd

EQUIPMENT NAME : NO_x Analyzer

MANUFACTURER : Teledyne - API

MODEL : T200

SERIAL NO : 2199

STANDARD GAS CONCENTRATION (PPM) : 53.40

CYLINDER NO : C745169

CYLINDER PRESSURE (psig) : 2000

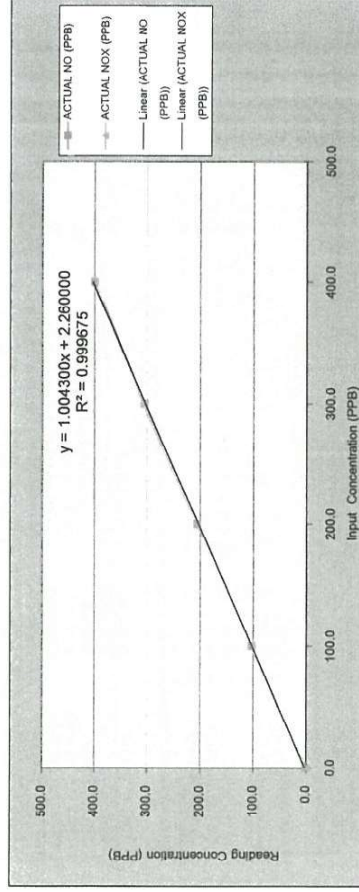
CERTIFIED DATE : Mar 10, 2021

CERTIFIED BY : AIRGAS SPECIALTY GASES

EXPIRED DATE : Mar 10, 2029

CALIBRATION RESULTS

POINT NO	CALIBRATION RESULTS					
	REAL (PPB)	ACTUAL NO (PPB)	ERROR NO (PPB)	% ERROR NO (PPB)	ERROR NO _x (PPB)	% ERROR NO _x
ZERO	0.0	0.0	0.0	-	0.0	-
1	100.0	103.4	3.4	3.4	103.3	3.3
2	200.0	205.0	5.0	2.5	205.1	5.1
3	300.0	304.7	4.7	1.6	306.8	6.8
4	400.0	399.8	-0.2	-0.1	400.4	0.4
AVERAGE (%)						2.1



CALIBRATED BY : คุณทวีชัย นาคินานท์

ดำเนินการรับรองทางด้านเทคนิคเพิ่มเติม : คุณพรชัย นาคินานท์ โทรศัทพ์ : 02-515-8987

DATE : 7 มีนาคม 2565

เลขที่ 388 ถนนรัชดาภิเษก แขวงจันทระนอก เขตจตุจักร กรุงเทพมหานคร 10900 โทรศัพท์ : 0-2515-8999 โทรสาร : 0-2515-8988 E-Mail : Info@kinetics.co.th

หมายเหตุ

- ทำการเปลี่ยน Sintered Filter 1 ชิ้น, O-ring 2 ชิ้น, Spring 1 ชิ้น
- ทำการเปลี่ยนหลอด CD PMT 1 ชิ้น
- นำตัวอย่างทดสอบผ่านจาก Touch Screen ได้ แต่ตามากกว่า Mouse ตามปกติ
- ตรวจพบค่า SAMPLE READING มีค่าติดลบ และพบว่าค่า NOx SLOPE, NO SLOPE, NOx OFFSET, NO OFFSET มีค่าสูง
- ไม่สามารถทำการ Calibrate ZERO / SPAN ได้ / แก้ไขเรียบร้อยแล้ว

ลงนามเจ้าหน้าที่ (Signature)

ดำเนินการรับรองเพิ่มเติมทางด้านเทคนิค กรุณาติดต่อ : คุณพรชัย นาคินานท์ โทรศัพท์ : 0-2515-8987
เลขที่ 388 ถนนรัชดาภิเษก แขวงจันทระนอก เขตจตุจักร กรุงเทพมหานคร 10900 โทรศัพท์ : 0-2515-8999 โทรสาร : 0-2515-8988 E-Mail : Info@kinetics.co.th

CERTIFICATE OF ANALYSIS

Grade of Product: EPA Protocol

Part Number: E04N99E15A0622
Cylinder Number: CC745169
Laboratory: 124 - Plumsteadville - PA
PGVP Number: A12021
Gas Code: CO, NO, NOX, SO₂, BALN
Reference Number: 160-402045691-1
Cylinder Volume: 144.4 CF
Cylinder Pressure: 2015 PSIG
Valve Outlet: 660
Certification Date: Mar 10, 2021
Expiration Date: Mar 10, 2029

Certification performed in accordance with EPA Testability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)* document EPA 600/R-12/531, using the assay procedures listed. Analytical methodology does not include any chemical 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 the calibration mixture. All concentrations are on a mole/mole 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
NOX	53.00 PPM	53.40 PPM	G1	+/- 1.1% NIST Traceable
NITRIC OXIDE	53.00 PPM	53.40 PPM	G1	+/- 1.1% NIST Traceable
SULFUR DIOXIDE	53.00 PPM	53.79 PPM	G1	+/- 0.9% NIST Traceable
CARBON MONOXIDE	4500 PPM	4512 PPM	G1	+/- 0.6% NIST Traceable
NITROGEN	Balance			

CALIBRATION STANDARDS			
Type	Lot ID	Cylinder No	Expiration Date
NTRM	0760227	EB0079116	Jul 23, 2023
PRM	12386	D865025	Feb 20, 2020
GMS	124206889	CC332707	Aug 15, 2021
NTRM	16010203	KAL003097	Dec 23, 2021
NTRM	08012341	KAL004716	Jun 07, 2024

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

ANALYTICAL EQUIPMENT		
Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
SIEMENS ULTRAMAT 6 N1XD579	NDIR	Feb 28, 2021
Nicoler IS50 FTIR AUP2010245 NO	FTIR	Feb 11, 2021
Nicoler IS50 FTIR AUP2010245 NO2	FTIR	Feb 22, 2021
Nicoler IS50 FTIR AUP2010245 SO2	FTIR	Feb 18, 2021

Triad Data Available Upon Request

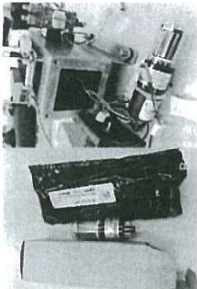

NOTES:
Gross Weight: 28.1 Kg
Net Weight: 4.6 Kg



388 Ratchadapisek Rd. 32
Chadrasakem, Chatuchak
Bangkok 10900 | Thailand
+66 (0) 2-515-8999
Env_Service@kinetics.co.th

Environmental Science Business Unit

Service Report

Physical Checking	ตรวจสอบเครื่องต้นพ่น - ไม่สามารถทำการ Calibrate ZERO / Span ได้	  รูป ก่อน CD PMT
Correction Working	- ทำการเปลี่ยนหลอด CD PMT 1 ถัง - ทำการเปลี่ยน Sintered Filter 1 ถัง - ทำการเปลี่ยน O-ring 2 ถัง - ทำการเปลี่ยน Spring 1 ถัง	
Recommendation		



บริษัท ไคนีติกส์ คอร์ปอเรชั่น จำกัด

KINETICS CORPORATION LTD.

รายงานผลการซ่อมและปรับเทียบอุปกรณ์ตรวจวัดคุณภาพอากาศ

ลูกค้า / หน่วยงาน : SGS (Thailand) Co., Ltd
วันที่ : 7 กุมภาพันธ์ 2565
รายชื่ออุปกรณ์ / เครื่องมือ : NO_x Analyzer
รุ่นของอุปกรณ์ / เครื่องมือ : T200

TEST VALUES			
API MODEL T200		BEFORE	AFTER
1	RANGE	50 - 20,000 PPB	500
2	STABILITY	≤ 1 PPB	0.10
3	SAMPLE FLOW	500 ± 10% cc/min	493
4	OZONE FLOW	80 ± 10% cc/min	86
5	PMT	mV	34.2
6	NORM PMT	mV	14.4
7	A ZERO	-20 To 150 mV	23.4
8	HPVS	400 - 900 V	626
9	RX CELL TEMP	50 ± 1 °C	50.3
10	BOX TEMP	AMBIENT ± 5 °C	33.9
11	PMT TEMP	7 ± 2 °C	6.8
12	MOLY TEMP	315 ± 5 °C	314.6
13	RX CELL PRESSURE	<10 in - Hg-A	4.7
14	SAMPLE PRESSURE	25 - 35 in - Hg-A	28.6
15	NOX SLOPE	1.0 ± 0.3	1.001
16	NOX OFFSET	-50 To 150	-0.4
17	NO SLOPE	1.0 ± 0.3	0.980
18	NO OFFSET	-50 To 150	-1.2
19	NO SAMPLE READING	PPB	-0.6
20	NO2 SAMPLE READING	PPB	11.5
21	NOX SAMPLE READING	PPB	5.5
22	OPTIC TEST	2000 ± 1000 mV	2196.4
23	ELECTRICAL TEST	2000 ± 1000 mV	2063.3
24	VOLTAGE TEST	+5 V +12 V +15 V -15 V	-
25	ZERO GAS NONOX	0.000/0.00 PPB	-4.6 / -4.5
26	SPAN GAS NONOX	400.00/400.00 PPB	401.2 / 410.2

หมายเหตุ



ลงนามเจ้าหน้าที่ (Signature)

ต้องการข้อมูลเพิ่มเติมทางด้านเทคนิค กรุณาติดต่อ : คุณพรชัย ภาติวันรักษ์ โทรศัพท์ : 0-2515-8987
เลขที่ 388 ถนนรัชดาภิเษก แขวงจันทรมายุม เขตจตุจักร กรุงเทพฯ 10900 โทรศัพท์ : 0-2515-8999 โทรสาร : 0-2515-8988 E-Mail : info@kinetics.co.th



บริษัท ไคนีติกส์ คอร์ปอเรชั่น จำกัด

KINETICS CORPORATION LTD.

รายงานผลการซ่อมและปรับเทียบอุปกรณ์ตรวจวัดคุณภาพอากาศ

ลูกค้า / หน่วยงาน : SGS (Thailand) Co., Ltd
วันที่ : 7 กุมภาพันธ์ 2565
รายชื่ออุปกรณ์ / เครื่องมือ : NO_x Analyzer
รุ่นของอุปกรณ์ / เครื่องมือ : T200

TEST VALUES			
API MODEL T200		BEFORE	AFTER
1	RANGE	50 - 20,000 PPB	500
2	STABILITY	≤ 1 PPB	0.12
3	SAMPLE FLOW	500 ± 10% cc/min	496
4	OZONE FLOW	80 ± 10% cc/min	87
5	PMT	mV	9.8
6	NORM PMT	mV	-33.4
7	A ZERO	-20 To 150 mV	45.2
8	HPVS	400 - 900 V	660
9	RX CELL TEMP	50 ± 1 °C	50.3
10	BOX TEMP	AMBIENT ± 5 °C	33.4
11	PMT TEMP	7 ± 2 °C	6.8
12	MOLY TEMP	315 ± 5 °C	313.9
13	RX CELL PRESSURE	<10 in - Hg-A	4.1
14	SAMPLE PRESSURE	25 - 35 in - Hg-A	28.6
15	NOX SLOPE	1.0 ± 0.3	0.992
16	NOX OFFSET	-50 To 150	-5.4
17	NO SLOPE	1.0 ± 0.3	0.966
18	NO OFFSET	-50 To 150	-6.4
19	NO SAMPLE READING	PPB	-12.7
20	NO2 SAMPLE READING	PPB	8.8
21	NOX SAMPLE READING	PPB	-3.8
22	OPTIC TEST	2000 ± 1000 mV	2249
23	ELECTRICAL TEST	2000 ± 1000 mV	2039
24	VOLTAGE TEST	+5 V +12 V +15 V -15 V	-
25	ZERO GAS NONOX	0.000/0.00 PPB	-9.1 / -7.1
26	SPAN GAS NONOX	400.00/400.00 PPB	378.9 / 326.6

หมายเหตุ



ลงนามเจ้าหน้าที่ (Signature)

ต้องการข้อมูลเพิ่มเติมทางด้านเทคนิค กรุณาติดต่อ : คุณพรชัย ภาติวันรักษ์ โทรศัพท์ : 0-2515-8987
เลขที่ 388 ถนนรัชดาภิเษก แขวงจันทรมายุม เขตจตุจักร กรุงเทพฯ 10900 โทรศัพท์ : 0-2515-8999 โทรสาร : 0-2515-8988 E-Mail : info@kinetics.co.th



บริษัท ไอทีคอนซัลแตนท์ (ประเทศไทย) จำกัด
1035/66 ถนนพหลโยธิน แขวงจตุจักร เขตจตุจักร กรุงเทพฯ 10250
Tel. 0 2322 1852-54 โทรสาร. 0 2322 1852 ถึง 100

บริษัท ไอทีคอนซัลแตนท์ (ประเทศไทย) CO., LTD.
1035/66 ถนนพหลโยธิน แขวงจตุจักร เขตจตุจักร กรุงเทพฯ 10250
Tel. 466 2322 1852-54 Fax. 466 2322 1852 ext.100

รายงานผลการรับเทียบระบบควบคุมอัตราการไหลอากาศบริสุทธิ์ MASS FLOW CONTROL ZERO AIR CALIBRATION REPORT

Calibration Instrument

เครื่องมือตรวจวัด : เครื่องมือควบคุมการเทียบ
Instrument : 08500311
รุ่น : 0-10 LPM
Model : S4BO
ผู้ค้า : SGS (THAILAND) LIMITED
Manufacturer : Customer

วันที่รับเทียบ : 16 พฤษภาคม 2565
Date of calibration

Result of Calibration

Flow Rate Volume (Multi Gas Calibrator Display)		Sensor Reading			
Flow Set (LPM)	Monitor (LPM)	Before	%Error	After	%Error
1.00	1.00	1.051	4.853	1.011	1.088
2.00	2.00	2.104	4.943	2.019	0.941
3.00	3.00	3.132	4.215	3.026	0.859
4.00	4.00	4.135	3.265	4.028	0.895
5.00	5.00	5.122	2.362	5.030	0.596
6.00	6.00	6.113	1.849	6.031	0.514
7.00	7.00	7.113	1.569	7.034	0.483
8.00	8.00	8.123	1.514	8.029	0.361
9.00	9.00	9.213	2.312	9.024	0.266
10.00	10.00	10.300	2.913	10.019	0.190
AVERAGE DIFFERENCE (%)		2.9833		0.5994	
Interception		-0.0426		-0.0204	
Correlation		0.9999		1.0000	

Calibration Tolerance : % Difference be should + / - 1 % of Full Scal
User Manual of Reference

Reference Standard Instrument

เครื่องมือสอบเทียบ : DryCal (High)
Instrument : DCL-MH
รุ่น : BIOS
Model : 122189
ผู้ขาย : SGS (THAILAND) LIMITED
Manufacturer : Customer

Result : ☒ Accepted
☐ Not Accepted

ผู้ดำเนินการ :
Service By

ผู้ตรวจสอบ :
Approved By

Doc. No. :-
VERIFIED
DATE 17/22



บริษัท ไอทีคอนซัลแตนท์ (ประเทศไทย) จำกัด
1035/66 ถนนพหลโยธิน แขวงจตุจักร เขตจตุจักร กรุงเทพฯ 10250
Tel. 0 2322 1852-54 โทรสาร. 0 2322 1852 ถึง 100

บริษัท ไอทีคอนซัลแตนท์ (ประเทศไทย) CO., LTD.
1035/66 ถนนพหลโยธิน แขวงจตุจักร เขตจตุจักร กรุงเทพฯ 10250
Tel. 466 2322 1852-54 Fax. 466 2322 1852 ext.100

รายงานผลการรับเทียบระบบควบคุมอัตราการไหลอากาศบริสุทธิ์ MASS FLOW CONTROL STANDARD GAS CALIBRATION REPORT

Calibration Instrument

เครื่องมือตรวจวัด : เครื่องมือควบคุมการเทียบ
Instrument : 08500311
รุ่น : 0-100 CCPM
Model : S4BO
ผู้ค้า : SGS (THAILAND) LIMITED
Manufacturer : Customer

วันที่รับเทียบ : 16 พฤษภาคม 2565
Date of Calibration

Result of Calibration

Flow Rate Volume (Multi Gas Calibrator Display)		Sensor Reading			
Flow Set (CCPM)	Monitor (CCPM)	Before	%Error	After	%Error
10.00	10.00	10.94	8.55	10.13	1.28
20.00	20.00	21.63	7.55	20.21	1.04
30.00	30.00	32.38	7.34	30.27	0.89
40.00	40.00	43.02	7.02	40.28	0.70
50.00	50.00	53.44	6.44	50.32	0.64
60.00	60.00	64.04	6.30	60.37	0.61
70.00	70.00	74.37	5.87	70.41	0.58
80.00	80.00	84.84	5.70	80.39	0.49
90.00	90.00	96.20	6.44	90.34	0.38
100.00	100.00	107.22	6.73	100.29	0.29
AVERAGE DIFFERENCE (%)		6.7566		0.6891	
Interception		-0.2690		-1.874	
Correlation		1.0000		1.0000	

Calibration Tolerance : % Difference be should + / - 1 % of Full Scal
User Manual of Reference

Reference Standard Instrument

เครื่องมือสอบเทียบ : DryCal (High)
Instrument : DCL-MH
รุ่น : BIOS
Model : 122189
ผู้ขาย : SGS (THAILAND) LIMITED
Manufacturer : Customer

Result : ☒ Accepted
☐ Not Accepted

ผู้ดำเนินการ :
Service By

ผู้ตรวจสอบ :
Approved By

Doc. No. :-
VERIFIED
DATE 17/22



บริษัท ไคเนติกส์ คอร์ปอเรชั่น จำกัด

KINETICS CORPORATION LTD.

รายงานผลการซ่อมและปรับเทียบอุปกรณ์ตรวจวัดคุณภาพอากาศ

ลูกค้า / หน่วยงาน : SGS (Thailand) Co., Ltd
วันที่ : 7 กุมภาพันธ์ 2565
รายชื่ออุปกรณ์ / เครื่องมือ : SO₂ Analyzer
รุ่นของอุปกรณ์ / เครื่องมือ : T100

TEST VALUES			
API MODEL T100		BEFORE	AFTER
1	RANGE	50 - 20,000 PPB	500
2	STABILITY	≤ 1 PPB	0.02
3	PRESSURE	25 - 35 in - Hg-A	27.1
4	SAMPLE FLOW	650 ± 10% cc/min	708.4
5	PMT	mV	15.9
6	NORM PMT	mV	16.3
7	UV LAMP	1000 - 4800 mV	3972.1
8	LAMP RATIO	30 To 120 %	98.1
9	STRAY LIGHT	≤ 100 PPB	7.5
10	DARK PMT	-50 ± 200 % mV	1.9
11	DARK LAMP	-50 ± 200 % mV	3.0
12	SO2 SLOPE	1.0 ± 0.3	0.988
13	SO2 OFFSET	< 250 mV	0.068
14	HWPS	400 - 900 V	505
15	RX CELL TEMP	50 ± 1 °C	50.0
16	BOX TEMP	AMBIENT ± 5 °C	36.8
17	PMT TEMP	7 ± 2 °C	8.4
18	SO2 SAMPLE READING	PPB	-1.115
19	OPTIC TEST	2000 ± 1000 mV	1866
20	ELECTRICAL TEST	2000 ± 1000 mV	1937.3
21	VOLTAGE TEST	+5 V +12 V -15 V	-
22	ZERO GAS	0.00 PPB	-1.436
23	SPAN GAS	400.00 PPB	418.243

หมายเหตุ



บริษัท ไคเนติกส์ คอร์ปอเรชั่น จำกัด



ลงนามเจ้าหน้าที่ (Signature)

ต้องการข้อมูลเพิ่มเติมทางด้านเทคนิค กรุณาติดต่อ : คุณพรชัย ภาติยานรักษ์ โทรศัพท์ : 0-2515-8987
เลขที่ 388 ถนนรัชดาภิเษก แขวงจันทระเกษม เขตจตุจักร กรุงเทพฯ 10900 โทรศัพท์ : 0-2515-8999 โทรสาร : 0-2515-8988 E-Mail : info@kinetics.co.th



บริษัท ไคเนติกส์ คอร์ปอเรชั่น จำกัด

KINETICS CORPORATION LTD.

รายงานผลการซ่อมและปรับเทียบอุปกรณ์ตรวจวัดคุณภาพอากาศ

ลูกค้า / หน่วยงาน : SGS (Thailand) Co., Ltd
วันที่ : 7 กุมภาพันธ์ 2565
รายชื่ออุปกรณ์ / เครื่องมือ : SO₂ Analyzer
รุ่นของอุปกรณ์ / เครื่องมือ : T100

TEST VALUES			
API MODEL T100		BEFORE	AFTER
1	RANGE	50 - 20,000 PPB	500
2	STABILITY	≤ 1 PPB	0.16
3	PRESSURE	25 - 35 in - Hg-A	27.1
4	SAMPLE FLOW	650 ± 10% cc/min	688.2
5	PMT	mV	12.8
6	NORM PMT	mV	16.2
7	UV LAMP	1000 - 4800 mV	3780
8	LAMP RATIO	30 To 120 %	93.5
9	STRAY LIGHT	≤ 100 PPB	7.4
10	DARK PMT	-50 ± 200 % mV	6.3
11	DARK LAMP	-50 ± 200 % mV	1.7
12	SO2 SLOPE	1.0 ± 0.3	0.993
13	SO2 OFFSET	< 250 mV	0.060
14	HWPS	400 - 900 V	511
15	RX CELL TEMP	50 ± 1 °C	50.0
16	BOX TEMP	AMBIENT ± 5 °C	35.7
17	PMT TEMP	7 ± 2 °C	8.3
18	SO2 SAMPLE READING	PPB	0.401
19	OPTIC TEST	2000 ± 1000 mV	2841.3
20	ELECTRICAL TEST	2000 ± 1000 mV	1992.3
21	VOLTAGE TEST	+5 V +12 V -15 V	-
22	ZERO GAS	0.00 PPB	0.253
23	SPAN GAS	400.00 PPB	412.846

หมายเหตุ



บริษัท ไคเนติกส์ คอร์ปอเรชั่น จำกัด



ลงนามเจ้าหน้าที่ (Signature)

ต้องการข้อมูลเพิ่มเติมทางด้านเทคนิค กรุณาติดต่อ : คุณพรชัย ภาติยานรักษ์ โทรศัพท์ : 0-2515-8987
เลขที่ 388 ถนนรัชดาภิเษก แขวงจันทระเกษม เขตจตุจักร กรุงเทพฯ 10900 โทรศัพท์ : 0-2515-8999 โทรสาร : 0-2515-8988 E-Mail : info@kinetics.co.th



Manometer Verification

Dry Gas Meter ID. : ENSS 045 Date of Calibration : 23/10/2021
Instrument Brand : Apex / Model 572 Calibrated By : OC.MW

Manometric gauge Information

Magnehelic Brand : Dwyer Industries, Inc. Magnehelic S/N : R0608022A1109
Magnehelic Model : 2000-100MM Expire Date : 14/10/2022

Manometer data				
Test No.	Manometer Reference ΔP (mm.H ₂ O);A	Manometer monitoring ΔP (mm.H ₂ O);B	Difference	Reference/Monitoring A/B
1	2.0	2.0	0.00	1.00
2	6.0	6.0	0.00	1.00
3	10.0	10.5	0.50	0.95
4	16.0	16.0	0.00	1.00
5	20.0	20.0	0.00	1.00
Average			0.10	0.99

Remark : [Reference(Avg) / Monitoring(Avg)] must be = 0.95 to 1.05

Checked By :

Position :
Date :

Operation Manager
25/10/2021

Approved By :

Position :
Date :

Technical Manager
25/10/2021



Meter Console Verification

Dry Gas Meter ID. : ENSS 045 Date of Calibration : 23/10/2021
Instrument Brand : Apex / Model 572 Calibrated By : OC

Wet gas meter Information

Wet gas Brand : Shinagawa Wet gas S/N : 544122
Wet gas Model : W-NK-2.5A Expire Date : 27 July 2022

Orifice Setting $\Delta H@$ (mm H ₂ O)	Wet gas		Metering System		Time (min)	Yi	$\Delta H@$
	V _w (L)	T _w (°C)	V _d (L)	T _m (°C)			
13	137.20	25.2	140.0	22.5	12.23	0.9700	50.518
13	137.08	25.0	140.0	23.0	12.29	0.9713	51.288
26	136.44	25.0	140.0	23.0	8.34	0.9656	48.823
26	135.78	24.9	140.0	23.0	8.34	0.9614	49.250
40	270.39	24.6	280.0	23.5	13.44	0.9584	49.001
40	270.21	24.5	280.0	24.0	13.43	0.9598	48.816
50	268.39	24.2	280.0	24.0	12.08	0.9533	48.362
50	267.15	24.1	280.0	24.0	12.09	0.9492	48.913
70	266.29	24.1	280.0	24.0	10.06	0.9444	47.703
70	265.77	24.0	280.0	24.0	10.06	0.9429	47.857
90	264.06	23.9	280.0	24.0	8.54	0.9354	48.457
90	264.26	23.8	280.0	24.0	8.57	0.9364	48.896
			Average			0.9540	48.990

Remark :
 $Y_i \leq \pm 0.02$ from average
 $Y_i = 1.00 \pm 0.05$
 $\Delta H@ \leq \pm 5.08$ mm H₂O from average
 $\Delta H@ = 46.7 \pm 6.4$ mm.H₂O

Checked By :

Position :
Date :

Operation Manager
25/10/2021

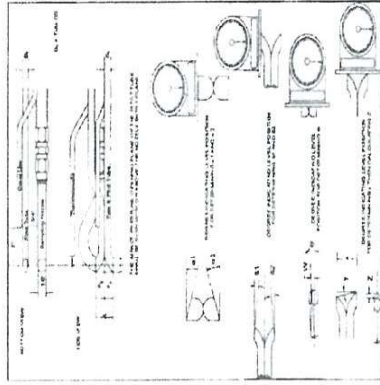
Approved By :

Position :
Date :

Technical Manager
25/10/2021

Certificate of Calibration

S-Type Geometric Pitot Tube Calibration
See the Code of Federal Regulations, Title 40, Part 60, Appendix A,
Method 2, Item 4



Pitot tube/Probe No. No. 3

Parameter	Value	Allowable Range	Check
Assembly Level?	Y	Yes or Y	PASS
Ports Damaged?	N	No or n	PASS
$\alpha 1$	-0.4	$-10^\circ < \alpha 1 < +10^\circ$	PASS
$\alpha 2$	-0.4	$-10^\circ < \alpha 1 < +10^\circ$	PASS
$\beta 1$	-1.3	$-5^\circ < \alpha 1 < +5^\circ$	PASS
$\beta 2$	-0.6	$-5^\circ < \alpha 1 < +5^\circ$	PASS
γ	2	N/A	-
θ	1.6	N/A	-
D_t	0.375	$0.188''$ to $0.375''$	PASS
A	0.988	$2.10, \leq A \leq 3.00$	PASS
A/2D _t	1.317	$1.05 \leq P_t/D_t \leq 1.5$	PASS
Z = A tan γ	0.035	$Z \leq 0.125''$	PASS
W = A tan θ	0.028	$W \leq 0.031''$	PASS

I certify that pitot tube/probe No. 3 meets or exceeds all specifications, criteria and/or applicable design features and is hereby assigned a pitot tube certification factor of 0.84. See 40 CFR Pt. 60, App. A, EPA Method 2

Standard Device
Device Name Digital Inclinator
Manufacturer BASELINE
Model 12-1057
ID No. QC-1824

Expiration data
ENSS No. 07-Dec-22
ENSS 22159

Certified by
Date

Approved by
Date

Temperature Display Verification

Dry Gas Meter ID. : ENS5 045 Date of Calibration : 23/10/2021
Instrument Brand : Apex / Model 572 Calibrated By : MW

Temperature Simulator Information

Simulator Brand : Handy Cal Simulator S/N : T1L1015
Simulator Model : CA11E Expire Date : 15/06/2022

Standard Value	Instrument Display			
	Stack	Probe	Filter	Aux
300	299	299	300	300
200	199	199	199	200
150	150	151	150	151
100	100	101	100	101
50	50	50	49	51
0	0	0	0	0
Difference	0.2%	1.0	1.0	1.0

Remark :
Stack $\leq \pm 1.5\%$ Absolute
Probe $\leq \pm 3.0^\circ\text{C}$
Filter $\leq \pm 3.0^\circ\text{C}$

Aux $\leq \pm 3.0^\circ\text{C}$
Exit $\leq \pm 3.0^\circ\text{C}$

Checked By :

Approved By :

Position :
Date :

Operation Manager
Date : 25/10/2021

Technical Manager
Date : 25/10/2021

MULTI-POINT GAS TEST REPORT OF NITRIC OXIDE

Equipment Information

Manufacturer	Horiba	Calibration Date	26-Dec-21
Model	HORIBA PG-350	Background Coefficient	-
Serial Number	8SPNRVX4	Room Temperature	1.0432
			24.7 °C

Standard Gas Information

Zero Gas		Span Gas	
Cylinder Number	14W004104	Cylinder Number	GN0019208
Component	N2	Component	NO
Concentration	99.999 %	Concentration	90.33 ppm
Expiration Date	-	Expiration Date	28-Feb-27

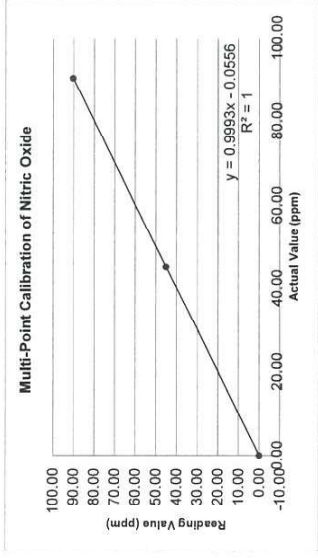
Measurement Range	100
% Measurement Range	90.33

Multi-Point Gas Test Data

Level	Actual Value	Reading Value (ppm)			Difference	
		1	2	3	Average	%
0%	0.00	0.00	-0.10	0.00	-0.03	
50%	45.17	45.00	45.00	45.10	45.03	0.29
100%	90.33	90.30	90.20	90.20	90.23	-0.10
					Average	0.20
					Result	PASS

Slope	0.9993	Interception	-0.0556	Correlation Coefficient	1.0000
%Slope	-0.0701%	% Interception	-0.0556%	% Correlation Coefficient	0.0000%
Result	PASS	Result	PASS	Result	PASS

Multi-Point Gas Test Chart



Test By

Approve By

Date

MULTI-POINT GAS TEST REPORT OF OXYGEN

Equipment Information

Manufacturer	Horiba	Calibration Date	26-Dec-21
Model	HORIBA PG-350	Background Coefficient	-
Serial Number	8SPNRVX4	Room Temperature	1.0552
			24.7 °C

Standard Gas Information

Zero Gas		Span Gas	
Cylinder Number	14W004104	Cylinder Number	ND27125
Component	N2	Component	O2
Concentration	99.999 %	Concentration	21.15 %
Expiration Date	-	Expiration Date	7-Dec-29

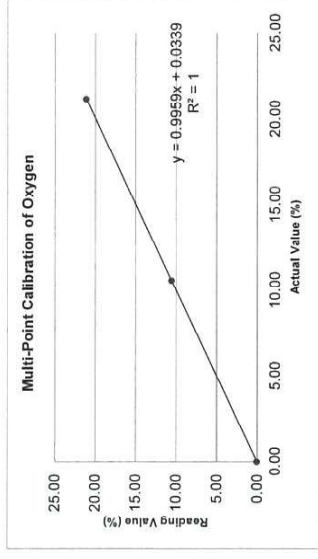
Measurement Range	25
% Measurement Range	84.6

Multi-Point Gas Test Data

Level	Actual Value	Reading Value (%)			Difference	
		1	2	3	Average	%
0%	0.00	0.03	0.05	0.04	0.04	0.04
50%	10.58	10.56	10.54	10.56	10.55	-0.02
100%	21.15	21.11	21.09	21.11	21.10	-0.05
					Average	0.21
					Result	PASS

Slope	0.9959	Interception	0.0339	Correlation Coefficient	1.0000
%Slope	-0.4098%	% Interception	0.1356%	% Correlation Coefficient	-0.0001%
Result	PASS	Result	PASS	Result	PASS

Multi-Point Gas Test Chart



Test By

Approve By

Date

MULTI-POINT GAS TEST REPORT OF CARBON MONOXIDE

Equipment Information

Manufacturer	Horiba	Calibration Date	26-Dec-21
Model	HORIBA PG-350	Background Coefficient	-
Serial Number	8SPNRVX4	Room Temperature	1.0195 °C

Standard Gas Information

Zero Gas		Span Gas	
Cylinder Number	14W004104	Cylinder Number	ND27117
Component	N2	Component	CO
Concentration	99.999 %	Concentration	905.9 ppm
Expiration Date	-	Expiration Date	20-Jul-29

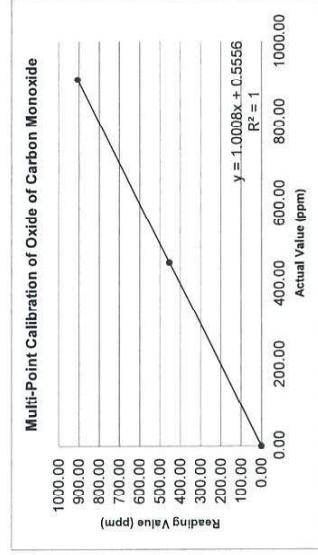
Measurement Range	1000
% Measurement Range	90.59

Multi-Point Gas Test Data

Level	Actual Value	Reading Value (ppm)			Difference	
		1	2	3	Average	%
0%	0.00	1.00	1.00	0.00	0.67	
50%	452.95	454.00	454.00	453.00	453.67	0.16
100%	905.90	907.00	908.00	907.00	907.33	0.16
				Average	0.16	
				Result	PASS	

Slope	1.0008	Interception	0.5556	Correlation Coefficient	1.0000
%Slope	0.0846%	% Interception	0.0556%	% Correlation Coefficient	0.0000%
Result	PASS	Result	PASS	Result	PASS

Multi-Point Gas Test Chart



Test By

Approve By

Date

MULTI-POINT GAS TEST REPORT OF SULFUR DIOXIDE

Equipment Information

Manufacturer	Horiba	Calibration Date	26-Dec-21
Model	HORIBA PG-350	Background Coefficient	-
Serial Number	8SPNRVX4	Room Temperature	1.0457 °C

Standard Gas Information

Zero Gas		Span Gas	
Cylinder Number	14W004104	Cylinder Number	GN0019208
Component	N2	Component	SO2
Concentration	99.999 %	Concentration	90.61 ppm
Expiration Date	-	Expiration Date	7-Jun-24

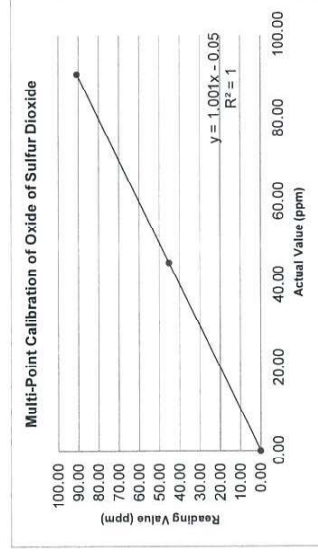
Measurement Range	200
% Measurement Range	45.305

Multi-Point Gas Test Data

Level	Actual Value	Reading Value (ppm)			Difference	
		1	2	3	Average	%
0%	0.00	0.00	0.00	0.10	0.03	
50%	45.31	45.20	45.10	45.10	45.13	0.38
100%	90.61	90.70	90.80	90.70	90.73	0.12
				Average	0.16	
				Result	PASS	

Slope	1.0010	Interception	-0.0500	Correlation Coefficient	1.0000
%Slope	0.0993%	% Interception	-0.0250%	% Correlation Coefficient	-0.0005%
Result	PASS	Result	PASS	Result	PASS

Multi-Point Gas Test Chart



Test By

Approve By

Date

HORIBA

Process & Environmental

Horiba (Thailand) Limited (Head Office) 393, 395, 397, 399, 401, 403 Laya Road, Somdechaoapaya, Khlongsan, Bangkok 10600
Telephone (66) 02 851-5945, Facsimile (66) 02 861-5200 <http://www.horiba.com>
Tax ID: 010-554-7016-7-48

Horiba (Thailand) Limited (Lai Krabang Office) 850/7 Lai Krabang Road, Lai Krabang, Bangkok 10520
Telephone (66) 02 734-4434, Facsimile (66) 02 734-4438

MULTI-POINT GAS TEST REPORT OF CARBON DIOXIDE

Equipment Information

Manufacturer	Horiba	Calibration Date	26-Dec-21
Model	HORIBA PG-350	Background Coefficient	-
Serial Number	8SPNRVX4	Room Temperature	1.0053
			24.7 °C

Standard Gas Information

Zero Gas		Span Gas	
Cylinder Number	14W004104	Cylinder Number	GN0018529
Component	N2	Component	CO2
Concentration	99.999 %	Concentration	20.95 %
Expiration Date	-	Expiration Date	14-Feb-27

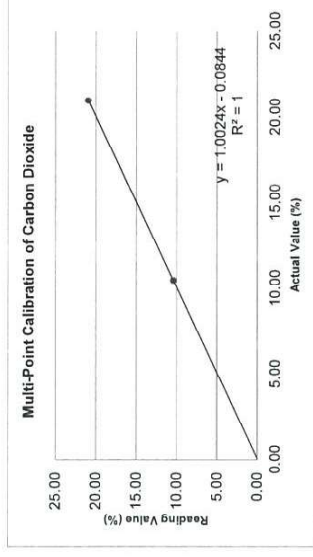
Measurement Range	30
% Measurement Range	69.833333

Multi-Point Gas Test Data

Level	Actual Value	Reading Value (%)			Difference	
		1	2	3	Average	%
0%	0.00	-0.05	-0.10	-0.07	-0.07	-0.07
50%	10.48	10.40	10.39	10.39	10.39	-0.08
100%	20.95	20.92	20.96	20.90	20.93	-0.02
					Average	0.11
					Result	PASS

Slope	1.0024	Interception	-0.0844	Correlation Coefficient	1.0000
% Slope	0.2387%	% Interception	-0.2815%	% Correlation Coefficient	-0.0002%
Result	PASS	Result	PASS	Result	PASS

Multi-Point Gas Test Chart



Test By

Approve By

Date

Date

FM-708-TPM1-01 Rev. 01 Issue date 13.05.20

INNOVATIVE INSTRUMENT CALIBRATION LAB
INNOVATIVE INSTRUMENT CO., LTD. HEAD OFFICE
7139 MOO 13, SOI SINTINAKORN 11 TAMBON BANG KALO,
AMPHOE BANG PHU SAMUT PRAKAN PROVINCE 10540 THAILAND
TEL : (66)0-2116-5860-1 FAX: (66)0-2116-7140



Calibration Note
UUC Adjustment : Not Adjust

Certificate No : 21-TPM-210
Request No : Req-2021-0920
Page : 2/2

Result of Calibration :

UUC Sensor	Standard Temperature (°C)	UUC Reading (°C)	Correction (°C)	Uncertainty (°C)
WET	25.003	24.8	+ 0.2	0.14
	35.005	34.8	+ 0.2	0.14
	45.007	44.8	+ 0.2	0.14
DRY	25.006	24.8	+ 0.2	0.14
	35.005	34.8	+ 0.2	0.14
	45.006	44.8	+ 0.2	0.14
GLOBE	25.005	24.8	+ 0.2	0.14
	35.005	34.8	+ 0.2	0.14
	45.003	44.8	+ 0.2	0.14

End of Certificate

Calibrated By :



Note

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



Approved By :



Calibration Engineer Supervisor

Issue Date :

19 July 2021



Certificate of Calibration

Customer
Name : SGS (Thailand) Limited.
Address : 100 Nanglinchee Road, Chongnonsi, Yamaa Bangkok 10120

Certificate No : 21-TPM-210
Request No : Req-2021-0920
Page : 1/2

Unit Under Calibration Details

Calibration Parameter : Temperature
Instrument Name : Area Heat Stress Monitor
Manufacturer : 3M
Model : QT-34
Serial Number : TEM030025
Resolution : 0.1 °C
ID Number : -
Range Calibration : 25 °C to 45 °C
Type of Sensor : RTD
Sensor Diameter (mm) : 4.5
Calibration Position (mm) : 67.5
Instrument Status : Used

Calibration Environment and Details

Temperature : 23 °C ± 3 °C
Humidity : 55 %RH ± 15 %RH
Received Date : 12 July 2021
Calibrated Date : 14 July 2021
Calibration Procedure : In-house method CP-TPM-01 by Comparison with Standard Thermometer.

Reference Standard

Digital Thermometer with Sensor, Manufacturer: GINGO GINGO, Model: GT11-RTD100, SN: 12900077, ID: AR-TPM Which was calibrated on 30 March 2021, Calibration Certificate No.: QR21-0719

Traceability

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

CALIBRATION REPORT

Condition of this calibration result :

1. Environment : Temperature : (23 ± 3) °C
Relative Humidity : (50 ± 15) %

2. Reference / Procedure Used :

- This Instrument was calibrated by substitution with reference illuminance meter, the instrument and reference illuminance meter were mounted with the plane of its diffuser vertical and normal to the direction of measurement
- Calibration was illuminated by the luminous standard lamp (operated at colour temperature 2856K) according to GIC Calibration Laboratory calibration procedure No.GICLAB-CP-L01.

3. Reference Standard Instrument :

Instrument	Model	Serial No	Certificate No	Due Dated
Illuminance meter	PMA2200 / PMA2130	17323 / 25664	TP-1031-20	16 Oct 21

4. This Certification is traceable to the SI unit through :

- The National Institute of Metrology (Thailand) .

5. Uncertainty :

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

VERIFIED

DATE Jul 20, 2021

700/20-21 Phaholyothin Rd., Samsennai, Phayathai,
Bangkok 10400 Thailand

Tel : +66 (02) 615 4999
Fax : +66 (02) 615 4844
E-mail : cal@gic.co.th

Certificate of Calibration

Equipment : LED Light Meter
Manufacturer : EXTECH
Model / Type : LT40
Serial No. : 171100792
ID No. : ENWP18194
Customer : SGS (Thailand) Limited.
100 Nanglinchee Road, Chongnonsee, Yannawa, Bangkok 10120.

C.S.R. No. : L0000972-21
Received Date : 13 July 2021
Calibration Date : 14 July 2021

Calibrated By : NATAPOL KINGKAEW

Approved By : NATAPOL KINGKAEW

Issue Date : 15 July 2021

VERIFIED

DATE Jul 20, 2021

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

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CERTIFICATE No. CAL0044-22 PAGE 1 OF 3

Certificate of Calibration

Equipment : DIGITAL LIGHT METER
Manufacturer : Testo
Model / Type : testo 540
Serial No. : 39105471/0902
ID No. : ENWP20204
Customer : SGS (Thailand) Limited.
100 Nanglinchee Road, Chongnonsee, Yamawa, Bangkok 10120.
C.S.R. No. : L00000035-22
Received Date : 10 January 2022
Calibration Date : 11 January 2022

Calibrated By : TONTRAKARN SRIKACHA
Approved By : WIWAT CHAMNANDEE
Issue Date : 11 January 2022

VERIFIED	
BY	DATE

The uncertainties are for a level of confidence of approximately 95%.
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CERTIFICATE No. CAL00953-21 PAGE 3 OF 3

CALIBRATION REPORT

All data shown below were as received value : After adjustment
Before Adjustment Condition :

Standard (lux)	UUC (lux)
1000	789.5

Calibration result :

Function: Illuminance Measurement

U.U.C. Range (lux)	Standard Setting (lux)	U.U.C. Reading (lux)	Error (lux)	Uncertainty of measurement \pm (lux)
AUTO RANGE	0	0.0	0.0	0.60
	50	48.5	-1.5	1.6
	250	247.0	-3.0	6.5
	500	495.2	-4.8	13
	1000	990.0	-10.0	26
	1500	1488	-12	36
	2000	1987	-13	48
	2999	2974	-25	72
	4000	3965	-35	96
	4999	4958	-41	0.12 klux

- U.U.C. = Unit Under Calibration

This result of calibration was found accurate as show on data and place of calibration only.

- END -

VERIFIED	DATE 20/01/2021
----------	-----------------

CALIBRATION REPORT

All data shown below were as received value : Without adjustment

Calibration result :

Function: Illuminance Measurement

U.U.C. Range (lux)	Standard Setting (lux)	U.U.C. Reading (lux)	Error (lux)	Uncertainty of measurement ± (lux)
AUTO RANGE				
	0	0	0	0.82
	50	49	-1	1.6
	250	239	-11	6.5
	500	486	-14	13
	1000	995	-5	26
	1500	1497	-3	36
	2000	1998	-2	48
	3000	3077	77	72
	4000	4107	107	96
	5000	5138	138	0.12 klux

- U.U.C. = Unit Under Calibration

This result of calibration was found accurate as show on data and place of calibration only.

- END -

CALIBRATION REPORT

Condition of this calibration result :

1. Environment : Temperature : (23 ± 3) °C
 Relative Humidity : (50 ± 15) %

2. Reference / Procedure Used :

- This Instrument was calibrated by substitution with reference illuminance meter, the Instrument and reference illuminance meter were mounted with the plane of its diffuser vertical and normal to the direction of measurement
- Calibration was illuminated by the luminous standard lamp (operated at colour temperature 2856K) according to GIIC Calibration Laboratory calibration procedure No.GIICLAB-CP-L01.

3. Reference Standard Instrument :

Instrument	Model	Serial No	Certificate No	Due Dated
Illuminance meter	PMA2200 / PMA2130	25531 / 025000	TP-1010-21	27 May 22

4. This Certification is traceable to the SI unit through :

- The National Institute of Metrology (Thailand) .

5. Uncertainty :

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

Certificate of Calibration

Customer		Certificate No : 22-ACT-168
Name	: SGS (Thailand) Limited,	
Address	: 100 Nanglinsee Road, Chongnonsi, Yanawa Bangkok 10120	Remest No : Rem-2022-0423

Unit Under Calibration Details

Measurement Item:	: Sound Level Meter
Manufacturer	: Cirrus
Model	: CR171B
Serial Number	: G078054
ID	: -
Resolution	: 0.1 dB
Microphone Class:	: 1
Microphone Model:	: MK224
Microphone S.N.:	: 202157A
Preamplifier Model:	: MK170
Preamplifier S.N.:	: 0805
Intermitt Status:	: Used

Calibration Environment and Details

Temperature	: 23 °C ± 2 °C
Humidity	: 50 %RH ± 20 %RH
Barometric Pressure	: 1013 hPa ± 10 hPa
Received Date	: 23 February 2022
Calibrated Date	: 7 March 2022

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

Reference Standard

Instrument	Brand	Model	SN	Due calibration	Traceability
Standard Microphone	GRAS	40AN	188273	15 September 2022	GRAS
Multifrequency Calibrator	Quest	Quest-cal	4F-A000234	14 June 2022	TSI
Audio Generator	Svantek	Swan401	131	18 October 2022	WK Electric

Note

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

Calibrated B

Approved By: _____

Calibration Officer

Calibration Engineer Supervisor

Issue Date:

7 March 2022

VERIFIED

DATE Mar 8 2012

The results related only to the item [redacted] consent in full without written approval of the Innovative Instrument Co. [redacted]

FM-708-SF M-01 Rev. 0 Issues date 01/07/10

1. Indication at the calibration check frequency

UUC Setting	Nominal		Before Adjust		Adjust		UNCERTAINTY (\pm dB)	Acceptance Limit (\pm dB)
	Level (dB)	ERR (dB)	UUC (dB)	ERR (dB)	UUC (dB)			
FAST / A 20+140								
Calibrator Setting								
1000 Hz 94.00 dB	94.08		94.1	+0.02	93.9	-0.18	0.20	0.3

Note : Absolute sensitivity was established by the use of Sound Calibrator Brand Cirrus, Model CB-515, SN. 90411

2. Self-generated noise, Microphone installed

UUC Setting	Measured (dB)	UNCERTAINTY (\pm dB)
FAST 20-140		
UUC Weighting		
A	16.5	0.10

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

UUC Setting	Measured	UNCERTAINTY
FAST 20-140		
UUC Weighting	(dB)	(\pm dB)
A	-	0.10
C	16.1	0.10
Z	28.5	0.10

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

U/C Setting	Deviation from various Frequency				UNCERTAINTY	Acceptance Limit (\pm dB)
	Weighting Response curve					
	A	C	Z			
FAST 20-140						
STD Setting						
125 Hz	0.5	0.5	0.5	0.50		1.0
1000 Hz	0.0	0.0	0.0	0.60		0.7
4000 Hz	-0.5	-0.4	-0.5	0.60		1.0
8000 Hz	-1.0	-1.0	-1.0	0.70		+1.5 -2.5

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

FM-708-S(M-0) Rev 0 Issue date: 01/07/19

Certificate No : 22-ACT-168
Request No : Req-2022-0423

7. Long Term Stability

UUC Setting	Measured	UNCERTAINTY (\pm dB)	Acceptance Limit (\pm dB)
FAST A 20-140	UUC (dB)		
STD Setting			
Initial	114.0		
Final	114.0		
Deviated	0.0	0.1	0.1

8. Level linearity on the reference level range

UUC Setting	Anticipated	Deviation	UNCERTAINTY (\pm dB)	Acceptance Limit (\pm dB)
FAST A 20-140	REF (dB)	UUC (dB)	ERR (dB)	
STD dB				
139.00	139	139.0	0.0	0.8
124.00	124	124.0	0.0	0.8
129.00	129	129.0	0.0	0.8
124.06	124	124.0	0.0	0.8
119.00	119	119.0	0.0	0.8
114.00	114	114.0	0.0	0.8
109.00	109	109.0	0.0	0.8
104.00	104	104.0	0.0	0.8
99.00	99	99.0	0.0	0.8
94.00	94	94.1	0.1	0.8
89.00	89	89.1	0.1	0.8
84.00	84	84.0	0.0	0.8
79.00	79	79.1	0.1	0.8
74.00	74	74.1	0.1	0.8
69.00	69	69.1	0.1	0.8
64.00	64	64.1	0.1	0.8
59.00	59	59.1	0.1	0.8
54.00	54	54.1	0.1	0.8
49.00	49	49.1	0.1	0.8
44.00	44	44.1	0.1	0.8
39.00	39	39.1	0.1	0.8
34.00	34	34.1	0.1	0.8
29.00	29	29.1	0.1	0.8
24.00	24	23.9	-0.1	0.8

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

Certificate No : 22-ACT-168
Request No : Req-2022-0423

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

UUC Setting	Deviation from various Frequency	UNCERTAINTY (\pm dB)	Acceptance Limit (\pm dB)
FAST / 20-140	Weighting Response curve		
STD Setting	A (dB)	C (dB)	Z (dB)
63 Hz	0.3	0.0	0.0
125 Hz	0.2	0.1	0.0
250 Hz	0.2	0.0	0.0
500 Hz	0.1	0.0	0.0
1000 Hz	0.0	0.0	0.0
2000 Hz	-0.2	0.0	0.0
4000 Hz	-0.4	-0.2	0.0
8000 Hz	-0.5	-0.4	-0.1
16000 Hz	0.1	0.2	-0.4
		0.2	0.7
			1.0
			1.0
			1.0
			+1.5, -2.5
			-2.5, -16.0

6. Frequency and time weightings at 1kHz

UUC Setting	STD	Measured	UNCERTAINTY (\pm dB)	Acceptance Limit (\pm dB)
FAST / 20-140	REF (dB)	UUC (dB)	ERR (dB)	
UUC Weighting				
A	114.00	114.0	0.0	0.2
C	114.00	114.0	0.0	0.2
Z	114.00	114.0	0.0	0.2

UUC Setting	STD	Measured	UNCERTAINTY (\pm dB)	Acceptance Limit (\pm dB)
20-140 / A	REF (dB)	UUC (dB)	ERR (dB)	
UUC Time Response				
Fast	114.00	114.0	0.0	0.1
Slow	114.00	114.0	0.0	0.1
Leq	114.00	114.0	0.0	0.1

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

Certificate No : 22-AC1-168
Request No : Req-2022-0423

9. Level linearity including the level range control

UUC Setting	STD REF (dB)	Measured		UNCERTAINTY (± dB)	Acceptance Limit (± dB)
		UUC (dB)	ERR (dB)		
FAST A	25.4	25.4	0.0	0.3	0.8
UUC Range	114	114.0	0.0	0.3	0.8

10. Tone burst response

UUC Setting	STD Toneburst (ms)	Anticipated Ref (dB)	Measured		UNCERTAINTY (± dB)	Acceptance Limit (± dB)
			UUC (dB)	ERR (dB)		
A / 20-140	200	126.0	126.0	0.0	0.3	0.5
UUC Time Response	2	119.0	118.9	-0.1		+1.0, -1.5
	0.25	110.0	109.8	-0.2		+1.0, -3.0
Fast	200	129.6	129.6	0.0		0.5
Slow	2	110.0	110.0	0.0		+1.0, -3.0
SEL	200	120.0	120.0	0.0		0.5
	2	110.0	110.0	0.0		+1.0, -1.5
	0.25	101.0	100.9	-0.1		+1.0, -3.0

11. Peak C Sound level

UUC Setting	Anticipated REF (dB)	Measured		UNCERTAINTY (± dB)	Acceptance Limit (± dB)
		UUC (dB)	ERR (dB)		
FAST / C / 20-140	135.4	135.6	-0.20	0.2	2.0
STD Setting	134.4	134.2	-0.20		1.0
Complete cycle	134.4	134.2	-0.20		1.0
Positive half cycle					
Negative half cycle					

12. Overload indication

UUC Setting	Measured UUC (dB)	UNCERTAINTY (± dB)	Acceptance Limit (± dB)
FAST A / 20-140	140.9	0.2	1.5
STD Setting	140.9		
Positive one-half cycle	140.9		
Negative one-half cycle			
Deviated	0.0		

13. High Level Stability

UUC Setting	Measured UUC (dB)	UNCERTAINTY (± dB)	Acceptance Limit (± dB)
FAST A / 20-140	139.0	0.1	0.1
STD Setting	139.0		
Initial	139.0		
Final			
Deviated	0.0		

End of Certificate

Certificate No : 22-ACT-052
Request No : Req-2022-0120

1. Indication at the calibration check frequency

UUC Setting	Nominal Level (dB)	Before Adjust		Adjust		Acceptance Limit (± dB)
		UUC (dB)	ERR (dB)	UUC (dB)	ERR (dB)	
FAST A 20-140						
Calibrator Setting						
1000 Hz 114.00 dB	113.91	113.5	-0.41	113.9	-0.01	0.3

Note : Absolute sensitivity was established by the use of Sound Calibrator Brand CASILLA, Model CEL-120/2, SN: 3864875

2. Self-generated noise, Microphone installed

UUC Setting	Measured (dB)	UNCERTAINTY (± dB)
FAST / 20-140		
UUC Weighting		
A	19.3	0.10

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

UUC Setting	Measured (dB)	UNCERTAINTY (± dB)
FAST / 20-140		
UUC Weighting		
A	-	0.10
C	19.8	0.10
Z	32.8	0.10

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

UUC Setting	Deviation from various Frequency Weighting Response curve (dB)	UNCERTAINTY (± dB)		Acceptance Limit (± dB)
		A	C	
FAST 20-140				
STD Setting				
125 Hz	-0.5	-0.7	-0.6	0.50
1000 Hz	0.0	0.0	0.0	0.60
4000 Hz	0.0	0.2	0.2	0.60
8000 Hz	-0.2	-0.5	-0.3	0.70

Certificate of Calibration

Customer
Name : SGS (Thailand) Limited.
Address : 100 Nanglinchee Road, Chongmaon, Yanawa Bangkok 10120

Certificate No : 22-ACT-052
Request No : Req-2022-0120

Unit Under Calibration Details

Measurement item : Sound Level Meter
Manufacturer : Cirrus
Model : CR-161B
Serial Number : G078417
ID : -
Resolution : 0.1 dB
Microphone Class : 1
Microphone Model : MK224
Microphone S.N. : 209938D
Preamplifier Model : MK170
Preamplifier S.N. : 0895
Instrument Status : Used

Calibration Environment and Details

Temperature : 23 °C ± 2 °C
Humidity : 50 %RH ± 20 %RH
Barometric Pressure : 1013 hPa ± 10 hPa
Received Date : 20 January 2022
Calibrated Date : 26 January 2022
Calibration Procedure : In-house method CP-SLM-01 based on IEC 61672-3 : 2013 Electroacoustics - Sound level meters - Part 3: Periodic tests
Location of Calibration : Lab Acoustic

Reference Standard

Instrument	Brand	Model	S.N.	Due calibration	Traceability
Standard Microphone	GRAS	40AN	188273	15 September 2022	GRAS
Multi-frequency Calibrator	Quest	Quest-cal	FFA00234	14 June 2022	TSI
Audio Generator	Stanek	Scan401	131	18 October 2022	WK Elektrik

Note

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

Calibrated

Approved by

Calibration Officer

Issue Date : 26 January 2022
Calibration Engineer Supervisor

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

UUC Setting	Deviation from various Frequency				UNCERTAINTY (\pm dB)	Acceptance Limit (\pm dB)
	FAST / 20-140	A (dB)	C (dB)	Z (dB)		
STD Setting						
63 Hz		0.3	0.1	0.0		1.0
125 Hz		0.3	0.1	0.0		1.0
250 Hz		0.2	0.0	0.0		1.0
500 Hz		0.1	0.1	0.0		1.0
1000 Hz		0.0	0.0	0.0	0.2	0.7
2000 Hz		-0.1	0.0	0.0		1.0
4000 Hz		-0.3	-0.2	0.0		1.0
8000 Hz		-0.5	-0.3	-0.1		+1.5, -2.5
16000 Hz		0.2	0.4	-0.2		-2.5, -16.0

6. Frequency and time weightings at 1kHz

UUC Setting	STD		Measured		UNCERTAINTY (\pm dB)	Acceptance Limit (\pm dB)
	FAST / 20-140	REF (dB)	UUC (dB)	ERR (dB)		
UUC Weighting						
A		114.00	114.0	0.0		0.2
C		114.00	114.0	0.0	0.2	0.2
Z		114.00	114.0	0.0		0.2

UUC Setting	STD		Measured		UNCERTAINTY (\pm dB)	Acceptance Limit (\pm dB)
	20-140 / A	REF (dB)	UUC (dB)	ERR (dB)		
UUC Time Response						
Fast		114.00	114.0	0.0		0.1
Slow		114.00	114.0	0.0	0.2	0.1
Leq		114.00	114.0	0.0		0.1

7. Long Term Stability

UUC Setting	Measured		UNCERTAINTY (\pm dB)	Acceptance Limit (\pm dB)
	FAST / A 20-140	UUC (dB)		
STD Setting				
Initial		114.0		
Final		114.0		
Deviated		0.0	0.1	0.1

8. Level linearity on the reference level range

UUC Setting	Anticipated		Deviation		UNCERTAINTY (\pm dB)	Acceptance Limit (\pm dB)
	FAST / A 20-140	REF (dB)	UUC (dB)	ERR (dB)		
STD dB						
139.00		139	139.0	0.0		0.8
134.00		134	134.0	0.0		0.8
129.00		129	129.0	0.0		0.8
124.00		124	124.0	0.0		0.8
119.00		119	119.0	0.0		0.8
114.00		114	114.0	0.0		0.8
109.00		109	109.0	0.0		0.8
104.00		104	104.0	0.0		0.8
99.00		99	99.0	0.0		0.8
94.00		94	94.0	0.0		0.8
89.00		89	89.0	0.0		0.8
84.00		84	84.0	0.0		0.8
79.00		79	79.1	0.1	0.3	0.8
74.00		74	74.1	0.1		0.8
69.00		69	69.1	0.1		0.8
64.00		64	64.1	0.1		0.8
59.00		59	59.1	0.1		0.8
54.00		54	54.1	0.1		0.8
49.00		49	49.1	0.1		0.8
44.00		44	44.1	0.1		0.8
39.00		39	39.1	0.1		0.8
34.00		34	34.1	0.1		0.8
29.00		29	29.0	0.0		0.8
24.00		24	24.1	0.1		0.8

9. Level linearity including the level range control

UUC Setting	STD REF	Measured		UNCERTAINTY (\pm dB)	Acceptance Limit (\pm dB)
		UUC (dB)	ERR (dB)		
FAST / A		25.9	0.2	0.3	0.8
UUC Range					0.8
20-140	114	114.0	0.0		

10. Tone burst response

UUC Setting	STD Toneburst (ms)	Anticipated		Measured		UNCERTAINTY (\pm dB)	Acceptance Limit (\pm dB)
		Ref		UUC (dB)	ERR (dB)		
A / 20-140							
UUC Time Response							
Fast	2	136.0		136.0	0.0	0.3	0.5
	0.25	119.6		118.9	-0.1		+1.0, -1.5
Slow	200	110.0		109.8	-0.2		+1.0, -3.0
	2	129.6		129.5	-0.1		0.5
	2	110.0		109.9	-0.1		+1.0, -3.0
SEL	200	130.0		130.0	0.0		0.5
	2	110.0		110.0	0.0		+1.0, -1.5
	0.25	101.0		100.9	-0.1		+1.0, -3.0

11. Peak C Sound level

UUC Setting	Anticipated		Measured		UNCERTAINTY (\pm dB)	Acceptance Limit (\pm dB)
	REF		UUC (dB)	ERR (dB)		
FAST / C / 20-140						
STD Setting						
Complete cycle	135.4		135.4	0.00	0.2	2.0
Positive half cycle	134.4		134.3	-0.10	1.0	
Negative half cycle	134.4		134.3	-0.10	1.0	

12. Overload indication

UUC Setting	Measured	UNCERTAINTY (\pm dB)	Acceptance Limit (\pm dB)
	UUC (dB)		
FAST A / 20-140			
STD Setting			
Positive one-half cycle	146.7		
Negative one-half cycle	146.6		
Deviated	0.1	0.2	1.5

13. High Level Stability

UUC Setting	Measured	UNCERTAINTY (\pm dB)	Acceptance Limit (\pm dB)
	UUC (dB)		
FAST A / 20-140			
STD Setting			
Initial	139.0		
Final	139.0		
Deviated	0.0	0.1	0.1

End of Certificate

Certificate of Calibration

Customer
Name : SGS (Thailand) Limited.
Address : 100 Nanglinchee Road, Chongnonsi, Yamaeva Bangkok 10120

Certificate No : 22-ACT-293
Request No : Req-2022-0735

Unit Under Calibration Details
Measurement item : Sound Level Meter
Manufacturer : Cirrus
Model : CE161B
Serial Number : G078421
ID : -
Resolution : 0.1 dB
Microphone Class : 1
Microphone Model : MK224
Microphone S/N : 205274A
Preamplifier Model : KM170
Preamplifier S/N : 0807
Innment Status : Used

Calibration Environment and Details
Temperature : 23 °C ± 2 °C
Humidity : 50 %RH ± 20 %RH
Barometric Pressure : 1013 hPa ± 10 hPa
Received Date : 20 April 2022
Calibrated Date : 29 April 2022
Calibration Procedure : In-house method (P-SLM-0) based on IEC 61672-3 : 2013 Electroacoustics - Sound level meters - Part 3: Periodic tests
Location of Calibration : Lab Acoustic

Instrument	Brand	Model	SN	Due calibration	Traceability
Standard Microphone	GRAS	40AN	188273	13 September 2022	GRAS
Multi-frequency Calibrator	Quest	Quest-eal	EFA000234	14 June 2022	TSI
Audio Generator	Svanick	Svan401	131	18 October 2022	WK Electric

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

Calibrated By : [Redacted]

Approved By : [Redacted]

Calibration Officer

Calibration Engineer Supervisor

Issue Date : 29 April 2022

VERIFIED
DATE 10/5/22

Certificate No : 22-ACT-293
Request No : Req-2022-0735

1. Indication at the calibration check frequency

UUC Setting	Nominal Level	Before Adjust	Adjust	UNCERTAINTY	Acceptance Limit
FAST / A / 20-140	(dB)	ERR (dB)	UUC (dB)	ERR (dB)	(± dB)
Calibrator Setting	93.85	95.1	93.7	-0.15	0.20
1000 Hz 94.00 dB		+1.25			0.3

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

2. Self-generated noise, Microphone installed

UUC Setting	Measured	UNCERTAINTY
FAST / 20-140	(dB)	(± dB)
UUC Weighting	16.1	0.10
A		

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

UUC Setting	Measured	UNCERTAINTY
FAST / 20-140	(dB)	(± dB)
UUC Weighting	-	0.10
A		0.10
C		0.10
Z	29.0	0.10

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

UUC Setting	Deviation from various Frequency Weighting Response curve				UNCERTAINTY	Acceptance Limit
	A	C	Z			
FAST / 20-140	(dB)	(dB)	(dB)	(± dB)		(± dB)
STD Setting						
125 Hz	0.4	0.2	0.1	0.50		1.0
1000 Hz	0.0	0.0	0.0	0.60		0.7
4000 Hz	-0.3	-0.2	0.0	0.60		1.0
8000 Hz	0.0	0.0	0.3	0.70		+1.5-2.5

Certificate No : 22-ACT-293
Request No : Req-2022-0735

7. Long Term Stability

UUC Setting	Measured	UNCERTAINTY	Acceptance
FAST / A / 20-140	UUC (dB)	(± dB)	Limit (± dB)
STD Setting			
Initial	114.0		
Final	114.0		
Deviated	0.0	0.1	0.1

8. Level linearity on the reference level range

UUC Setting	Anticipated	Deviation	UNCERTAINTY	Acceptance
FAST / A / 20-140	REF (dB)	UUC (dB)	ERR (dB)	Limit (± dB)
STD dB				
130.00	139	139.0	0.0	0.8
134.00	134	134.0	0.0	0.8
129.00	129	129.0	0.0	0.8
124.00	124	124.0	0.0	0.8
119.00	119	119.0	0.0	0.8
114.00	114	114.0	0.0	0.8
109.00	109	109.0	0.0	0.8
104.00	104	104.0	0.0	0.8
99.00	99	99.0	0.0	0.8
94.00	94	94.0	0.0	0.8
89.00	89	89.0	0.0	0.8
84.00	84	84.0	0.0	0.8
79.00	79	79.0	0.0	0.8
74.00	74	74.0	0.0	0.8
69.00	69	69.0	0.0	0.8
64.00	64	64.0	0.0	0.8
59.00	59	59.1	0.1	0.8
54.00	54	54.1	0.1	0.8
49.00	49	49.0	0.0	0.8
44.00	44	44.0	0.0	0.8
39.00	39	39.0	0.0	0.8
34.00	34	34.0	0.0	0.8
29.00	29	28.9	-0.1	0.8
24.00	24	23.8	-0.2	0.8

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

Certificate No : 22-ACT-293
Request No : Req-2022-0735

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

UUC Setting	Deviation from various Frequency	UNCERTAINTY	Acceptance
FAST / 20-140	A (dB)	(± dB)	Limit (± dB)
STD Setting			
65 Hz	0.2	0.0	1.0
125 Hz	0.2	0.1	1.0
250 Hz	0.2	0.0	1.0
500 Hz	0.1	0.0	1.0
1000 Hz	0.0	0.0	0.7
2000 Hz	-0.2	0.0	1.0
4000 Hz	-0.4	-0.2	1.0
8000 Hz	-0.5	-0.3	+1.5, -2.5
16000 Hz	0.2	0.4	+2.5, -16.0

6. Frequency and time weightings at 1kHz

UUC Setting	STD	Measured	UNCERTAINTY	Acceptance
FAST / 20-140	REF (dB)	UUC (dB)	ERR (dB)	Limit (± dB)
UUC Weighting				
A	114.00	114.0	0.0	0.2
C	114.00	114.0	0.0	0.2
Z	114.00	114.0	0.0	0.2
UUC Setting	STD	Measured	UNCERTAINTY	Acceptance
20-140 / A	REF (dB)	UUC (dB)	ERR (dB)	Limit (± dB)
UUC Time Response				
Fast	114.00	114.0	0.0	0.1
Slow	114.00	114.0	0.0	0.1
Leq	114.00	114.0	0.0	0.1

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

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

Certificate No : 22-ACT-293
Request No : Req-2022-0735

12. Overload indication

UUC Setting	Measured	UNCERTAINTY (\pm dB)	Acceptance Limit (\pm dB)
FAST / A / 20-140	UUC (dB)		
STD Setting			
Positive one-half cycle	145.9		
Negative one-half cycle	145.9		
Deviated	0.0	0.2	1.5

13. High Level Stability

UUC Setting	Measured	UNCERTAINTY (\pm dB)	Acceptance Limit (\pm dB)
FAST / A / 20-140	UUC (dB)		
STD Setting			
Initial	139.0		
Final	139.0		
Deviated	0.0	0.1	0.1

End of Certificate

Certificate No : 22-ACT-293
Request No : Req-2022-0735

9. Level linearity including the level range control

UUC Setting	STD	Measured	UNCERTAINTY (\pm dB)	Acceptance Limit (\pm dB)
FAST / A	REF (dB)	UUC (dB)	ERR (dB)	
UUC Range				
	25.8	25.7	-0.1	0.8
20-140	114	114.0	0.0	0.8

10. Tone burst response

UUC Setting	STD	Anticipated	Measured	UNCERTAINTY (\pm dB)	Acceptance Limit (\pm dB)
A / 20-140	Toneburst (ms)	Ref (dB)	UUC (dB)	ERR (dB)	
UUC Time Response					
	200	136.0	136.0	0.0	0.5
Fast	2	119.0	118.9	-0.1	+1.0, -1.5
	0.25	110.0	109.9	-0.1	+1.0, -3.0
Slow	200	129.6	129.6	0.0	0.5
	2	110.0	110.0	0.0	+1.0, -3.0
	200	130.0	130.0	0.0	0.5
SEL	2	110.0	110.0	0.0	+1.0, -1.5
	0.25	101.0	101.0	0.0	+1.0, -3.0

11. Peak C Sound level

UUC Setting	Anticipated	Measured	UNCERTAINTY (\pm dB)	Acceptance Limit (\pm dB)
FAST / C / 20-140	REF (dB)	UUC (dB)	ERR (dB)	
STD Setting				
Complete cycle	135.4	135.5	+0.10	2.0
Positive half cycle	134.4	134.2	-0.20	1.0
Negative half cycle	134.4	134.2	-0.20	1.0



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-64/0851

MTC No. EEL. BP. 59/0964

The reported expanded uncertainty is based upon a standard uncertainty multiplied by a coverage factor $k = 2$, providing a level of confidence of approximately 95%.

Nominal Output of Unit Under Test = 94 dB re 20 μ Pa at 1000 Hz

Acoustic Output in dB re 20 μ Pa, Corrected to Reference Conditions: 101.325 kPa, 23.0 °C and 50 %RH.

1. Sound Pressure Level

Standard Microphone Type	Measured Sound Pressure Level (dB)	Deviated value (dB)	Uncertainty (dB)	Tolerance limit IEC60942:2003 Class 1
1/2 inch Briel&Kjaer 4180	94.08	0.08	± 0.10	± 0.40 dB

2. Frequency

Standard Microphone Type	Measured Frequency (Hz)	Deviated value (Hz)	Uncertainty (Hz)	Tolerance limit IEC60942:2003 Class 1
1/2 inch Briel&Kjaer 4180	1000.3	0.3	± 1.5	$\pm 1.0\%$

3. Total Distortion

Standard Microphone Type	Measured Total Distortion (%)	Uncertainty (%)	Tolerance limit IEC60942:2003 Class 1
1/2 inch Briel&Kjaer 4180	0.86	± 0.50	$\pm 3.0\%$

Note : 1. No adjustment.

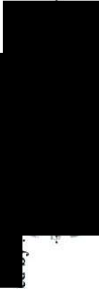
2. The calibrator pressure correction was not included.

3. The microphone volume correction was not included.

Calibrated by



Approved by



Acting Director

Electrical and Electronic Standards Laboratory
Industrial Metrology and Testing Service Centre

Date of Calibration : 27 Sep. 2021

Date of Issue : 28 Sep. 2021

Ref : 20111264091703872002

End of Certificate

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FNBLMTC.002 Rev.4

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-64/0851

MTC No. EEL. BP. 59/0964

CALIBRATION CERTIFICATE

Submitted by : SGS (Thailand) Limited.

Address : 100 Nanglinchee Rd., Chongnonsee, Yannawa, Bangkok 10120.

Calibrated at : Electrical and Electronic Standards Laboratory, Industrial Metrology and Testing Service Centre.

: Soi 1C, Bangpoo Industrial Estate, Sukhumvit Rd., Muang, Samutprakan 10280.

Instrument Calibrated :

Description : Acoustic Calibrator

Manufacturer : Cirrus

Model : CR-515

Serial No. : 81745 (ID No.: ENSL17154)

Ambient Environment

Temperature : $(23 \pm 3) ^\circ\text{C}$

Relative Humidity : $(50 \pm 15) \%$

Ambient Pressure : $(101.325 \pm 1.500) \text{ kPa}$

Standards used : 1. Digital Function Synthesizer NF Electronic DF-193A S/N 122037.

2. Measuring Amplifier Briel&Kjaer 2636 S/N 1537484.

3. Programmable Attenuator Tanagawa TPA-303A S/N OF 2214.

4. Digital Multimeter Agilent 34401A S/N MY44005560.

5. Pressure Transmitter Vaisala PTB202AD S/N T0650001.

6. Audio Analyzer Panasonic VP-7722A S/N 041477D122.

7. Condenser Microphone Briel&Kjaer 4180 S/N 2889871.

Calibration Procedure: CP-102-04 based on IEC 60942:2003. The sound pressure level of instrument was measured by standard microphone using an insert voltage technique.

This instrument has been calibrated against standards maintained at Electrical and Electronic Standards Laboratory (EEL), which are traceable to the International System of Units through the National Institute of Metrology (Thailand).

The information on actual reading is attached herewith and the uncertainty limits quoted refer to the measured values only.

Date of Receipt : 17 Sep. 2021

Date of Calibration : 27 Sep. 2021

1 / 2

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FNBLMTC.002 Rev.4

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E-mail : sumalee@tistr.or.th

Certificate No : 22-ACT-050

Request No : Req-2022-0118

Customer

Name : SGS (Thailand) Limited.

Address : 100 Nanglinchee Road, Chongnonsi, Yanawa Bangkok 10120

Unit Under Calibration Details

Measurement item : Sound Level Meter

Manufacturer : Cirrus

Model : CR161B

Serial Number : G078642

ID : -

Resolution : 0.1 dB

Microphone Class : 1

Microphone Model : MK224

Microphone S/N : 206565A

Preamplifier Model : MK170

Preamplifier S/N : 0911

Instrument Status : Used

Certificate No : 22-ACT-050

Request No : Req-2022-0118

Calibration Environment and Details

Temperature : 23 °C ± 2 °C

Humidity : 50%RH ± 20 %RH

Barometric Pressure : 1013 hPa ± 10 hPa

Received Date : 20 January 2022

Calibrated Date : 26 January 2022

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

Location of Calibration : Lab Acoustic

Reference Standard

Instrument	Brand	Model	S/N	Due calibration	Traceability
Standard Microphone	GRAS	40AN	188273	15 September 2022	GRAS
Multifrequency Calibrator	Quest	Questcal	EFA000234	14 June 2022	TSI
Audio Generator	Svanick	Swan401	131	18 October 2022	WK Electric

Note

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

Calibrated

Approved By

Calibration Officer

Calibration Engineer Supervisor

Issue Date : 26 January 2022

Certificate No : 22-ACT-050

Request No : Req-2022-0118

1. Indication at the calibration check frequency

UUC Setting	Nominal Level (dB)	Before Adjust		Adjust		Acceptance Limit (± dB)
		UUC (dB)	ERR (dB)	UUC (dB)	ERR (dB)	
FAST A, 20-140	113.91	113.8	-0.11	113.9	-0.01	0.3

Note : Absolute sensitivity was established by the use of Sound Calibrator Brand CASELLA, Model CEL-1202, SN: 3864875

2. Self-generated noise, Microphone installed

UUC Setting	Measured (dB)	UNCERTAINTY (± dB)
FAST 20-140	18.1	0.10
UUC Weighting		
A		

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

UUC Setting	Measured (dB)	UNCERTAINTY (± dB)
FAST 20-140	19.0	0.10
UUC Weighting		
A		
C		
Z		

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

UUC Setting	Deviation from various Frequency Weighting Response curve (dB)	UNCERTAINTY (± dB)			Acceptance Limit (± dB)
		A C Z			
		(dB)	(dB)	(dB)	
FAST 20-140	0.3	0.1	0.1	0.50	1.0
STD Setting					
125 Hz	0.0	0.0	0.0	0.60	0.7
1000 Hz	-0.5	-0.3	-0.1	0.60	1.0
4000 Hz	0.1	0.4	0.6	0.70	+1.5 -2.5

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

FM-706-SI-M-01 Rev.0 Issue date:01/07/19

Certificate No : 22-ACI-050

Request No : Req-2022-0118

7. Long Term Stability

UUC Setting	Measured	UNCERTAINTY	Acceptance Limit
FAST A: 20-140	UUC (dB)	(± dB)	(± dB)
STD Setting			
Initial	114.0		
Final	114.0		
Deviated	0.0	0.1	0.1

8. Level linearity on the reference level range

UUC Setting	Anticipated	Deviation	UNCERTAINTY	Acceptance Limit
FAST A: 20-140	REF (dB)	UUC (dB)	(± dB)	(± dB)
STD dB		ERR (dB)		
139.00	139	139.0	0.0	0.8
134.00	134	134.0	0.0	0.8
129.00	129	129.0	0.0	0.8
124.00	124	124.0	0.0	0.8
119.00	119	119.0	0.0	0.8
114.00	114	114.0	0.0	0.8
109.00	109	109.0	0.0	0.8
104.00	104	104.0	0.0	0.8
99.00	99	99.0	0.0	0.8
94.00	94	94.0	0.0	0.8
89.00	89	89.1	0.1	0.8
84.00	84	84.0	0.0	0.8
79.00	79	79.0	0.0	0.8
74.00	74	74.1	0.1	0.8
69.00	69	69.1	0.1	0.8
64.00	64	64.1	0.1	0.8
59.00	59	59.1	0.1	0.8
54.00	54	54.1	0.1	0.8
49.00	49	49.1	0.1	0.8
44.00	44	44.1	0.1	0.8
39.00	39	39.1	0.1	0.8
34.00	34	34.1	0.1	0.8
29.00	29	29.1	0.1	0.8
24.00	24	24.3	0.3	0.8

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

Certificate No : 22-ACI-050

Request No : Req-2022-0118

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

UUC Setting	Deviation from various Frequency	UNCERTAINTY	Acceptance Limit
FAST 20-140	Weighting Response curve	(± dB)	(± dB)
STD Setting	A (dB)	C (dB)	Z (dB)
63 Hz	0.5	0.1	0.1
125 Hz	0.3	0.1	0.1
250 Hz	0.2	0.1	0.0
500 Hz	0.2	0.1	0.0
1000 Hz	0.0	0.0	0.0
2000 Hz	-0.1	0.0	0.0
4000 Hz	-0.3	-0.1	0.0
8000 Hz	-0.5	-0.3	-0.1
16000 Hz	0.2	0.4	-0.2
			0.2
			0.7
			1.0
			1.0
			1.0
			1.0
			+1.5, -2.5
			+2.5, -16.0

6. Frequency and time weightings at 1kHz

UUC Setting	STD	Measured	UNCERTAINTY	Acceptance Limit
FAST 20-140	REF (dB)	UUC (dB)	ERR (dB)	(± dB)
UUC Weighting				
A	114.00	114.0	0.0	0.2
C	114.00	114.0	0.0	0.2
Z	114.00	114.0	0.0	0.2

UUC Setting	STD	Measured	UNCERTAINTY	Acceptance Limit
20-140 A	REF (dB)	UUC (dB)	ERR (dB)	(± dB)
UUC Time Response				
Fast	114.00	114.0	0.0	0.1
Slow	114.00	114.0	0.0	0.1
Leq	114.00	114.0	0.0	0.1

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

Certificate No : 22-ACT-050
Request No : Req-2022-0118

12. Overload indication

UUC Setting	Measured	UNCERTAINTY	Acceptance Limit
FAST / A / 20-140	UUC (dB)	(\pm dB)	(\pm dB)
STD Setting	143.7		
Positive one-half cycle	143.7		
Negative one-half cycle	0.0	0.2	1.5
Deviated			

13. High Level Stability

UUC Setting	Measured	UNCERTAINTY	Acceptance Limit
FAST / A / 20-140	UUC (dB)	(\pm dB)	(\pm dB)
STD Setting	139.0		
Initial	139.0		
Final	0.0	0.1	0.1
Deviated			

End of Certificate

Certificate No : 22-ACT-050
Request No : Req-2022-0118

9. Level linearity including the level range control

UUC Setting	STD	Measured	UNCERTAINTY	Acceptance Limit
FAST / A	REF (dB)	UUC (dB)	(\pm dB)	(\pm dB)
UUC Range	28.8	29.0	0.2	0.8
20-140	114	114.0	0.3	0.8

10. Tone burst response

UUC Setting	STD	Anticipated	Measured	UNCERTAINTY	Acceptance Limit
A / 20-140	Toneburst (ms)	Ref (dB)	UUC (dB)	ERR (dB)	(\pm dB)
UUC Time Response	200	136.0	136.0	0.0	0.5
Fast	2	119.0	118.9	-0.1	+1.0, -1.5
	0.25	110.0	109.8	-0.2	+1.0, -3.0
Slow	200	129.6	129.5	-0.1	0.5
	2	110.0	109.9	-0.1	+1.0, -3.0
SEIL	200	130.0	130.0	0.0	0.5
	2	110.0	110.0	0.0	+1.0, -1.5
	0.25	101.0	100.9	-0.1	+1.0, -3.0

11. Peak C Sound level

UUC Setting	Anticipated	Measured	UNCERTAINTY	Acceptance Limit
FAST / C / 20-140	REF (dB)	UUC (dB)	ERR (dB)	(\pm dB)
STD Setting	135.4	135.5	+0.10	2.0
Complete cycle				
Positive half cycle	134.4	134.3	-0.10	1.0
Negative half cycle	134.4	134.3	-0.10	1.0



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-63/0833

MTC No. EEL BP. 36/0963

9. Power Amplifier Brüel&Kjær 2706 S/N 1517650;
10. Speaker Tannoy Limited, Great Britain British Patent No. 215300;
11. Digital Multimeter Agilent 34401A S/N MY44005560; and
12. Programmable Attenuator Tamagawa TPA-303A S/N 2212.

Calibration Procedure :

This instrument was calibrated by using calibration procedures no CP-102-02 and CP-102-03, which were based on IEC 61672-3 Electroacoustics - Sound Level Meters - Part 3 : Periodic tests (2006). These calibration procedures were related to the electrical and acoustic signal tests. The electrical signal test was carried out with the direct measurement method. The acoustic signal test was performed in an anechoic room with the comparison measurement method.

This instrument has been calibrated against standards maintained at the Electrical and Electronic Standards Laboratory (EEL), which are traceable to the International System of Units through the National Institute of Metrology (Thailand).

The information on actual reading is attached herewith and the uncertainty limits quoted refer to the measured values only.

The reported expanded uncertainty is based upon a standard uncertainty multiplied by a coverage factor $k=2$, providing a level of confidence of approximately 95%.

Date of Calibration : 17-28 Sep. 2020

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-63/0833

MTC No. EEL BP. 36/0963

CALIBRATION CERTIFICATE

Submitted by : SGS (Thailand), Ltd.
Address : 100 Nanglinchee Rd., Chongnonsee, Yanmawa, Bangkok 10120.
Calibrated at : Electrical and Electronic Standards Laboratory, Industrial Metrology and Testing Service Center,
Sri 1, Bangpoo Industrial Estate, Sukhumvit Rd., A.Muang, Samutprakarn 10280.

Instrument Calibrated :

Description	: Sound Level Meter
Manufacturer	: Cirrus
Model	: CR-161B
Serial No.	: G079727 (ENSL 18156)
Microphone	: Cirrus MK224 No.209930D
Preamplifier	: No.7759F

Ambient Environment

Temperature	: $(23 \pm 3) ^\circ\text{C}$
Relative Humidity	: $(50 \pm 15) \%$
Ambient Pressure	: $(101.325 \pm 1.5) \text{ kPa}$

Standards used :

1. Band Pass Filter Stanford Research Systems SR 650 S/N 28712;
2. Condenser Microphone Brüel&Kjær 4180 S/N 2889871;
3. Decade Attenuator Ando AI-205 S/N 00464602;
4. Function/Arbitrary Waveform Generator Agilent 33220A S/N MY44042668;
5. Digital Function Synthesizer NF Electronic Instruments DF-193A S/N 122037;
6. Digital Multimeter Fluke 8520A S/N 4985007;
7. Multifunction Acoustic Calibrator Brüel&Kjær 4226 S/N 2810358;
8. Measuring Amplifier Brüel&Kjær 2636 S/N 1537484;

VERIFIED

Date of Receipt : 14 Sep. 2020

Date of Calibration : 17-28 Sep. 2020

DATE 02/10/2020

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-63/0833

MITC No. EEL, BP. 36/0963

3. Acoustical signal test of frequency weightings

Frequency (Hz)	Deviation from response curve			Uncertainty (±dB)	Tolerance Limits Class 1 (±dB)
	A-weighting (dB)	C-weighting (dB)	Flat (dB)		
125	0.4	0.3	0.2	0.40	1.5
1 000	-0.3	-0.3	-0.3	0.40	1.1
4 000	-0.1	0.0	0.1	0.40	1.6

4. Electrical signal test of frequency weightings

Frequency (Hz)	Deviation from response curve			Uncertainty (±dB)	Tolerance Limits Class 1 (±dB)
	A-weighting (dB)	C-weighting (dB)	Flat (dB)		
63	0.4	0.2	0.1	0.20	1.5
125	0.3	0.2	0.1	0.20	1.5
250	0.3	0.0	0.0	0.20	1.4
500	0.2	0.0	0.0	0.20	1.4
1 000	0.0	0.0	0.0	0.20	1.1
2 000	-0.1	0.1	0.1	0.20	1.6
4 000	-0.3	-0.2	0.1	0.20	1.6
8 000	-0.4	-0.2	0.0	0.20	+2.1; -3.1
16 000	0.3	0.5	-0.1	0.20	+3.5; -17.0

Date of Calibration : 17-28 Sep. 2020

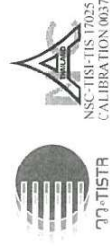
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FM.BLMTC.002 Rev.3



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-63/0833

MITC No. EEL, BP. 36/0963

1. Absolute Sensitivity

Reference Acoustic Signal (dB)	Unit Under Test			Tolerance limit Class 1 (±dB)
	Measured Value (dB)	Deviation (dB)	Uncertainty (±dB)	
93.97	Before adjust	After adjust		
	93.8	94.0	0.0	0.50
				1.1

Note: The external calibration adjustment was firstly performed. The internal calibration adjustment was then completed at the display of 94.0 dB.

2. Self-generated noise

2.1 Normal test

Measured value (dB)	Uncertainty (±dB)
18.9	0.10

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

Frequency Weighting	Measured Value (dB)	Uncertainty (±dB)
A-Weighting	under-range	-
C-Weighting	19.5	0.10
Flat	30.6	0.10

Note: The under-range means the indicator cannot display the value because it is under the setting range 20-140 dB.

Date of Calibration : 17-28 Sep. 2020

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-63/0833

MTC No. EEL. BP. 36/0963

6. Level linearity on the reference level range (continue)

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Uncertainty (\pm dB)	Tolerance Limits Class 1 (\pm dB)
119	119.0	0.0	0.30	1.1
114	114.0	0.0	0.30	1.1
109	109.0	0.0	0.30	1.1
104	104.0	0.0	0.30	1.1
99	99.0	0.0	0.30	1.1
94	94.0	0.0	0.30	1.1
89	89.0	0.0	0.30	1.1
84	84.0	0.0	0.30	1.1
79	79.0	0.0	0.30	1.1
74	74.0	0.0	0.30	1.1
69	69.0	0.0	0.30	1.1
64	64.0	0.0	0.30	1.1
59	59.0	0.0	0.30	1.1
54	54.0	0.0	0.30	1.1
49	49.0	0.0	0.30	1.1
44	44.0	0.0	0.30	1.1
39	39.0	0.0	0.30	1.1
34	34.0	0.0	0.30	1.1
29	29.1	0.1	0.30	1.1
24	24.1	0.1	0.30	1.1

Date of Calibration : 17-28 Sep. 2020

The results relate only to the items tested or calibrated.

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FM.BL.MTC.002 Rev.3

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Fax. (66) 0 2579 8592
E-mail : sumalee@tistr.or.th



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-63/0833

MTC No. EEL. BP. 36/0963

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated Value (dB)	Uncertainty (\pm dB)	Tolerance Limits Class 1 (\pm dB)
A-weighting	114.0	0.0	0.20	0.4
C-weighting	114.0	0.0	0.20	0.4
Flat	114.0	0.0	0.20	0.4

5.2 Time weightings at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated Value (dB)	Uncertainty (\pm dB)	Tolerance Limits Class 1 (\pm dB)
Fast	114.0	0.0	0.20	0.3
Slow	114.0	0.0	0.20	0.3
Leq	114.0	0.0	0.20	0.3

6. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Uncertainty (\pm dB)	Tolerance Limits Class 1 (\pm dB)
138	138.0	0.0	0.30	1.1
137	137.0	0.0	0.30	1.1
136	136.0	0.0	0.30	1.1
135	135.0	0.0	0.30	1.1
134	134.0	0.0	0.30	1.1
129	129.0	0.0	0.30	1.1
124	124.0	0.0	0.30	1.1

Date of Calibration : 17-28 Sep. 2020

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FM.BL.MTC.002 Rev.3

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-63/0833

MTC No. EEL-BP. 36/0963

9. Peak C sound level

Number of cycles in test signal	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Uncertainty (±dB)	Tolerance limits Class 1 (±dB)
Complete cycle	135.4	135.6	0.2	0.20	2.4
Positive half cycle	134.4	134.1	-0.3	0.20	1.4
Negative half cycle	134.4	134.1	-0.3	0.20	1.4

10. Overload indication

Measured value (dB)	Deviated value (dB)	Uncertainty (±dB)	Tolerance Limits Class 1 (±dB)
Positive one-half cycle	140.7	0.0	1.8
Negative one-half cycle	140.7	0.0	1.8

Calibrated by :

Approved by :

.....

.....

Electrical and Electronic Standards Laboratory
Industrial Metrology and Testing Service Center

Date of Calibration : 17-28 Sep. 2020

Date of Issue : 29 Sep. 2020

Ref : 2011263091403585001

End of Certificate

8 / 8

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-63/0833

MTC No. EEL-BP. 36/0963

7. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Uncertainty (±dB)	Tolerance Limits Class 1 (±dB)
20-140	135	135.0	0.0	0.30	1.1

8. Tone burst response

Time Weighting	Toneburst Duration, Tb (ms)	Measured Value (dB)	Deviated Value (dB)	Uncertainty (±dB)	Tolerance Limits Class 1 (dB)
Fast	200	136.0	0.0	0.20	±0.8
	2	118.9	-0.1	0.20	+1.3; -1.8
	0.25	109.8	-0.2	0.20	+1.3; -3.3
Slow	200	129.5	-0.1	0.20	±0.8
	2	109.9	-0.1	0.20	+1.3; -3.3
	200	130.0	0.0	0.20	±0.8
SEL	2	110.0	0.0	0.20	+1.3; -1.8
	0.25	101.0	0.0	0.20	+1.3; -3.3

Date of Calibration : 17-28 Sep. 2020

.....

Certificate No : 22-ACT-051
Request No : Req-2022-0119

Certificate of Calibration

Customer		SGS (Thailand) Limited	
Name		: 100 Nanglinchae Road, Chongnonsi, Yanawa Bangkok 10120	
Address			
Unit Under Calibration Details		Microphone Class : 1	
Measurement Item :		Sound Level Meter	
Manufacturer		: Cirrus	
Model		: CR-161B	
Serial Number		: C079772	
ID		: -	
Resolution		: 0.1 dB	
Calibration Environment and Details		Preamplifier S/N : 0926	
Temperature		: 23 °C ± 2 °C	
Humidity		: 50 %RH ± 20 %RH	
Barometric Pressure		: 1013 hPa ± 10 hPa	
Received Date		: 20 January 2022	
Calibrated Date		: 26 January 2022	
Calibration Procedure		: In-house method CP-SLM-01 based on IEC 61672-3 : 2013 Electroacoustics - Sound level meters - Part 3: Portable tests	
Location of Calibration		: Lab Acoustic	
Reference Standard			
Instrument		Brand	Model
Standard Microphone		GRAS	40AN
Multi-frequency Calibrator		Quest	Quest-cal
Audio Generator		Stanek	Stan401
SN		188273	EF400234
Due calibration		15 September 2022	14 June 2022
Traceability		GRAS	TSI
WK Electric		18 October 2022	
Note		The reported uncertainty is based on standard uncertainty multiplied by the Coverage Factor $k = 2$, providing a level of confidence approximately 95 %.	

VERIFIED

BY *Wassana P*

DATE Feb 5, 2022

Calibrated By : *Me*

Approved By : *Me*

Calibration Officer

Issue Date : 26 January 2022

Calibration Engineer Supervisor

Certificate No : 22-ACT-051
Request No : Req-2022-0119

7. Long Term Stability

UUC Setting	Measured UUC (dB)	UNCERTAINTY (\pm dB)	Acceptance Limit (\pm dB)
FAST A / 20-140			
STD Setting	114.0		
Initial	114.0		
Final	114.0		
Deviated	0.0	0.1	0.1

8. Level linearity on the reference level range

UUC Setting	Anticipated		Deviation		UNCERTAINTY (\pm dB)	Acceptance Limit (\pm dB)
	REF (dB)	UUC (dB)	ERR (dB)	ERR (dB)		
FAST A / 20-140						
STD dB	139.0	139.0	0.0	0.0		0.8
134.00	134	134.0	0.0	0.0		0.8
129.00	129	129.0	0.0	0.0		0.8
124.00	124	124.0	0.0	0.0		0.8
119.00	119	119.0	0.0	0.0		0.8
114.00	114	114.0	0.0	0.0		0.8
109.00	109	109.0	0.0	0.0		0.8
104.00	104	104.0	0.0	0.0		0.8
99.00	99	99.0	0.0	0.0		0.8
94.00	94	94.1	0.1	0.1		0.8
89.00	89	89.0	0.0	0.0		0.8
84.00	84	84.0	0.0	0.0		0.8
79.00	79	79.0	0.0	0.0		0.8
74.00	74	74.1	0.1	0.1		0.8
69.00	69	69.1	0.1	0.1		0.8
64.00	64	64.1	0.1	0.1		0.8
59.00	59	59.1	0.1	0.1		0.8
54.00	54	54.1	0.1	0.1		0.8
49.00	49	49.1	0.1	0.1		0.8
44.00	44	44.2	0.2	0.2		0.8
39.00	39	39.1	0.1	0.1		0.8
34.00	34	34.1	0.1	0.1		0.8
29.00	29	29.1	0.1	0.1		0.8
24.00	24	24.3	0.3	0.3		0.8

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FM-708-SI-M-01 Rev 0 Issue date 01/07/19

Certificate No : 22-ACT-051
Request No : Req-2022-0119

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

UUC Setting	Deviation from various Frequency				UNCERTAINTY (± dB)	Acceptance Limit
	Weighting Response curve					
FAST / 20-140	A (dB)	C (dB)	Z (dB)			
STD setting						
63 Hz	0.5	0.0	0.1		0.2	1.0
125 Hz	0.3	0.0	0.0			1.0
250 Hz	0.2	0.0	0.0			1.0
500 Hz	0.1	0.0	-0.1			1.0
1000 Hz	0.0	0.0	-0.1			0.7
2000 Hz	-0.2	-0.1	-0.1			1.0
4000 Hz	-0.4	-0.2	-0.1			1.0
8000 Hz	-0.5	-0.4	-0.2			+1.5, -2.5
16000 Hz	0.2	0.3	-0.2		-2.5, -16.0	

6. Frequency and time weightings at 1kHz

UUC Setting	STD	REF (dB)	Measured		UNCERTAINTY (\pm dB)	Acceptance Limit (\pm dB)
			UUC (dB)	ERR (dB)		
FAST / 20-140						
UUC Weighting						
A		114.00	114.0	0.0		0.2
C		114.00	114.0	0.0	0.2	0.2
Z		114.00	114.0	0.0		0.2

UUC Setting	STD	REF (dB)	Measured		UNCERTAINTY (\pm dB)	Acceptance Limit (\pm dB)
			UUC (dB)	ERR (dB)		
20-140 / A						
UUC Time Response						
Fast		114.00	114.0	0.0		0.1
Slow		114.00	114.0	0.0	0.2	0.1
1 eq		114.00	114.0	0.0		0.1

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FM-708-SI-M-01 Rev 0 Issue date 01/07/19

Certificate No : 22-ACT-051
 Request No : Req-2022-0119

9. Level linearity including the level range control

UUC Setting	STD	Measured		UNCERTAINTY (± dB)	Acceptance Limit (± dB)
		UUC (dB)	ERR (dB)		
FAST / A	REF	29.1	0.2	0.3	0.8
UUC Range		28.9			0.8
20-140	114	114.0	0.0		0.8

10. Tone burst response

UUC Setting	STD	Toneburst (ms)	Anticipated		Measured		UNCERTAINTY (± dB)	Acceptance Limit (± dB)
			Ref (dB)	ERR (dB)	UUC (dB)	ERR (dB)		
A / 20-140								
UUC Time Response								
Fast	200	2	136.0	0.0	136.0	0.0	0.3	0.5
								+1.0, -1.5
								+1.0, -3.0
Slow	200	2	110.0	-0.1	109.8	-0.2	0.3	0.5
								+1.0, -3.0
								0.5
SFL	200	2	130.0	0.0	130.0	0.0	0.3	0.5
								+1.0, -1.5
								+1.0, -3.0

11. Peak C Sound level

UUC Setting	STD	Toneburst (ms)	Anticipated		Measured		UNCERTAINTY (± dB)	Acceptance Limit (± dB)
			Ref (dB)	ERR (dB)	UUC (dB)	ERR (dB)		
FAST / C / 20-140								
STD Setting								
Complete cycle	135.4	2	135.5	+0.10	135.5	+0.10	0.2	2.0
Positive half cycle	134.4	2	134.3	-0.10	134.3	-0.10	0.2	1.0
Negative half cycle	134.4	2	134.3	-0.10	134.3	-0.10	0.2	1.0

Certificate No : 22-ACT-051
 Request No : Req-2022-0119

12. Overload indication

UUC Setting	Measured	UNCERTAINTY (± dB)	Acceptance Limit (± dB)
	UUC (dB)		
FAST A / 20-140			
STD Setting			
Positive one-half cycle	146.4		
Negative one-half cycle	146.3		
Deviated	0.1	0.2	1.5

13. High Level Stability

UUC Setting	Measured	UNCERTAINTY (± dB)	Acceptance Limit (± dB)
	UUC (dB)		
FAST A / 20-140			
STD Setting			
Initial	139.0		
Final	139.0		
Deviated	0.0	0.1	0.1

End of Certificate

Certificate of Calibration

Customer
Name : SGS (Thailand) Limited
Address : 100 Nanglinchae Road, Chongnons, Yamaawa Bangkok 10120
Certificate No : 22-ACT-053
Request No : Req-2022-0121

Unit Under Calibration Details
Measurement Item : Sound Level Meter
Manufacturer : Cirrus
Model : CR161B
Serial Number : G000136
ID : -
Resolution : 0.1 dB
Microphone Class : 1
Microphone Model : MK224
Microphone S/N : 211700D
Preamplifier Model : MK170
Preamplifier S/N : 0915
Instrument Status : Used

Calibration Environment and Details
Temperature : 23 °C ± 2 °C
Humidity : 50 %RH ± 20 %RH
Barometric Pressure : 1013 hPa ± 10 hPa
Received Date : 20 January 2022
Calibrated Date : 26 January 2022
Calibration Procedure : In-house method CP-SLM-01 based on IEC 61672-3 : 2013 Electroacoustics - Sound level meters - Part 3: Periodic tests
Location of Calibration : Lab Acoustic

Instrument	Brand	Model	SN	Due calibration	Traceability
Standard Microphone	GRAS	40AN	188273	15 September 2022	GRAS
Multifrequency Calibrator	Quest	Quest-cal	EFAD00034	14 June 2022	ISI
Audio Generator	Stanek	Stan-401	131	18 October 2022	WK Electric

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

Calibrated By : [Signature]
Calibration Officer
Approved By : [Signature]
Issue Date : 26 January 2022
Calibration Engineer Supervisor

**Certificate No : 22-ACT-053
Request No : Req-2022-0121**

1. Indication at the calibration check frequency				
UUC Setting	Nominal Level (dB)	Before Adjust		Acceptance Limit (± dB)
		UUC (dB)	ERR (dB)	
1000 Hz 114.00 dB	113.91	114.6	+0.69	0.3

Note : Absolute sensitivity was established by the use of Sound Calibrator Brand CASELLA, Model CEL-120.2, SN. 3864875

2. Self-generated noise, Microphone installed		
UUC Setting	Measured (dB)	UNCERTAINTY (± dB)
FAST 20-140	16.6	0.10
UUC Weighting		
A		

3. Self-generated noise, Microphone replaced by the electrical input signal device		
UUC Setting	Measured (dB)	UNCERTAINTY (± dB)
FAST 20-140	-	0.10
UUC Weighting		
A	16.1	0.10
C	29.0	0.10
Z		

4. Acoustic signal test of frequency weightings (Without Windscreen)					
UIC Setting	Deviation from various Frequency Weighting Response curve			UNCERTAINTY (± dB)	Acceptance Limit (± dB)
	A (dB)	C (dB)	Z (dB)		
FAST 20-140					
STD Setting					
125 Hz	0.3	0.1	-0.1	0.50	1.0
1000 Hz	0.0	0.0	0.0	0.60	0.7
4000 Hz	0.3	0.5	0.6	0.60	1.0
8000 Hz	1.2	1.3	1.3	0.70	+1.5 -2.5

Certificate No : 22-ACT-053
Request No : Req-2022-0121

7. Long Term Stability

UUC Setting	Measured		UNCERTAINTY (\pm dB)	Acceptance Limit (\pm dB)
	FAST A / 20-140	UUC (dB)		
STD Setting	Initial	114.0	0.1	0.1
	Final	114.0		
	Deviated	0.0		

8. Level linearity on the reference level range

UUC Setting	Anticipated REF (dB)	Deviation		UNCERTAINTY (\pm dB)	Acceptance Limit (\pm dB)
		UUC (dB)	ERR (dB)		
FAST A / 20-140	139	139.0	0.0	0.3	0.8
		134.0	0.0		0.8
		129.0	0.0		0.8
STD dB	124	124.1	0.1		0.8
		119.0	0.0		0.8
		114.0	0.0		0.8
109.00	109	109.0	0.0		0.8
		104.0	0.0		0.8
		99.0	0.0		0.8
94.00	94	94.0	0.0		0.8
		89.0	0.0		0.8
		84.0	0.0		0.8
79.00	79	79.0	0.0		0.8
		74.1	0.1		0.8
		69.1	0.1		0.8
64.00	64	64.1	0.1		0.8
		59.1	0.1		0.8
		54.1	0.1		0.8
49.00	49	49.1	0.1		0.8
		44.1	0.1		0.8
		39.1	0.1		0.8
34.00	34	34.1	0.1		0.8
		29.1	0.1		0.8
		24.2	0.2		0.8

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FAC-708-SI-M-01 Rev 0 Issue date 01/07/19

Certificate No : 22-ACT-053
Request No : Req-2022-0121

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

UUC Setting	Deviation from various Frequency Weighting Response curve				UNCERTAINTY (\pm dB)	Acceptance Limit (\pm dB)
	FAST / 20-140	A (dB)	C (dB)	Z (dB)		
STD Setting	63 Hz	0.2	0.0	0.0	0.2	1.0
	125 Hz	0.2	0.0	0.0		1.0
	250 Hz	0.2	0.0	0.0		1.0
1000 Hz	500 Hz	0.1	0.0	0.0		1.0
	1000 Hz	0.0	0.0	0.0		0.7
	2000 Hz	-0.2	-0.1	0.0		1.0
4000 Hz	4000 Hz	-0.4	-0.2	-0.1	+1.5, -2.5	1.0
	8000 Hz	-0.6	-0.4	-0.2		+1.5, -2.5
	16000 Hz	0.0	0.1	-0.4		+2.5, -16.0

6. Frequency and time weightings at 1kHz

UUC Setting	STD REF (dB)	Measured		UNCERTAINTY (\pm dB)	Acceptance Limit (\pm dB)
		UUC (dB)	ERR (dB)		
FAST / 20-140	114.00	114.0	0.0	0.2	0.2
		114.0	0.0		0.2
		114.0	0.0		0.2

UUC Setting	STD REF (dB)	Measured		UNCERTAINTY (\pm dB)	Acceptance Limit (\pm dB)
		UUC (dB)	ERR (dB)		
20-140 A	114.00	114.0	0.0	0.1	0.1
		114.0	0.0		0.1
		114.0	0.0		0.1

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FAC-708-SI-M-01 Rev 0 Issue date 01/07/19

Certificate No : 22-ACT-053
 Request No : Req-2022-0121

9. Level linearity including the level range control

UUC Setting	STD	Measured	UNCERTAINTY	Acceptance Limit
FAST A	REF (dB)	UUC (dB)	ERR (dB)	(± dB)
UUC Range	25.0	25.1	0.1	0.8
20-140	11.4	114.0	0.0	0.8

10. Tone burst response

UUC Setting	STD	Anticipated	Measured	UNCERTAINTY	Acceptance Limit
A / 20-140	Timeburst (ms)	Ref (dB)	UUC (dB)	ERR (dB)	(± dB)
UUC Time Response	200	136.0	136.0	0.0	0.5
Fast	2	119.0	118.9	-0.1	+1.0, -1.5
	0.25	110.0	109.8	-0.2	+1.0, -3.0
Slow	200	129.6	129.6	0.0	0.5
	2	110.0	110.0	0.0	+1.0, -3.0
SEL	200	130.0	130.0	0.0	0.5
	2	110.0	110.0	0.0	+1.0, -1.5
	0.25	101.0	100.9	-0.1	+1.0, -3.0

11. Peak C Sound level

UUC Setting	Anticipated	Measured	UNCERTAINTY	Acceptance Limit
FAST C / 20-140	REF (dB)	UUC (dB)	ERR (dB)	(± dB)
STD Setting	135.4	135.6	-0.20	2.0
Complete cycle	134.4	134.2	-0.20	1.0
Positive half cycle	134.4	134.2	-0.20	1.0
Negative half cycle	134.4	134.2	-0.20	1.0

Certificate No : 22-ACT-053
 Request No : Req-2022-0121

12. Overload indication

UUC Setting	Measured	UNCERTAINTY	Acceptance Limit
FAST A / 20-140	UUC (dB)	(± dB)	(± dB)
STD Setting	142.1		
Positive one-half cycle	142.1		
Negative one-half cycle	0.0	0.2	1.5
Deviated			

13. High Level Stability

UUC Setting	Measured	UNCERTAINTY	Acceptance Limit
FAST A / 20-140	UUC (dB)	(± dB)	(± dB)
STD Setting	139.0		
Initial	139.0		
Final	0.0	0.1	0.1
Deviated			

End of Certificate



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-65/0173

MTC No. EEL. BP. 52/1264

9. Power Amplifier Briel&Kjaer 2706 S/N 1517650.
10. Speaker Tannoy Limited, Great Britain British Patent No. 215300.
11. Digital Multimeter Agilent 34401A S/N MY44005560.
12. Programmable Attenuator Tamagawa TPA-303A S/N 2212.

Calibration Procedure :

This instrument was calibrated by using calibration procedures no CP-102-02 and CP-102-03, which were based on IEC 61672-3 Electroacoustics - Sound Level Meters - Part 3 : Periodic tests (2006). These calibration procedures were related to the electrical and acoustic signal tests. The electrical signal test was carried out with the direct measurement method. The acoustic signal test was performed in an anechoic room with the comparison measurement method.

This instrument has been calibrated against standards maintained at the Electrical and Electronic Standards Laboratory (EEL), which are traceable to the International System of Units through the National Institute of Metrology (Thailand).

The information on actual reading is attached herewith and the uncertainty limits quoted refer to the measured values only.

The reported expanded uncertainty is based upon a standard uncertainty multiplied by a coverage factor $k=2$, providing a level of confidence of approximately 95%.

Date of Calibration : 10-18 Jan. 2022

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The results relate only to the items tested/calibrated or value assigned.

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FM.BI.MTC.002 Rev.4



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-65/0173

MTC No. EEL. BP. 52/1264

CALIBRATION CERTIFICATE

Submitted by : SGS (Thailand), Ltd.
Address : 100 Nanglinchee Rd., Chongnisee, Yannawa, Bangkok 10120.

Calibrated at : Electrical and Electronic Standards Laboratory, Industrial Metrology and Testing Service Centre.
Soi 1C, Bangpoo Industrial Estate, Sukhumvit Rd., A.Muang, Samutprakan 10280.

Instrument Calibrated :

Description : Sound Level Meter
Manufacturer : Cirrus
Model : CR:161B
Serial No. : G080140 (ENSL 18162)
Microphone : Cirrus MK224 No.206464A
Preamplifier : No.5472F

Ambient Environment

Temperature : $(23 \pm 3) ^\circ\text{C}$
Relative Humidity : $(50 \pm 15) \%$
Ambient Pressure : $(101.325 \pm 1.5) \text{ kPa}$

Standards used :

1. Band Pass Filter Stanford Research Systems SR 650 S/N 28712.
2. Condenser Microphone Briel&Kjaer 4180 S/N 2889871.
3. Decade Attenuator Ando AL-205 S/N 00464602.
4. Function/Arbitrary Waveform Generator Agilent 33220A S/N MY44042668.
5. Digital Function Synthesizer NF Electronic Instruments DF-193A S/N 122037.
6. Digital Multimeter Fluke 8520A S/N 4985007.
7. Multifunction Acoustic Calibrator Briel&Kjaer 4226 S/N 2810358.
8. Measuring Amplifier Briel&Kjaer 2636 S/N 1537484.

Date of Receipt : 14 Dec. 2021

Date of Calibration : 10-18 Jan. 2022

VERIFIED

DATE 10 Jan 2022 / 8

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FM.BI.MTC.002 Rev.4



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-65/0173

MTC No. EEL. BP. 52/1264

3. Acoustical signal test of frequency weightings

Frequency (Hz)	Deviation from response curve			Uncertainty (±dB)	Tolerance Limits Class 1 (±dB)
	A-weighting (dB)	C-weighting (dB)	Flat (dB)		
125	0.4	0.3	0.2	0.40	1.5
1 000	-0.3	-0.3	-0.3	0.40	1.1
4 000	-1.1	-0.9	-0.8	0.40	1.6

4. Electrical signal test of frequency weightings

Frequency (Hz)	Deviation from response curve			Uncertainty (±dB)	Tolerance Limits Class 1 (±dB)
	A-weighting (dB)	C-weighting (dB)	Flat (dB)		
63	0.3	0.1	0.1	0.20	1.5
125	0.2	0.0	0.1	0.20	1.5
250	0.2	0.0	0.0	0.20	1.4
500	0.1	0.0	0.0	0.20	1.4
1 000	0.0	0.0	0.0	0.20	1.1
2 000	-0.1	0.0	0.1	0.20	1.6
4 000	-0.4	-0.2	0.0	0.20	1.6
8 000	-0.5	-0.3	-0.1	0.20	+2.1; -3.1
16 000	0.2	0.4	-0.2	0.20	+3.5; -17.0

Date of Calibration : 10-18 Jan. 2022

4 / 8

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-65/0173

MTC No. EEL. BP. 52/1264

1. Absolute Sensitivity

Reference Acoustic Signal (dB)	Unit Under Test			Tolerance limit Class 1 (±dB)
	Measured Value (dB)	Deviation (dB)	Uncertainty (±dB)	
94.03	93.8	-0.2	0.50	1.1

Note: No adjustment.

2. Self-generated noise

2.1 Normal test

Measured value (dB)	Uncertainty (±dB)
18.4	0.10

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

Frequency	Measured Value (dB)	Uncertainty (±dB)
Weighting	under-range	-
A-Weighting	16.5	0.10
C-Weighting	28.3	0.10

Note: The under-range means the indicator cannot display the value because it is under the setting range 20-140 dB.

Date of Calibration : 10-18 Jan. 2022

3 / 8

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6. Level linearity on the reference level range (cont.)

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Uncertainty (\pm dB)	Tolerance Limits Class 1 (\pm dB)
119	119.0	0.0	0.30	1.1
114	114.0	0.0	0.30	1.1
109	109.0	0.0	0.30	1.1
104	104.0	0.0	0.30	1.1
99	99.0	0.0	0.30	1.1
94	94.0	0.0	0.30	1.1
89	89.0	0.0	0.30	1.1
84	84.0	0.0	0.30	1.1
79	79.0	0.0	0.30	1.1
74	74.0	0.0	0.30	1.1
69	69.0	0.0	0.30	1.1
64	63.9	-0.1	0.30	1.1
59	58.9	-0.1	0.30	1.1
54	53.9	-0.1	0.30	1.1
49	48.9	-0.1	0.30	1.1
44	43.9	-0.1	0.30	1.1
39	39.0	0.0	0.30	1.1
34	33.9	-0.1	0.30	1.1
29	29.0	0.0	0.30	1.1
24	24.0	0.0	0.30	1.1

Date of Calibration : 10-18 Jan. 2022

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5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated Value (dB)	Uncertainty (\pm dB)	Tolerance Limits Class 1 (\pm dB)
A-weighting	114.0	0.0	0.20	0.4
C-weighting	114.0	0.0	0.20	0.4
Flat	114.0	0.0	0.20	0.4

5.2 Time weightings at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated Value (dB)	Uncertainty (\pm dB)	Tolerance Limits Class 1 (\pm dB)
Fast	114.0	0.0	0.20	0.3
Slow	114.0	0.0	0.20	0.3
Leq	114.0	0.0	0.20	0.3

6. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Uncertainty (\pm dB)	Tolerance Limits Class 1 (\pm dB)
139	139.1	0.1	0.30	1.1
134	134.0	0.0	0.30	1.1
129	129.0	0.0	0.30	1.1
124	124.0	0.0	0.30	1.1

Date of Calibration : 10-18 Jan. 2022

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E-mail: rumpalest@ist.or.th Website: www.ist.or.th	E-mail: mt@ist.or.th	E-mail: sumalest@ist.or.th

Certificate No : 22-ACT-138
Request No : Req-2022-0293

7. Long Term Stability

UUC Setting	Measured	UNCERTAINTY	Acceptance Limit
FAST A 20-140	UUC (dB)	(\pm dB)	(\pm dB)
STD Setting			
Initial	114.0		
Final	114.0		
Deviated	0.0	0.1	0.1

Certificate No : 22-ACT-138
Request No : Req-2022-0293

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

UUC Setting	Deviation from various Frequency Weighting Response curve				UNCERTAINTY (± dB)	Acceptance Limit (± dB)
	A (dB)	C (dB)	Z (dB)			
FAST /20-140						
STD Setting						
63 Hz	0.3	0.0	0.0		0.2	1.0
125 Hz	0.2	0.0	0.0			1.0
250 Hz	0.2	0.0	0.0			1.0
500 Hz	0.1	0.0	0.0			1.0
1000 Hz	0.0	0.0	0.0			0.7
2000 Hz	-0.1	0.0	0.0			1.0
4000 Hz	-0.3	-0.2	0.0			1.0
8000 Hz	-0.5	-0.3	-0.1			+1.5, -2.5
16000 Hz	0.2	0.3	-0.2		+2.5, -16.0	

6. Frequency and time weightings at 1kHz

UUC Setting	STD	REF	Measured		UNCERTAINTY (\pm dB)	Acceptance Limit (\pm dB)
			UUC (dB)	ERR (dB)		
FAST 20-140						
UUC Weighting						
A	114.00	114.00	114.0	0.0		0.2
C	114.00	114.00	114.0	0.0	0.2	0.2
Z	114.00	114.00	114.0	0.0		0.2

UUC Setting	STD	REF	Measured		UNCERTAINTY (\pm dB)	Acceptance Limit (\pm dB)
			UUC (dB)	ERR (dB)		
20-140 / A						
UUC Time Response						
Fast	114.00	114.00	114.0	0.0		0.1
Slow	114.00	114.00	114.0	0.0	0.2	0.1
Leq	114.00	114.00	114.0	0.0		0.1



Certificate No : 22-ACT-138

Request No : Req-2022-0293

12. Overload indication

UUC Setting	Measured	UNCERTAINTY (\pm dB)	Acceptance Limit (\pm dB)
FAST A / 20-140	UUC (dB)		
STD Setting	143.3		
Positive one-half cycle	143.3		
Negative one-half cycle			
Deviated	0.0	0.2	1.5

13. High Level Stability

UUC Setting	Measured	UNCERTAINTY (\pm dB)	Acceptance Limit (\pm dB)
FAST A / 20-140	UUC (dB)		
STD Setting	139.0		
Initial	139.0		
Final			
Deviated	0.0	0.1	0.1

End of Certificate



Certificate No : 22-ACT-138

Request No : Req-2022-0293

9. Level linearity including the level range control

UUC Setting	STD	Measured	UNCERTAINTY (\pm dB)	Acceptance Limit (\pm dB)
FAST A	REF (dB)	UUC (dB)	ERR (dB)	
UUC Range	25.0	25.2	0.2	0.8
20-140	11.4	11.40	0.0	0.8

10. Tone burst response

UUC Setting	STD	Anticipated	Measured	UNCERTAINTY (\pm dB)	Acceptance Limit (\pm dB)
A / 20-140	Toneburst (ms)	Ref (dB)	UUC (dB)	ERR (dB)	
UUC Time Response	200	136.0	136.0	0.0	0.5
Fast	2	119.0	118.8	-0.2	+1.0, -1.5
	0.25	110.0	109.8	-0.2	+1.0, -3.0
Slow	200	129.6	129.5	-0.1	0.5
	2	110.0	109.9	-0.1	+1.0, -3.0
	200	130.0	130.0	0.0	0.5
SEL	2	110.0	110.0	0.0	+1.0, -1.5
	0.25	101.0	100.9	-0.1	+1.0, -3.0

11. Peak C Sound level

UUC Setting	Anticipated	Measured	UNCERTAINTY (\pm dB)	Acceptance Limit (\pm dB)
FAST C / 20-140	REF (dB)	UUC (dB)	ERR (dB)	
STD Setting	135.4	135.6	+0.20	2.0
Complete cycle				
Positive half cycle	134.4	134.2	-0.20	1.0
Negative half cycle	134.4	134.2	-0.20	1.0



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-65/0173

MTC No. EEL. BP. 53/1264

9. Power Amplifier Brüel&Kjær 2706 S/N 1517650.
10. Speaker Tamoy Limited, Great Britain British Patent No. 215300.
11. Digital Multimeter Agilent 34401A S/N MY44005560.
12. Programmable Attenuator Tanagawa TPA-303A S/N 2212.

Calibration Procedure :

This instrument was calibrated by using calibration procedures no CP-102-02 and CP-102-03, which were based on IEC 61672-3 Electroacoustics - Sound Level Meters - Part 3 : Periodic tests (2006). These calibration procedures were related to the electrical and acoustic signal tests. The electrical signal test was carried out with the direct measurement method. The acoustic signal test was performed in an anechoic room with the comparison measurement method.

This instrument has been calibrated against standards maintained at the Electrical and Electronic Standards Laboratory (EEL), which are traceable to the International System of Units through the National Institute of Metrology (Thailand).

The information on actual reading is attached herewith and the uncertainty limits quoted refer to the measured values only.

The reported expanded uncertainty is based upon a standard uncertainty multiplied by a coverage factor $k=2$, providing a level of confidence of approximately 95%.

Date of Calibration : 19-25 Jan. 2022

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FM.BLMTC.002 Rev.4



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-65/0173

MTC No. EEL. BP. 53/1264

CALIBRATION CERTIFICATE

Submitted by : SGS (Thailand), Ltd.
Address : 100 Nanglinchee Rd., Chongnonsee, Yannawa, Bangkok 10120.
Calibrated at : Electrical and Electronic Standards Laboratory, Industrial Metrology and Testing Service Centre,
Sri 1C, Bangpoo Industrial Estate, Sukhumvit Rd., A.Muang, Samutprakan 10280.

Instrument Calibrated :

Description : Sound Level Meter
Manufacturer : Cirrus
Model : CR-161B
Serial No. : G080148 (ENSL 18166)
Microphone : Cirrus MK224 No.209925D
Preamplifier : No. 7645F

Ambient Environment
Temperature : $(23 \pm 3) ^\circ\text{C}$
Relative Humidity : $(50 \pm 15) \%$
Ambient Pressure : $(101.325 \pm 1.5) \text{ kPa}$

Standards used :

1. Band Pass Filter Stanford Research Systems SR 650 S/N 28712.
2. Condenser Microphone Brüel&Kjær 4180 S/N 2889871.
3. Decade Attenuator Ando AL-205 S/N 00464602.
4. Function/Arbitrary Waveform Generator Agilent 33220A S/N MY44042668.
5. Digital Function Synthesizer NF Electronic Instruments DF-193A S/N 122037.
6. Digital Multimeter Fluke 8520A S/N 4985007.
7. Multifunction Acoustic Calibrator Brüel&Kjær 4226 S/N 2810358.
8. Measuring Amplifier Brüel&Kjær 2636 S/N 1537484.

Date of Receipt : 14 Dec. 2021

Date of Calibration : 19-25 Jan. 2022

VERIFIED

DATE 8 / 3 / 2022 1 / 8

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-65/0173

MTC No. EEL. BP. 53/1264

3. Acoustical signal test of frequency weightings

Frequency (Hz)	Deviation from response curve			Uncertainty (\pm dB)	Tolerance Limits Class 1 (\pm dB)
	A-weighting (dB)	C-weighting (dB)	Flat (dB)		
125	0.8	0.8	0.8	0.40	1.5
1 000	-0.4	-0.5	-0.5	0.40	1.1
4 000	0.6	0.8	1.0	0.40	1.6

4. Electrical signal test of frequency weightings

Frequency (Hz)	Deviation from response curve				Uncertainty (\pm dB)	Tolerance Limits Class 1 (\pm dB)
	A-weighting (dB)	C-weighting (dB)	Flat (dB)	Flat (dB)		
63	0.4	0.1	0.0	0.0	0.20	1.5
125	0.3	0.1	0.0	0.0	0.20	1.5
250	0.2	0.0	0.0	0.0	0.20	1.4
500	0.1	0.1	0.0	0.0	0.20	1.4
1 000	0.0	0.0	0.0	0.0	0.20	1.1
2 000	-0.1	0.0	0.0	0.0	0.20	1.6
4 000	-0.3	-0.2	0.0	0.0	0.20	1.6
8 000	-0.5	-0.3	-0.1	-0.1	0.20	+2.1; -3.1
16 000	0.2	0.3	-0.2	-0.2	0.20	+3.5; -17.0

Date of Calibration : 19-25 Jan. 2022

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-65/0173

MTC No. EEL. BP. 53/1264

1. Absolute Sensitivity

Reference Acoustic Signal (dB)	Unit Under Test			Tolerance limit Class 1 (\pm dB)
	Measured Value (dB)	Deviation (dB)	Uncertainty (\pm dB)	
94.03	94.0	0.0	0.50	1.1

Note: No adjustment.

2. Self-generated noise

2.1 Normal test

Measured value (dB)	Uncertainty (\pm dB)
19.8	0.10

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

Frequency Weighting	Measured Value (dB)	Uncertainty (\pm dB)
A-Weighting	14.6	0.10
C-Weighting	21.6	0.10
Flat	35.6	0.10

Note: The under-range means the indicator cannot display the value because it is under the setting range 20-140 dB.

Date of Calibration : 19-25 Jan. 2022

3 / 8

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E-mail : sunalee@tistr.or.th

6. Level linearity on the reference level range (cont.)

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Uncertainty (+dB)	Tolerance Limits Class 1 (+dB)
119	119.0	0.0	0.30	1.1
114	114.0	0.0	0.30	1.1
109	109.0	0.0	0.30	1.1
104	104.0	0.0	0.30	1.1
99	99.0	0.0	0.30	1.1
94	94.0	0.0	0.30	1.1
89	89.0	0.0	0.30	1.1
84	84.0	0.0	0.30	1.1
79	79.0	0.0	0.30	1.1
74	73.9	-0.1	0.30	1.1
69	69.0	0.0	0.30	1.1
64	63.9	-0.1	0.30	1.1
59	58.9	-0.1	0.30	1.1
54	54.0	0.0	0.30	1.1
49	49.0	0.0	0.30	1.1
44	43.9	-0.1	0.30	1.1
39	38.9	-0.1	0.30	1.1
34	34.0	0.0	0.30	1.1
29	28.9	-0.1	0.30	1.1
24	23.9	-0.1	0.30	1.1

Date of Calibration : 19-25 Jan. 2022

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FM.BLMTC.002 Rev.4

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated Value (dB)	Uncertainty (+dB)	Tolerance Limits Class 1 (+dB)
A-weighting	114.0	0.0	0.20	0.4
C-weighting	114.0	0.0	0.20	0.4
Flat	114.0	0.0	0.20	0.4

5.2 Time weightings at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated Value (dB)	Uncertainty (+dB)	Tolerance Limits Class 1 (+dB)
Fast	114.0	0.0	0.20	0.3
Slow	114.0	0.0	0.20	0.3
Leq	114.0	0.0	0.20	0.3

6. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Uncertainty (+dB)	Tolerance Limits Class 1 (+dB)
139	139.0	0.0	0.30	1.1
134	134.0	0.0	0.30	1.1
129	129.0	0.0	0.30	1.1
124	124.0	0.0	0.30	1.1

Date of Calibration : 19-25 Jan. 2022

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FM.BLMTC.002 Rev.4



NSC-TIS-TIS 17025
CALIBRATION 0037

THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-65/0173

MTC No. EEL. BP. 53/1264

9. Peak C sound level

Number of cycles in test signal	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Uncertainty (±dB)	Tolerance limits Class 1 (±dB)
Complete cycle	135.4	135.4	0.0	0.20	2.4
Positive half cycle	134.4	134.2	-0.2	0.20	1.4
Negative half cycle	134.4	134.2	-0.2	0.20	1.4

10. Overload indication

Measured value (dB)		Deviated value (dB)	Uncertainty (±dB)	Tolerance Limits Class 1 (±dB)
Positive one-half cycle	Negative one-half cycle	0.1	0.30	1.8
140.3	140.2			

Calibrated by

Approved by

Acting Director
Electrical and Electronic Standards Laboratory
Industrial Metrology and Testing Service Centre

Date of Calibration : 19-25 Jan. 2022

Date of Issue : 26 Jan. 2022

Ref : 2011264121405144003

End of Certificate

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FMBL/MTC.002 Rev.4



NSC-TIS-TIS 17025
CALIBRATION 0037

THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-65/0173

MTC No. EEL. BP. 53/1264

7. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Uncertainty (±dB)	Tolerance Limits Class 1 (±dB)
20-140	135	135.0	0.0	0.30	1.1

8. Tone burst response

Time Weighting	Toneburst Duration, Tb (ms)	Measured Value (dB)	Deviated Value (dB)	Uncertainty (±dB)	Tolerance Limits Class 1 (dB)
Fast	200	136.0	0.0	0.20	±0.8
	2	118.8	-0.2	0.20	+1.3; -1.8
	0.25	109.9	-0.1	0.20	+1.3; -3.3
Slow	200	129.6	0.0	0.20	±0.8
	2	110.0	0.0	0.20	+1.3; -3.3
	200	130.0	0.0	0.20	±0.8
SEL	2	110.0	0.0	0.20	+1.3; -1.8
	0.25	100.9	-0.1	0.20	+1.3; -3.3

Date of Calibration : 19-25 Jan. 2022

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FMBL/MTC.002 Rev.4

Certificate of Conformity and Calibration



Instrument Model:- dBadga2 Microphone Type:- CEL-252
 Serial Number 2311712 Serial Number 90939
 Firmware revision V07.00
 Instrument Class/Type:- 2
 Test Conditions:- 30 °C Test Engineer:- Nunzio Dipace
 50 %RH Date of Issue:- August 27, 2021
 1013 mbar

Declaration of conformity:-

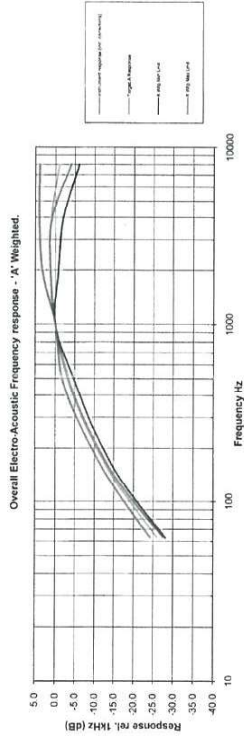
This test certificate confirms that the instrument specified above has been successfully tested to comply with the manufacturer's published specifications, which is designed to meet the requirements of IEC 61252 Ed 1.1 2002-03 and ANSI S1.25-1991. Tests are performed using equipment traceable to national standards in accordance with Casella's ISO 9001:2008 quality procedures. This product is certified as being compliant to the requirements of the CE Directive.

Test Summary:-

- Self generated Noise test All Tests Pass
- Frequency weightings A/C/Z All Tests Pass
- Level Linearity tests All Tests Pass
- Response to short duration signals All Tests Pass
- Response to unpolar pulses All Tests Pass
- Overload indicator All Tests Pass
- Time weightings tests All Tests Pass
- C-weighting peak response All Tests Pass
- Acoustic Tests (Please see below) All Tests Pass

Combined Electro-Acoustic Frequency Response - A Weighted

IEC 61252 Section 7.2, Frequency Weighting.
 The following A-Weighted frequency response graph shows the instruments overall frequency response based upon the application of multi-frequency pressure field calibrations. The microphones Pressure to Free field correction coefficients are applied to pressure response. Reference level taken at 1kHz.



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Solutions for Risk Reduction





THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-64/0217

MTC No. EEL. BP. 18/0164

9. Power Amplifier Brüel&Kjær 2706 S/N 1517650.
10. Speaker Tannoy Limited, Great Britain British Patent No. 215300.
11. Digital Multimeter Agilent 34401A S/N MY44005560.
12. Programmable Attenuator Tanagawa TPA-303A S/N 2212.

Calibration Procedure :

This instrument was calibrated by using calibration procedures no CP-102-02 and CP-102-03, which were based on IEC 61672-3 Electroacoustics - Sound Level Meters - Part 3 : Periodic tests (2006). These calibration procedures were related to the electrical and acoustic signal tests. The electrical signal test was carried out with the direct measurement method. The acoustic signal test was performed in an anechoic room with the comparison measurement method.

This instrument has been calibrated against standards maintained at the Electrical and Electronic Standards Laboratory (EEL), which are traceable to the International System of Units through the National Institute of Metrology (Thailand).

The information on actual reading is attached herewith and the uncertainty limits quoted refer to the measured values only.

The reported expanded uncertainty is based upon a standard uncertainty multiplied by a coverage factor $k=2$, providing a level of confidence of approximately 95%.

Date of Calibration : 14-20 Jan. 2021

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FM.BL.MTC.002 Rev.3

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-64/0217

MTC No. EEL. BP. 18/0164

CALIBRATION CERTIFICATE

Submitted by : SGS (Thailand), Ltd.
Address : 100 Nanglinchee Rd., Chongnonsee, Yanawa, Bangkok 10120.
Calibrated at : Electrical and Electronic Standards Laboratory, Industrial Metrology and Testing Service Centre,
Soi 1C, Bangpoo Industrial Estate, Sukhumvit Rd., A.Muang, Samutprakan 10280.

Instrument Calibrated :

Description : Sound Level Meter	Ambient Environment : Temperature : $(23 \pm 3) ^\circ\text{C}$
Manufacturer : Cirrus	Relative Humidity : $(50 \pm 15) \%$
Model : CR-171B	Ambient Pressure : $(101.325 \pm 1.5) \text{ kPa}$
Serial No. : G068723	
Microphone : Cirrus MK224 No.205135A	
Preamplifier : No.6174F	

Standards used :

1. Band Pass Filter Stanford Research Systems SR 650 S/N 28712.
2. Condenser Microphone Brüel&Kjær 4180 S/N 2889871.
3. Decade Attenuator Ando AL-205 S/N 00464602.
4. Function/Arbitrary Waveform Generator Agilent 33220A S/N MY44042668.
5. Digital Function Synthesizer NF Electronic Instruments DF-193A S/N 122037.
6. Digital Multimeter Fluke 8520A S/N 4985007.
7. Pistonphone Rion NC-72 S/N 00402446.
8. Measuring Amplifier Brüel&Kjær 2636 S/N 1537484.

Date of Receipt : 7 Jan. 2021

Date of Calibration : 14-20 Jan. 2021

VERIFIED

DATE 05/02/2021

1/8

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3. Acoustical signal test of frequency weightings

Frequency (Hz)	Deviation from response curve			Uncertainty (±dB)	Tolerance Limits Class 1 (±dB)
	A-weighting (dB)	C-weighting (dB)	Flat (dB)		
125	0.4	0.2	0.2	0.40	1.5
1 000	-0.3	-0.3	-0.3	0.40	1.1
4 000	0.0	0.1	0.3	0.40	1.6

4. Electrical signal test of frequency weightings

Frequency (Hz)	Deviation from response curve			Uncertainty (±dB)	Tolerance Limits Class 1 (±dB)
	A-weighting (dB)	C-weighting (dB)	Flat (dB)		
63	0.3	0.1	0.1	0.20	1.5
125	0.2	0.1	0.0	0.20	1.5
250	0.1	0.0	0.0	0.20	1.4
500	0.1	0.0	0.0	0.20	1.4
1 000	0.0	0.0	0.0	0.20	1.1
2 000	-0.2	0.0	0.0	0.20	1.6
4 000	-0.3	-0.2	0.0	0.20	1.6
8 000	-0.5	-0.4	-0.1	0.20	+2.1; -3.1
16 000	0.2	0.3	-0.2	0.20	+3.5; -17.0

Date of Calibration : 14-20 Jan. 2021

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FM.BL.MTC.002 Rev.3

1. Absolute Sensitivity

Reference Acoustic Signal (dB)	Unit Under Test				Tolerance limit Class 1 (±dB)
	Measured Value (dB)		Deviation (dB)	Uncertainty (±dB)	
	Before adjust	After adjust			
93.76	93.7	93.8	0.0	0.50	1.1

Note: The external calibration adjustment was firstly performed. The internal calibration adjustment was then completed at the display of 93.7 dB.

2. Self-generated noise

2.1 Normal test

Measured value (dB)	Uncertainty (±dB)
19.1	0.10

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

Frequency	Measured Value (dB)	Uncertainty (±dB)
A-Weighting	13.6	0.10
C-Weighting	21.5	0.10
Flat	29.8	0.10

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6. Level linearity on the reference level range (cont.)

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Uncertainty (+dB)	Tolerance Limits Class 1 (+dB)
119	119.0	0.0	0.30	1.1
114	114.0	0.0	0.30	1.1
109	109.0	0.0	0.30	1.1
104	104.0	0.0	0.30	1.1
99	99.0	0.0	0.30	1.1
94	94.0	0.0	0.30	1.1
89	89.0	0.0	0.30	1.1
84	84.0	0.0	0.30	1.1
79	79.0	0.0	0.30	1.1
74	74.0	0.0	0.30	1.1
69	69.0	0.0	0.30	1.1
64	64.0	0.0	0.30	1.1
59	59.0	0.0	0.30	1.1
54	54.0	0.0	0.30	1.1
49	49.0	0.0	0.30	1.1
44	44.0	0.0	0.30	1.1
39	39.0	0.0	0.30	1.1
34	34.0	0.0	0.30	1.1
29	29.2	0.2	0.30	1.1
24	24.4	0.4	0.30	1.1

Date of Calibration : 14-20 Jan. 2021

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FM.BLMTC.002 Rev.3

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated Value (dB)	Uncertainty (+dB)	Tolerance Limits Class 1 (+dB)
A-weighting	114.0	0.0	0.20	0.4
C-weighting	114.0	0.0	0.20	0.4
Flat	114.0	0.0	0.20	0.4

5.2 Time weightings at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated Value (dB)	Uncertainty (+dB)	Tolerance Limits Class 1 (+dB)
Fast	114.0	0.0	0.20	0.3
Slow	114.0	0.0	0.20	0.3
Leq	114.0	0.0	0.20	0.3

6. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Uncertainty (+dB)	Tolerance Limits Class 1 (+dB)
137	137.0	0.0	0.30	1.1
136	136.0	0.0	0.30	1.1
135	135.0	0.0	0.30	1.1
134	134.0	0.0	0.30	1.1
129	129.0	0.0	0.30	1.1
124	124.0	0.0	0.30	1.1

Date of Calibration : 14-20 Jan. 2021

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FM.BLMTC.002 Rev.3



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-64/0217

MTC No. EEL. BP. 18/0164

9. Peak C sound level

Number of cycles in test signal	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Uncertainty (±dB)	Tolerance limits Class 1 (±dB)
Complete cycle	135.4	135.6	0.2	0.20	2.4
Positive half cycle	134.4	134.1	-0.3	0.20	1.4
Negative half cycle	134.4	134.1	-0.3	0.20	1.4

10. Overload indication

Measured value (dB)		Deviated value (dB)	Uncertainty (±dB)	Tolerance Limits Class 1 (±dB)
Positive one-half cycle	Negative one-half cycle	0.1	0.30	1.8
139.4	139.3			

Calibrated by :

Approved by :

Electrical and Electronic Standards Laboratory
Industrial Metrology and Testing Service Centre
Ref : 2011264010700062001

Date of Calibration : 14-20 Jan. 2021

Date of Issue : 21 Jan. 2021

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Request No. 21-64/0217

MTC No. EEL. BP. 18/0164

7. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Uncertainty (±dB)	Tolerance Limits Class 1 (±dB)
20-140	135	135.0	0.0	0.30	1.1

8. Tone burst response

Time Weighting	Toneburst Duration, Tb (ms)	Measured Value (dB)	Deviated Value (dB)	Uncertainty (±dB)	Tolerance Limits Class 1 (dB)
Fast	200	136.0	0.0	0.20	±0.8
	2	118.9	-0.1	0.20	+1.3; -1.8
	0.25	109.9	-0.1	0.20	+1.3; -3.3
Slow	200	129.6	0.0	0.20	±0.8
	2	109.9	-0.1	0.20	+1.3; -3.3
	0.25	130.1	0.1	0.20	±0.8
SEL	2	110.0	0.0	0.20	+1.3; -1.8
	0.25	101.0	0.0	0.20	+1.3; -3.3

Date of Calibration : 14-20 Jan. 2021

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Request No. 21-64/0217

MTC No. EEL. BP. 20/0164

9. Power Amplifier Brüel&Kjær 2706 S/N 1517650.
10. Speaker Tannoy Limited, Great Britain British Patent No. 215300.
11. Digital Multimeter Agilent 34401A S/N MY 44005560.
12. Programmable Attenuator Tamagawa TPA-303A S/N 2212.

Calibration Procedure :

This instrument was calibrated by using calibration procedures no CP-102-02 and CP-102-03, which were based on IEC 61672-3 Electroacoustics - Sound Level Meters - Part 3 : Periodic tests (2006). These calibration procedures were related to the electrical and acoustic signal tests. The electrical signal test was carried out with the direct measurement method. The acoustic signal test was performed in an anechoic room with the comparison measurement method.

This instrument has been calibrated against standards maintained at the Electrical and Electronic Standards Laboratory (EEL), which are traceable to the International System of Units through the National Institute of Metrology (Thailand).

The information on actual reading is attached herewith and the uncertainty limits quoted refer to the measured values only;

The reported expanded uncertainty is based upon a standard uncertainty multiplied by a coverage factor $k=2$, providing a level of confidence of approximately 95%.

Date of Calibration : 14-20 Jan. 2021

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-64/0217

MTC No. EEL. BP. 20/0164

CALIBRATION CERTIFICATE

Submitted by : SGS (Thailand), Ltd.

Address : 100 Nanglinchee Rd., Chongmonsee, Yanmawa, Bangkok 10120.

Calibrated at : Electrical and Electronic Standards Laboratory, Industrial Metrology and Testing Service Centre,
Soi 1C, Bangpoo Industrial Estate, Sukhumvit Rd., A.Muang, Samutprakan 10280.

Instrument Calibrated :

Description : Sound Level Meter : (23 ± 3) °C
Manufacturer : Cirrus : (50 ± 15) %
Model : CR-171B : (101.325 ± 1.5) kPa
Serial No. : G078141

Microphone : Cirrus MK224 No.211789D

Preamplifier : No.6037F

Standards used :

1. Band Pass Filter Stanford Research Systems SR 650 S/N 28712.
2. Condenser Microphone Brüel&Kjær 4180 S/N 2889871.
3. Decade Attenuator Ando AL-205 S/N 00464602.
4. Function/Arbitrary Waveform Generator Agilent 33220A S/N MY44042668.
5. Digital Function Synthesizer NF Electronic Instruments DF-193A S/N 122037.
6. Digital Multimeter Fluke 8520A S/N 4985007.
7. Pistonphone Rion NC-72 S/N 00402446.
8. Measuring Amplifier Brüel&Kjær 2636 S/N 1537484.

Date of Receipt : 7 Jan. 2021

Date of Calibration : 14-20 Jan. 2021

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DATE 05/02/2021

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3. Acoustical signal test of frequency weightings

Frequency (Hz)	Deviation from response curve			Uncertainty (±dB)	Tolerance Limits Class 1 (±dB)
	A-weighting (dB)	C-weighting (dB)	Flat (dB)		
125	0.5	0.3	0.1	0.40	1.5
1 000	-0.3	-0.3	-0.2	0.40	1.1
4 000	0.4	0.5	0.6	0.40	1.6

4. Electrical signal test of frequency weightings

Frequency (Hz)	Deviation from response curve			Uncertainty (±dB)	Tolerance Limits Class 1 (±dB)
	A-weighting (dB)	C-weighting (dB)	Flat (dB)		
63	0.4	0.1	0.1	0.20	1.5
125	0.2	0.1	0.0	0.20	1.5
250	0.2	0.0	0.0	0.20	1.4
500	0.1	0.0	0.0	0.20	1.4
1 000	0.0	0.0	0.0	0.20	1.1
2 000	-0.1	0.0	0.0	0.20	1.6
4 000	-0.4	-0.2	0.0	0.20	1.6
8 000	-0.5	-0.3	-0.1	0.20	+2.1; -3.1
16 000	0.3	0.4	-0.2	0.20	+3.5; -17.0

Date of Calibration : 14-20 Jan. 2021

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1. Absolute Sensitivity

Reference Acoustic Signal (dB)	Unit Under Test			Tolerance limit Class 1 (±dB)
	Measured Value (dB)	Deviation (dB)	Uncertainty (±dB)	
93.74	Before adjust	After adjust		
	93.8	93.7	0.0	0.50
				1.1

Note: The external calibration adjustment was firstly performed. The internal calibration adjustment was then completed at the display of 93.7 dB.

2. Self-generated noise

2.1 Normal test

Measured value (dB)	Uncertainty (±dB)
17.4	0.10

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

Frequency	Measured Value (dB)	Uncertainty (±dB)
Weighting	under-range	-
A-Weighting		
C-Weighting	21.2	0.10
Flat	33.1	0.10

Note: The under-range means that the indicator cannot display the value in range 20-140 dB.

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6. Level linearity on the reference level range (cont.)

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Uncertainty (+dB)	Tolerance Limits Class 1 (+dB)
119	119.0	0.0	0.30	1.1
114	114.0	0.0	0.30	1.1
109	109.0	0.0	0.30	1.1
104	104.0	0.0	0.30	1.1
99	99.0	0.0	0.30	1.1
94	94.0	0.0	0.30	1.1
89	89.2	0.2	0.30	1.1
84	84.0	0.0	0.30	1.1
79	79.0	0.0	0.30	1.1
74	74.0	0.0	0.30	1.1
69	69.0	0.0	0.30	1.1
64	64.0	0.0	0.30	1.1
59	59.0	0.0	0.30	1.1
54	54.0	0.0	0.30	1.1
49	49.0	0.0	0.30	1.1
44	44.0	0.0	0.30	1.1
39	39.0	0.0	0.30	1.1
34	34.0	0.0	0.30	1.1
29	29.1	0.1	0.30	1.1
24	24.1	0.1	0.30	1.1

Date of Calibration : 14-20 Jan. 2021

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5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated Value (dB)	Uncertainty (+dB)	Tolerance Limits Class 1 (+dB)
A-weighting	114.0	0.0	0.20	0.4
C-weighting	114.0	0.0	0.20	0.4
Flat	114.0	0.0	0.20	0.4

5.2 Time weightings at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated Value (dB)	Uncertainty (+dB)	Tolerance Limits Class 1 (+dB)
Fast	114.0	0.0	0.20	0.3
Slow	114.0	0.0	0.20	0.3
Leq	114.0	0.0	0.20	0.3

6. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Uncertainty (+dB)	Tolerance Limits Class 1 (+dB)
138	138.1	0.1	0.30	1.1
137	137.1	0.1	0.30	1.1
136	136.1	0.1	0.30	1.1
135	135.0	0.0	0.30	1.1
134	134.0	0.0	0.30	1.1
129	129.0	0.0	0.30	1.1
124	124.0	0.0	0.30	1.1

Date of Calibration : 14-20 Jan. 2021

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-64/0217

MTC No. EEL, BP, 20/0164

9. Peak C sound level

Number of cycles in test signal	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Uncertainty (±dB)	Tolerance limits Class 1 (±dB)
Complete cycle	135.4	135.6	0.2	0.20	2.4
Positive half cycle	134.4	134.1	-0.3	0.20	1.4
Negative half cycle	134.4	134.2	-0.2	0.20	1.4

10. Overload indication

Measured value (dB)		Deviated value (dB)	Uncertainty (±dB)	Tolerance Limits Class 1 (±dB)
Positive one-half cycle	Negative one-half cycle	0.1	0.30	1.8
140.7	140.6			

Calibrated by :

Approved by :

Electrical and Electronic Standards Laboratory
Industrial Metrology and Testing Service Centre

Date of Calibration : 14-20 Jan. 2021

Date of Issue : 21 Jan. 2021

Ref : 2011264010700062003

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-64/0217

MTC No. EEL, BP, 20/0164

7. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Uncertainty (±dB)	Tolerance Limits Class 1 (±dB)
20-140	135	135.0	0.0	0.30	1.1

8. Tone burst response

Time Weighting	Toneburst Duration (ms)	Measured Value (dB)	Deviated Value (dB)	Uncertainty (±dB)	Tolerance Limits Class 1 (dB)
Fast	200	136.0	0.0	0.20	±0.8
	2	118.9	-0.1	0.20	+1.3; -1.8
	0.25	109.9	-0.1	0.20	+1.3; -3.3
Slow	200	129.6	0.0	0.20	±0.8
	2	110.0	0.0	0.20	+1.3; -3.3
	0.25	130.0	0.0	0.20	±0.8
SEL	2	110.0	0.0	0.20	+1.3; -1.8
	0.25	101.0	0.0	0.20	+1.3; -3.3

Date of Calibration : 14-20 Jan. 2021

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-64/0217 MTC No. EEL. BP. 23/0164

9. Power Amplifier Briel&Kjaer 2706 S/N 1517650.
10. Speaker Tannoy Limited, Great Britain British Patent No. 215300.
11. Digital Multimeter Agilent 34401A S/N MY44005560.
12. Programmable Attenuator Tamagawa TPA-303A S/N 2212.

Calibration Procedure :

This instrument was calibrated by using calibration procedures no CP-102-02 and CP-102-03, which were based on IEC 61672-3 Electroacoustics - Sound Level Meters - Part 3 : Periodic tests (2006). These calibration procedures were related to the electrical and acoustic signal tests. The electrical signal test was carried out with the direct measurement method. The acoustic signal test was performed in an anechoic room with the comparison measurement method.

This instrument has been calibrated against standards maintained at the Electrical and Electronic Standards Laboratory (EEL), which are traceable to the International System of Units through the National Institute of Metrology (Thailand).

The information on actual reading is attached herewith and the uncertainty limits quoted refer to the measured values only.

The reported expanded uncertainty is based upon a standard uncertainty multiplied by a coverage factor k=2, providing a level of confidence of approximately 95%.

Date of Calibration : 14-20 Jan. 2021

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-64/0217

MTC No. EEL. BP. 23/0164

CALIBRATION CERTIFICATE

Submitted by : SGS (Thailand), Ltd.

Address : 100 Nanglinchee Rd., Chongnonsee, Yannawa, Bangkok 10120.

Calibrated at : Electrical and Electronic Standards Laboratory, Industrial Metrology and Testing Service Centre.

Soi 1C, Bangpoo Industrial Estate, Sukhumvit Rd., A.Muang, Samutprakan 10280.

Instrument Calibrated :

Description : Sound Level Meter

Manufacturer : Cirrus

Model : CR-161B

Serial No. : G078509

Microphone : Cirrus MK224 No.209930D

Preamplifier : No.7196F

Standards used :

1. Band Pass Filter Stanford Research Systems SR 650 S/N 28712.
2. Condenser Microphone Briel&Kjaer 4180 S/N 2889871.
3. Decade Attenuator Ando AL-205 S/N 00464602.
4. Function/Arbitrary Waveform Generator Agilent 33220A S/N MY44042668.
5. Digital Function Synthesizer NF Electronic Instruments DF-193A S/N 122037.
6. Digital Multimeter Fluke 8520A S/N 4985007.
7. Pistonphone Rion NC-72 S/N 00402446.
8. Measuring Amplifier Briel&Kjaer 2636 S/N 1537484.

Ambient Environment

Temperature : (23 ± 3) °C

Relative Humidity : (50 ± 15) %

Ambient Pressure : (101.325 ± 1.5) kPa

VERIFIED

Date of Receipt : 7 Jan. 2021

Date of Calibration : 14-20 Jan. 2021

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Request No. 21-64/0217

MTC No. EEL. BP. 23/0164

Request No. 21-64/0217

MTC No. EEL. BP. 23/0164

3. Acoustical signal test of frequency weightings

Frequency (Hz)	Deviation from response curve			Uncertainty (±dB)	Tolerance Limits Class 1 (±dB)
	A-weighting (dB)	C-weighting (dB)	Flat (dB)		
125	0.5	0.3	0.2	0.40	1.5
1 000	-0.5	-0.5	-0.5	0.40	1.1
4 000	-0.3	-0.2	-0.1	0.40	1.6

4. Electrical signal test of frequency weightings

Frequency (Hz)	Deviation from response curve			Uncertainty (±dB)	Tolerance Limits Class 1 (±dB)
	A-weighting (dB)	C-weighting (dB)	Flat (dB)		
63	0.3	0.1	0.0	0.20	1.5
125	0.2	0.0	0.0	0.20	1.5
250	0.2	0.0	0.0	0.20	1.4
500	0.1	0.0	0.0	0.20	1.4
1 000	0.0	0.0	0.0	0.20	1.1
2 000	-0.1	0.0	0.0	0.20	1.6
4 000	-0.4	-0.2	0.0	0.20	1.6
8 000	-0.5	-0.3	-0.1	0.20	+2.1; -3.1
16 000	0.2	0.4	-0.2	0.20	+3.5; -17.0

Date of Calibration : 14-20 Jan. 2021

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FM.BLMTC.002 Rev.3

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Request No. 21-64/0217

MTC No. EEL. BP. 23/0164

1. Absolute Sensitivity

Reference Acoustic Signal (dB)	Unit Under Test			Tolerance limit Class 1 (±dB)
	Measured Value (dB)	Deviation (dB)	Uncertainty (±dB)	
93.74	Before adjust 93.9	After adjust 93.7	0.0	0.50
			0.0	1.1

Note: The external calibration adjustment was firstly performed. The internal calibration adjustment was then completed at the display of 93.7 dB.

2. Self-generated noise

2.1 Normal test

Measured value (dB)	Uncertainty (±dB)
16.7	0.10

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

Frequency	Measured Value (dB)	Uncertainty (±dB)
Weighting	under-range	-
A-Weighting	18.6	0.10
C-Weighting	30.4	0.10

Note: The under-range means that the indicator cannot display the value in range 20-140 dB.

Date of Calibration : 14-20 Jan. 2021

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6. Level linearity on the reference level range (cont.)

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Uncertainty (±dB)	Tolerance Limits Class 1 (±dB)
119	119.0	0.0	0.30	1.1
114	114.0	0.0	0.30	1.1
109	109.0	0.0	0.30	1.1
104	104.0	0.0	0.30	1.1
99	99.0	0.0	0.30	1.1
94	94.0	0.0	0.30	1.1
89	89.1	0.1	0.30	1.1
84	84.1	0.1	0.30	1.1
79	79.0	0.0	0.30	1.1
74	74.0	0.0	0.30	1.1
69	69.0	0.0	0.30	1.1
64	64.0	0.0	0.30	1.1
59	59.0	0.0	0.30	1.1
54	54.0	0.0	0.30	1.1
49	49.0	0.0	0.30	1.1
44	44.0	0.0	0.30	1.1
39	39.0	0.0	0.30	1.1
34	34.0	0.0	0.30	1.1
29	29.1	0.1	0.30	1.1
24	24.2	0.2	0.30	1.1

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5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated Value (dB)	Uncertainty (±dB)	Tolerance Limits Class 1 (±dB)
A-weighting	114.0	0.0	0.20	0.4
C-weighting	114.0	0.0	0.20	0.4
Flat	114.0	0.0	0.20	0.4

5.2 Time weightings at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated Value (dB)	Uncertainty (±dB)	Tolerance Limits Class 1 (±dB)
Fast	114.0	0.0	0.20	0.3
Slow	114.0	0.0	0.20	0.3
Leq	114.0	0.0	0.20	0.3

6. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Uncertainty (±dB)	Tolerance Limits Class 1 (±dB)
138	138.0	0.0	0.30	1.1
137	137.0	0.0	0.30	1.1
136	136.0	0.0	0.30	1.1
135	135.0	0.0	0.30	1.1
134	134.0	0.0	0.30	1.1
129	129.0	0.0	0.30	1.1
124	124.0	0.0	0.30	1.1

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9. Peak C sound level

Number of cycles in test signal	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Uncertainty (±dB)	Tolerance limits Class 1 (±dB)
Complete cycle	135.4	135.7	0.3	0.20	2.4
Positive half cycle	134.4	134.2	-0.2	0.20	1.4
Negative half cycle	134.4	134.2	-0.2	0.20	1.4

10. Overload indication

Measured value (dB)	Deviated value (dB)		Uncertainty (±dB)	Tolerance Limits Class 1 (±dB)
	Positive one-half cycle	Negative one-half cycle		
140.4		140.3	0.1	1.8

Calibrated by :

Approved by :

Electrical and Electronic Standards Laboratory
Industrial Metrology and Testing Service Centre
Date of Calibration : 14-20 Jan. 2021
Date of Issue : 21 Jan. 2021
Ref : 2011264010700062006
End of Certificate

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7. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Uncertainty (±dB)	Tolerance Limits Class 1 (±dB)
20-140	135	135.0	0.0	0.30	1.1

8. Tone burst response

Time Weighting	Toneburst Duration, Tb (ms)	Measured Value (dB)		Deviated Value (dB)	Uncertainty (±dB)	Tolerance Limits Class 1 (dB)
		Value (dB)	Value (dB)			
Fast	200	136.1	0.1	0.20	±0.8	
	2	119.0	0.0	0.20	+1.3; -1.8	
	0.25	109.9	-0.1	0.20	+1.3; -3.3	
Slow	200	129.6	0.0	0.20	±0.8	
	2	110.0	0.0	0.20	+1.3; -3.3	
	200	130.1	0.1	0.20	±0.8	
SEL	2	110.0	0.0	0.20	+1.3; -1.8	
	0.25	101.0	0.0	0.20	+1.3; -3.3	

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