

# Certificate of Calibration

Calibration Certification Information			
Cal. Date: November 20, 2017	Rootsmeter S/N: 438320	Ta: 294	°K
Operator: Jim Tisch		Pa: 756.9	mm Hg
Calibration Model #: TE-5025A	Calibrator S/N: 2456		

Run	Vol. Init (m3)	Vol. Final (m3)	ΔVol. (m3)	ΔTime (min)	ΔP (mm Hg)	ΔH (in H2O)
1	1	2	1	1.4440	3.2	2.00
2	3	4	1	1.0260	6.4	4.00
3	5	6	1	0.9130	7.8	5.00
4	7	8	1	0.8680	8.8	5.50
5	9	10	1	0.7190	12.7	8.00

Data Tabulation					
Vstd (m3)	Qstd (x-axis)	$\sqrt{\Delta H \left( \frac{Pa}{Pstd} \right) \left( \frac{Tstd}{Ta} \right)}$ (y-axis)	Va	Qa (x-axis)	$\sqrt{\Delta H \left( \frac{Ta}{Pa} \right)}$ (y-axis)
1.0052	0.6961	1.4209	0.9958	0.6896	0.8814
1.0010	0.9756	2.0095	0.9915	0.9664	1.2465
0.9991	1.0943	2.2467	0.9897	1.0840	1.3936
0.9978	1.1495	2.3563	0.9884	1.1387	1.4616
0.9926	1.3805	2.8418	0.9832	1.3675	1.7628
<b>QSTD</b>	m= 2.07133		<b>QA</b>	m= 1.29703	
	b= -0.01892			b= -0.01173	
	r= 0.99995			r= 0.99995	

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

Standard Conditions	
Tstd:	298.15 °K
Pstd:	760 mm Hg
Key	
ΔH:	calibrator manometer reading (in H2O)
ΔP:	rootsmeter manometer reading (mm Hg)
Ta:	actual absolute temperature (°K)
Pa:	actual barometric pressure (mm Hg)
b:	intercept
m:	slope

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

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**TSP SAMPLER CALIBRATION CALCULATION SPREADSHEET**

Project : Environmental Monitoring Works For Contract No. KLN/2015/07			Date of Calibration: 3-Jul-18		
Location : KER1b			Next Calibration Date: 2-Oct-18		
Brand:	Tisch		Technician: Toby Wan		
Model:	TE-5170	S/N:	3482		

CONDITIONS					
Sea Level Pressure (hPa):	1002.5	Corrected Pressure (mm Hg):	752		
Temperature (°C):	30	Temperature (K):	303		

CALIBRATION ORIFICE					
Make:	Tisch	Qstd Slope:	2.07013		
Model:	TE-5025A	Qstd Intercept:	-0.01892		
Calibration Date:	20-Nov-17	Expiry Date:	20-Nov-18		
S/N:	2456				

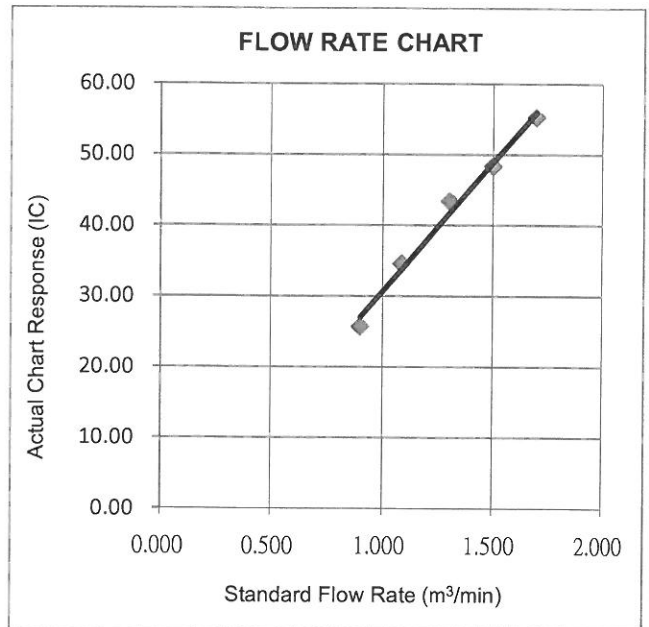
CALIBRATIONS							
Plate No.	H2O (L) (in)	H2O (R) (in)	H2O (in)	Qstd (m <sup>3</sup> /min)	I (chart)	IC (corrected)	LINEAR REGRESSION
18	4.10	-8.40	12.500	1.694	56.00	55.24	Slope = 36.4591 Intercept = -5.8642 Corr. coeff.: 0.9945
13	2.80	-7.00	9.800	1.501	49.00	48.34	
10	1.20	-6.20	7.400	1.305	44.00	43.41	
7	0.50	-4.60	5.100	1.085	35.00	34.53	
5	-0.10	-3.60	3.500	0.901	26.00	25.65	

**Calculations:**

Qstd = 1/m[ $\sqrt{H_2O(Pa/Pstd)(Tstd/Ta)}$ ]-b]  
 IC = I[ $\sqrt{Pa/Pstd}(Tstd/Ta)$ ]  
 Qstd = standard flow rate  
 IC = corrected chart response  
 I = actual chart response  
 m = calibrator Qstd slope  
 b = calibrator Qstd intercept  
 Ta = actual temperature during calibration (deg K)  
 Pa = actual pressure during calibration (mm Hg)  
 Tstd = 298 deg K  
 Pstd = 760 mm Hg

**For subsequent calculation of sampler flow:**

1/m((I)[ $\sqrt{298/Tav}(Pav/760)$ ]-b)  
 m = sampler slope  
 b = sampler intercept  
 I = chart response  
 Tav = daily average temperature  
 Pav = daily average pressure



**CHOI KAM HO**  
Project Consultant

**Report Date:** 3<sup>rd</sup> July, 2018

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**TSP SAMPLER CALIBRATION CALCULATION SPREADSHEET**

Project : Environmental Monitoring Works For Contract No. KLN/2015/07		Date of Calibration: 3-Jul-18
Location : KTD1a		Next Calibration Date: 2-Oct-18
Brand: Tisch	Technician: Toby Wan	
Model: TE-5170	S/N: 4037	

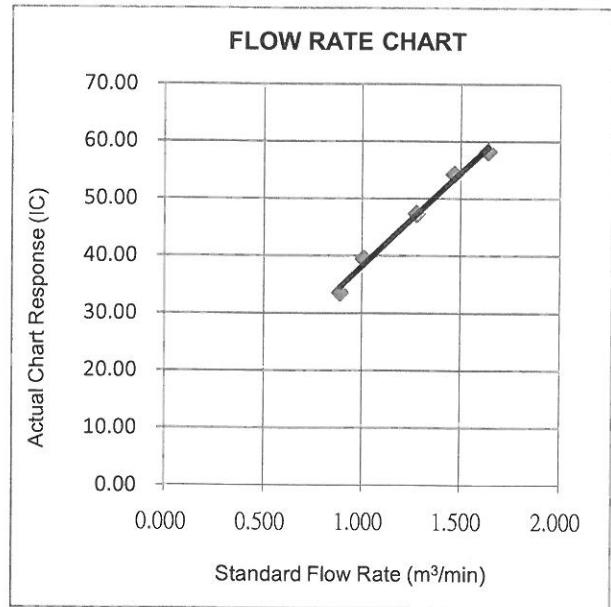
CONDITIONS			
Sea Level Pressure (hPa):	1002.5	Corrected Pressure (mm Hg):	752
Temperature (°C):	30	Temperature (K):	303

CALIBRATION ORIFICE			
Make: Tisch	Qstd Slope:	2.07013	
Model: TE-5025A	Qstd Intercept:	-0.01892	
Calibration Date: 20-Nov-17	Expiry Date:	20-Nov-18	
S/N: 2456			

CALIBRATIONS							
Plate No.	H2O (L) (in)	H2O (R) (in)	H2O (in)	Qstd (m <sup>3</sup> /min)	I (chart)	IC (corrected)	LINEAR REGRESSION
18	3.80	-7.90	11.700	1.639	59.00	58.20	Slope = 32.5139 Intercept = 5.6937 Corr. coeff.: 0.9962
13	2.60	-6.80	9.400	1.470	55.00	54.26	
10	1.50	-5.60	7.100	1.279	48.00	47.35	
7	0.20	-4.20	4.400	1.009	40.00	39.46	
5	-0.30	-3.70	3.400	0.888	34.00	33.54	

**Calculations:**

$Qstd = 1/m[\text{Sqrt}(H2O(Pa/Pstd)(Tstd/Ta))-b]$   
 $IC = I[\text{Sqrt}(Pa/Pstd)(Tstd/Ta)]$   
 Qstd = standard flow rate  
 IC = corrected chart response  
 I = actual chart response  
 m = calibrator Qstd slope  
 b = calibrator Qstd intercept  
 Ta = actual temperature during calibration (deg K)  
 Pa = actual pressure during calibration (mm Hg)  
 Tstd = 298 deg K  
 Pstd = 760 mm Hg  
**For subsequent calculation of sampler flow:**  
 $1/m((I)[\text{Sqrt}(298/Tav)(Pav/760)]-b)$   
 m = sampler slope  
 b = sampler intercept  
 I = chart response  
 Tav = daily average temperature  
 Pav = daily average pressure



**CHOI KAM HO**  
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**Report Date:** 3<sup>rd</sup> July, 2018

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**TSP SAMPLER CALIBRATION CALCULATION SPREADSHEET**

Project : Environmental Monitoring Works For Contract No. KLN/2015/07			Date of Calibration: 3-Jul-18
Location : KTD2a			Next Calibration Date: 2-Oct-18
Brand:	Tisch		Technician: Toby Wan
Model:	TE-5170	S/N: 3838	

CONDITIONS			
Sea Level Pressure (hPa):	1002.5	Corrected Pressure (mm Hg):	752
Temperature (°C):	30	Temperature (K):	303

CALIBRATION ORIFICE			
Make:	Tisch	Qstd Slope:	2.07013
Model:	TE-5025A	Qstd Intercept:	-0.01892
Calibration Date:	20-Nov-17	Expiry Date:	20-Nov-18
S/N:	2456		

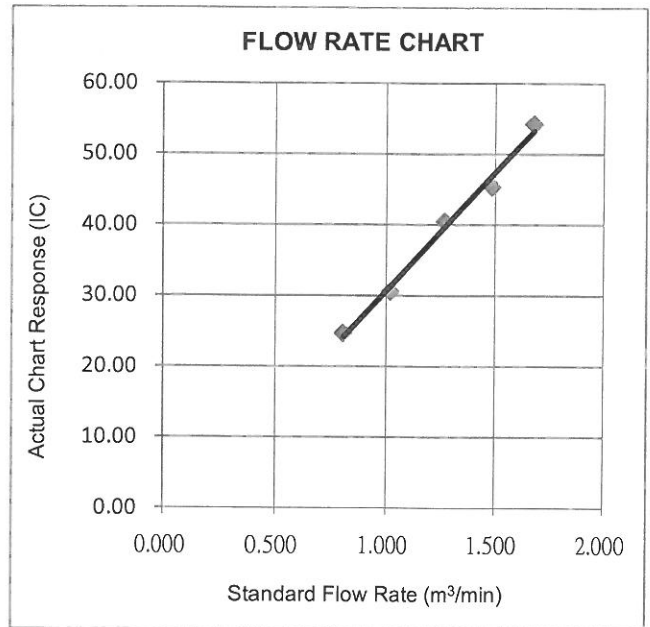
CALIBRATIONS							
Plate No.	H2O (L) (in)	H2O (R) (in)	H2O (in)	Qstd (m <sup>3</sup> /min)	I (chart)	IC (corrected)	LINEAR REGRESSION
18	4.00	-8.20	12.200	1.674	55.00	54.26	Slope = 33.5918 Intercept = -2.9631 Corr. coeff.: 0.9956
13	2.70	-6.90	9.600	1.486	46.00	45.38	
10	1.10	-5.90	7.000	1.270	41.00	40.45	
7	0.10	-4.40	4.500	1.020	31.00	30.58	
5	-0.60	-3.40	2.800	0.807	25.00	24.66	

**Calculations:**

Qstd = 1/m[ $\sqrt{H_2O(Pa/Pstd)(Tstd/Ta)}$ ]-b  
 IC = I[ $\sqrt{Pa/Pstd}(Tstd/Ta)$ ]  
 Qstd = standard flow rate  
 IC = corrected chart response  
 I = actual chart response  
 m = calibrator Qstd slope  
 b = calibrator Qstd intercept  
 Ta = actual temperature during calibration (deg K)  
 Pa = actual pressure during calibration (mm Hg)  
 Tstd = 298 deg K  
 Pstd = 760 mm Hg

**For subsequent calculation of sampler flow:**

1/m((I)[ $\sqrt{298/Tav}(Pav/760)$ ]-b)  
 m = sampler slope  
 b = sampler intercept  
 I = chart response  
 Tav = daily average temperature  
 Pav = daily average pressure



**CHOI KAM HO**  
Project Consultant

**Report Date:** 3<sup>rd</sup> July, 2018

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# MaterialLab

Report no.: 172379CA185011A

Page 1 of 1

## CALIBRATION CERTIFICATE OF SOUND LEVEL METER

### Client Supplied Information

Client : MaterialLab Consultants Ltd.

Address : Room 723 & 725, 7/F., Block B, Profit Industrial Building, 1-15 Kwai Fung Crescent, Kwai Chung, N.T.

Project : Calibration Services

Details of Unit Under Test, UUT

Description : Sound Level Meter  
Manufacturer : Casella

	Meter	Microphone	Preamplifier
Model No.	CEL-63X	CE-251	CEL-495
Serial No.	3148029	01910	003318

Next Calibration Date : 12-Apr-2019  
Specification Limit : EN 61672: 2003 Type 1

### Laboratory Information

Description : B & K Acoustic Multifunction Calibrator 4226 (Traditional free field setting)  
Equipment ID. : R-108-1  
Date of Calibration : 13-Apr-2018 Ambient Temperature : 22 °C  
Calibration Location : Calibration Laboratory of FTS  
Method Used : By direct comparison

### Calibration Results :

Parameters		Mean Value (dB)	Specification Limit(dB)
A-weighting frequency response	4000Hz	1.7	2.6 to -0.6
	2000Hz	1.4	2.8 to -0.4
	1000Hz	0.0	1.1 to -1.1
	500Hz	-3.4	-1.8 to -4.6
	250Hz	-8.8	-7.2 to -10.0
	125Hz	-16.2	-14.6 to -17.6
	63Hz	-26.2	-24.7 to -27.7
	31.5Hz	-39.1	-37.4 to -41.4
Differential level linearity	94dB-104dB	0.0	± 0.6
	104dB-114dB	0.0	± 0.6

### Remarks :

1. The equipment used in this calibration is traceable to recognized National Standards.
2. The mean value is the average of four measurements.
3. For calibration: Reference SPL are 94, 104 & 114dB, range setting is 20-140dB & time weighing is fast
4. The equipment does comply with EN 61672: 2003 Type 1 sound level meter for the above measurement.
5. This is to supersede the previous report no. 172379CA185011.

Checked by : cmf Date : 5-7-2018 Certified by : RJ Leung Date : 7-7-2018  
CA-R-297 (22/07/2009) Leung Kwok Tai (Assistant Manager)

\*\* End of Report \*\*

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# MateriaLab

Report no.: 172379CA180329

Page 1 of 1

## CALIBRATION CERTIFICATE OF SOUND LEVEL METER

### Client Supplied Information

Client : MateriaLab Consultants Ltd.

Address : Room 723 & 725, 7/F., Block B Profit Industrial Building, 1-15 Kwai Fung Crescent, Kwai Chung, N.T.

Project : Calibration Services

### Details of Unit Under Test, UUT

Description : Sound Level Meter

Manufacturer : Casella

Model No.

Serial No.

Next Calibration Date : 12-Feb-2019

Specification Limit : EN 61672: 2003 Type 1

Meter	Microphone	Preamplifier
CL63X	CE-251	CEL-495
1057055	00995	002317

### Laboratory Information

Description : B & K Acoustic Multifunction Calibrator 4226 (Traditional free field setting)

Equipment ID. : R-108-1

Date of Calibration : 13-Feb-2018 Ambient Temperature : 22 °C

Calibration Location : Calibration Laboratory of FTS



Method Used : By direct comparison

### Calibration Results :

Parameters		Mean Value (dB)	Specification Limit(dB)
A-weighting frequency response	4000Hz	0.4	2.6 to -0.6
	2000Hz	1.0	2.8 to -0.4
	1000Hz	0.2	1.1 to -1.1
	500Hz	-3.0	-1.8 to -4.6
	250Hz	-8.3	-7.2 to -10.0
	125Hz	-15.7	-14.6 to -17.6
	63Hz	-25.7	-24.7 to -27.7
	31.5Hz	-38.7	-37.4 to -41.4
Differential level linearity	94dB-104dB	0.1	± 0.6
	104dB-114dB	0.0	± 0.6

### Remarks :

1. The equipment used in this calibration is traceable to recognized National Standards.
2. The mean value is the average of four measurements.
3. For calibration: Reference SPL are 94, 104 & 114dB, range setting is 20-140dB & time weighing is fast
4. The equipment does comply with EN 61672: 2003 Type 1 sound level meter for the above measurement.

Checked by :  Date : 14/2/2018 Certified by :  Date : 26/2/2018

CA-R-297 (22/07/2009)

Chan Chun Wai (Manager)

\*\* End of Report \*\*

# FUGRO TECHNICAL SERVICES LIMITED

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# MateriaLab

Report no.: 172379CA172109

Page 1 of 1

## CALIBRATION CERTIFICATE OF SOUND LEVEL METER

### Client Supplied Information

Client : MateriaLab Consultants Ltd.

Address : Room 723 & 725, 7/F., Block B Profit Industrial Building, 1-15 Kwai Fung Crescent, Kwai Chung, N.T.

Project : Calibration Services

Details of Unit Under Test, UUT

Description : Sound Level Meter  
Manufacturer : Casella

	Meter	Microphone	Preamplifier
Model No.	CL63X	CE-251	CEL-495
Serial No.	4637931	01993	003538

Equipment ID : N-13  
Next Calibration Date : 17-Sep-2018  
Specification Limit : EN 61672: 2003 Type 1

### Laboratory Information


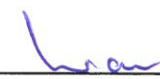
Description : B & K Acoustic Multifunction Calibrator 4226 (Traditional free field setting)  
Equipment ID. : R-108-1  
Date of Calibration : 18-Sep-2017 Ambient Temperature : 22 °C  
Calibration Location : Calibration Laboratory of MateriaLab  
Method Used : By direct comparison

### Calibration Results :

Parameters	Mean Value (dB)	Specification Limit(dB)
A-weighting frequency response	4000Hz	1.4
	2000Hz	1.3
	1000Hz	0.0
	500Hz	-3.2
	250Hz	-8.8
	125Hz	-16.3
	63Hz	-26.3
	31.5Hz	-39.3
Differential level linearity	94dB-104dB	0.0
	104dB-114dB	0.0

### Remarks :

1. The equipment used in this calibration is traceable to recognized National Standards.
2. The mean value is the average of four measurements.
3. For calibration: Reference range is 30-130dB, reference SPL is 94,104 & 114dB, frequency weighing is A,
4. The equipment does comply with EN 61672: 2003 Type 1 sound level meter for the above measurement.

Checked by :  Date : 19-9-2017 Certified by :  Date : 20-9-2017  
CA-R-297 (22/07/2009) Chan Chun Wai (Manager)

\*\* End of Report \*\*

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# MaterialLab

Report no.: 172379CA180671(1)

Page 1 of 1

## CALIBRATION CERTIFICATE OF SOUND CALIBRATOR

### Client Supplied Information

Client : MaterialLab Consultants Ltd.

Address : Room 723 & 725, 7/F., Block B Profit Industrial Building, 1-15 Kwai Fung Crescent, Kwai Chung, N.T.

Project : Calibration Services

### Details of Unit Under Test, UUT

Description : Sound Calibrator  
Manufacturer : Casella (Model no. CEL-120/1)  
Serial No. : 5230742  
Next Calibration Date : 10-Apr-2019  
Specification Limit : EN 60942: 2003 Type 1

### Laboratory Information

Description : Reference Sound Level Meter  
Equipment ID. : R-119-1  
Date of Calibration : 11-Apr-2018 Ambient Temperature : 21 °C  
Calibration Location : Calibration Laboratory of FTS  
Method Used : By direct comparison

### Calibration Results :

Parameters (Setting of UUT)	Mean Value (error of measurement)	Specification Limit (dB)
94dB	-0.4 dB	±0.4dB
114dB	0.0 dB	

### Remarks :

1. The equipment used in this calibration is traceable to recognized National Standards.
2. The mean value is the average of four measurements.
3. The equipment does comply with the specification limit.

Checked by :   
CA-R-297 (22/07/2009)

Date : 16/4/2018

Certified by : 

Chan Chun Wai (Manager)

Date : 16/4/2018

\*\* End of Report \*\*

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# MaterialLab

Report no.: 172379CA180517(1)

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## CALIBRATION CERTIFICATE OF SOUND CALIBRATOR

### Client Supplied Information

Client : MaterialLab Consultants Ltd.

Project : Calibration Services

Details of Unit Under Test, UUT

Description : Sound Calibrator  
Manufacturer : Casella (Model no. CEL-120/1)  
Serial No. : 5230758  
Equipment ID : FY-SLC-01  
Next Calibration Date : 11-Mar-2019  
Specification Limit : EN 60942: 2003 Type 1

### Laboratory Information

Description : Reference Sound level meter  
Equipment ID. : R-119-1  
Date of Calibration : 12-Mar-2018 Ambient Temperature : 22 °C  
Calibration Location : Calibration Laboratory of FTS  
Method Used : By direct comparison

### Calibration Results :

Parameters (Setting of UUT)	Mean Value (error of measurement)	Specification Limit(dB)
94dB	-0.4 dB	±0.4dB
114dB	-0.3 dB	

### Remarks :

1. The equipment used in this calibration is traceable to recognized National Standards.
2. The mean value is the average of four measurements.
3. The equipment does comply with the specification limit.

Checked by :  Date : 13.3.2018 Certified by :  Date : 13.3.2018  
CA-R-297 (22/07/2009) Chan Chun Wai (Manager)

**\*\* End of Report \*\***

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# MaterialLab

Report No. : 183057CA185180(1)

Page 1 of 1

## CALIBRATION CERTIFICATE OF ANEMOMETER

### Client Supplied Information

Client : MaterialLab Consultants Ltd.

Project : Calibration Services

### Details of Unit Under Test, UUT

Description : Anemometer

Manufacturer : Benetech

Model No. : GM816

Serial No. : 13372555

Equipment ID. : N/A

Next Calibration Date : 08-Jun-2019

### Laboratory Information

Details of Reference Equipment –

Description : Reference Anemometer

Equipment ID. : R-101-4

Date of Calibration : 09-Jun-2018 Ambient Temperature : 22 °C

Calibration Location : Calibration Laboratory of FTS

Method Used : By direct Comparison

### Calibration Results :

Reference Reading (m/s)	UUT Reading (m/s)	Error (m/s)
1.96	2.2	0.2
4.04	4.1	0.1
6.05	6.2	0.2
8.02	7.9	-0.1
10.06	9.7	-0.4

### Remark :

1. The equipment being used in this calibration is traceable to recognized National Standards.

Checked by : William Date : 12-6-2018 Certified by : Chan Chun Wai Date : 13.6.2018

CA-R-297 (22/07/2009)

Chan Chun Wai (Manager)

\*\* End of Report \*\*