

MTR Corporation Limited

Shatin to Central Link

Tai Wai to Hung Hom Section

Fixed Plant Noise Audit Report

(Batch 2 – Fung Tak Emergency Access and Emergency
Escape Access (FTA))

(April 2019)

Certified by: Fredrick Leong

Signature: 

Position: Independent Environmental Checker

Date: 12 April 2019

MTR Corporation Limited

Shatin to Central Link

Tai Wai to Hung Hom Section

Fixed Plant Noise Audit Report

(Batch 2 – Fung Tak Emergency Access and Emergency
Escape Access (FTA))

(April 2019)

Certified by: Lisa Poon

Signature: 

Position: Environmental Team Leader




Date: 12 April 2019

MTR Corporation Limited

Consultancy Agreement No. C11033

**Shatin to Central Link - Tai Wai to
Hung Hom Section [SCL(TAW – HUH)]
and Stabling Sidings at Hung Hom
Freight Yard [SCL(HHS)]****Fixed Plant Noise Audit Report
(Batch 2 – Fung Tak Emergency Access and
Emergency Escape Access (FTA))**

April 2019

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Reviewed & Approved:	 Josh Lam	

Version: A Date: 8 April 2019

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1 INTRODUCTION

1.1 Background

- 1.1.1 The Shatin to Central Link (SCL) is a 17km extension of the existing Ma On Shan Line (MOL) and East Rail Line (EAL) comprising (i) The East-West Corridor which extends the MOL from Tai Wai to Hung Hom via East Kowloon to connect with the West Rail Line (WRL) at Hung Hom Station (HUH) and Stabling Sidings at Hung Hom Freight Yard (HHS); and (ii) The North-South Corridor which is an extension of the EAL at Hung Hom across the harbour to Admiralty Station (ADM).
- 1.1.2 Environmental Impact Assessment (EIA) Reports for SCL – Tai Wai to Hung Hom Section [SCL (TAW-HUH)] (Register No. AEIAR-167/2012) and SCL Stabling Sidings at Hung Hom Freight Yard [SCL (HHS)] (Register No. AEIAR-164/2012) (hereinafter referred to as “the EIA Reports”) were approved on 17 February 2012 under the Environmental Impact Assessment Ordinance (EIAO). Following the approval of the EIA Reports, the Environmental Permit (EP) (EP No: EP-438/2012), covering the construction of both SCL (TAW-HUH) and SCL (HHS) (hereinafter referred to as “the Project”), was granted on 22 March 2012. Variations of Environmental Permit (VEP) were subsequently applied for EP-438/2012 and the latest Environmental Permit (EP No: EP-438/2012/K) was issued by Director of Environmental Protection (DEP) on 4 October 2016.
- 1.1.3 Pursuant to EP Condition 2.32, at least one month before commencement of operation of the Project, the Permit Holder, MTR Corporation Ltd (MTR), shall carry out fixed plant noise audit and deposit with the Director four hardcopies and one electronic copy of an audit report showing the design of the fixed plant noise sources associated with the Project complies with the maximum sound power levels determined in the approved SCL(TAW-HUH) EIA Report (Register No. AEIAR-167/2012) and SCL(HHS) EIA Report (Register No. AEIAR-164/2012) and all relevant documents in the Register, or otherwise approved by the Director in compliance with the requirements in Technical Memorandum on Environmental Impact Assessment Process having due regard to the characteristics of tonality, impulsiveness and intermittency.
- 1.1.4 Since the installation of fixed plant along the SCL (TAW-HUH) and SCL (HHS) would be completed in stages, the fixed plant noise audit will be conducted in stages according to the testing and commissioning programmes in each area.
- 1.1.5 AECOM Asia Co. Ltd was commissioned by the MTR to prepare the fixed plant noise audit report to check the compliance of the maximum sound power levels (SWLs) and to undertake noise measurement at the representative Noise Sensitive Receivers (NSRs) for investigation of any characteristics of tonality, impulsiveness and intermittency from the fixed plant noise sources associated with the Project.
- 1.1.6 Based on the latest design information, the maximum allowable SWLs of fixed plant items has been updated to reflect the latest design of the Project, and therefore Proposals were prepared to present the updated maximum allowable sound power levels (SWLs) of the fixed plant items at different stations of the Project. The Proposal for Updating Maximum Allowable Sound Power Levels of Louvers (Batch 2 – Fung Tak Emergency Access and Emergency Escape Access (FTA)) (hereinafter referred to as “the Proposal (Batch 2 – FTA)”) (**Appendix A** refers) was approved by DEP on 8 April 2019.
- 1.1.7 This Fixed Plant Noise Audit Report (Batch 2 – Fung Tak Emergency Access and Emergency Escape Access (FTA)) (hereinafter referred to as “the FPNAR (Batch 2 - FTA)”) presents the noise measurement methodology and measurement results at the fixed plant noise sources of FTA and at the representative NSRs near FTA, for checking compliance with the maximum allowable sound power levels (SWLs) determined in the Proposal (Batch 2 – FTA).

1.2 Purpose of This Report

- 1.2.1 This Report presents the noise measurement methodology and measurement results at the fixed plant noise sources of FTA and at the representative NSRs near FTA.

1.2.2 This Report comprises the following sections:

- Section 1 presents the background information.
- Section 2 presents the Updated SWL of fixed plant noise sources.
- Section 3 presents the noise measurement methodology.
- Section 4 presents the noise measurement results.
- Section 5 presents the conclusions.

2 UPDATED SOUND POWER LEVELS OF FIXED PLANT NOISE SOURCES

2.1.1 The updated maximum allowable SWL of fixed plant noise sources at FTA are extracted from the Proposal (Batch 2 – FTA) and are summarised in **Table 2.1**. The updated fixed plant noise sources locations at FTA are shown in **Figure No. C1103/C/SCL/ACM/M52/043**. The measured noise level of fixed plant noise sources during the commissioning test shall comply with the maximum allowable SWLs as summarised in **Table 2.1**. Appropriate corrections in tonal, impulsive or intermittent characteristics should be applied, where applicable, in accordance with the IND-TM during the commissioning test conducted at the representative NSRs.

Table 2.1 Summary of Updated Maximum Allowable SWLs for Fixed Plant Noise Sources at FTA

Location	Fixed Plant ID.	Fixed Plant Source	Maximum Allowable SWL, dB(A)	
			Daytime/Evening ⁽¹⁾	Night-time ⁽¹⁾
FTA	VS-WTS-01	Ventilation Louver	90	82
	VS-WTS-02	Ventilation Louver	97	89
	VS-WTS-03	Ventilation Louver	102	92
	VS-WTS-6A	Ventilation Louver	91	83
	VS-WTS-6B	Ventilation Louver	86	78
	VS-WTS-08	Ventilation Louver	90	82
	VS-WTS-09	Ventilation Louver	82	74
	VCU 101	Outdoor AC Unit	93	85
	VCU 102	Outdoor AC Unit	91	83
	VCU 103	Outdoor AC Unit	88	80

Note:

(1) Day: 0700 to 1900 hours, Evening: 1900 to 2300 hours, Night: 2300 to 0700 hours.

3 MEASUREMENT METHODOLOGY

3.1 Noise Measurement to obtain the SWLs of Fixed Plant Noise Sources

Measurement Methodology

3.1.1 Details of measurement methodology for SCL are presented in **Appendix B1**. Noise measurements to obtain the SWLs of the fixed plant noise sources followed Appendix B1 and were conducted by Gammon Construction Limited and supervised by Beexergy Consulting Limited.

Measurement Equipment

3.1.2 The sound level meters and calibrators used for noise measurements are listed in the **Table 3.1**. The instruments used for the noise measurements complied with International Electrotechnical Commission Publications 651:1979 (Type 1) and 804:1985 (Type 1). The calibration certificates of equipment are provided in **Appendix B2**.

Table 3.1 Noise Measurement Equipment

Equipment	Model	Serial Number
Sound Level Meter	Rion NL-52	00564841
Calibrator	SVANTEK SV35A	58708

3.1.3 Before and after each series of measurements, a calibration check was carried out on the sound level meter by the calibrator. The difference between the readings made before and after each series of measurements shall be less than or equal to 1.0 dB.

Measurement Date and Time

3.1.4 The operation of fixed plant sources at FTA is identical for both daytime and night-time. The noise measurements at FTA were all conducted during night-time period at the fixed plant noise sources. Details of the noise measurement schedule are shown in **Table 3.2**.

Table 3.2 Measurement Schedule

Location	Date
FTA	3 September 2018

3.2 Noise Measurement to Confirm any Tonal, Impulsive and Intermittent Characteristics from the Fixed Plant Noise Sources at Representative NSRs

Measurement Parameters

3.2.1 L_{Aeq} (30min) was measured at each designated measurement location. 1/3 octave band spectrum and time history over the measurement period was also be logged for determination of tonal, impulsiveness and intermittency characteristic.

3.2.2 Background noise level was measured at the same measurement location in term of L_{Aeq} (5 min) immediate before or after the noise measurement when all Project's fixed plant equipment shut down. To minimise the measurement data being influenced by background noise, noise data obtained at an instance of minimal or no traffic on the road was used to evaluate the tonal characteristic. The corrections for tonality, impulsiveness or intermittency at the representative NSRs was determined in accordance with IND-TM. In addition, any noticeable

characteristics of tonality, impulsiveness and intermittency from the fixed plant noise sources was recorded during the measurement. For the measurement was under unmanned condition (i.e. the one at FTA-FN2), the investigator conducted visit in the vicinity of the measurement location to record any noticeable characteristics of tonality, impulsiveness and intermittency from the fixed plant noise sources during the measurement.

Measurement Equipment

- 3.2.3 The sound level meters and calibrators used for noise measurements at representative NSRs are listed in **Table 3.3**. The instruments used for the noise measurements complied with International Electrotechnical Commission Publications 651:1979 (Type 1) and 804:1985 (Type 1). The calibration certificates of equipment are shown in **Appendix C1**.

Table 3.3 Noise Measurement Equipment

Equipment	Model	Serial Number
Sound Level Meter	B&K 2250	3001291
	B&K 2250L	2681366
	B&K 2270	2644597
Calibrator	B&K 4231	3006428
	Rion NC-74	34246490

- 3.2.4 Before and after each series of measurements, a calibration check was carried out on the sound level meter by the calibrator. The difference between the readings made before and after each series of measurements shall be less than or equal to 1.0 dB.

Measurement Locations

- 3.2.5 The proposed noise measurement locations were selected at the representative NSRs where have direct line of sight to the noise sources and were accessible for noise measurement. These measurement locations were agreed with EPD prior to noise measurement. The measurement locations are summarised in **Table 3.4** and shown in **Figure No. C1103/C/SCL/ACM/M52/044**. Photographs of measurement locations are shown in **Appendix C2**.

Table 3.4 Noise Measurement Locations

Measurement Location ID	Representative NSR (NSR ID)	Type	Measurement Height
FTA-FN1	Chui Yuen House (DIH-3-4)	Residential	6 th floor of the Chui Yuen House (free field condition) ⁽¹⁾
FTA-FN2	Wong Tai Sin Temple (DIH-16-1)	Place of Worship	Wong Tai Sin Temple (1m from boundary wall faced of building)
FTA-FN3	Rainbow Home (DIH-5-1) & Chuk Yuen United Village (DIH-17-1)	Residential	Site boundary of FTA (1.2m above ground level in free-field condition)

Note:

(1) Based on site observation, direct lines of sight between fixed plant noise sources and residential premises on lower floor levels (first to fifth floors) are screened by the podium of Chui Yuen House.

Measurement Date and Time

- 3.2.6 The operation of fixed plant sources at FTA is identical for both daytime and night-time, noise measurement at representative NSRs was therefore only conducted during night-time period. The measurement schedule is presented in **Table 3.5**.

Table 3.5 Measurement Schedule

Location	Date
FTA-FN1, FTA-FN2, FTA-FN3	24 Jan & 25 Jan 2019

4 MEASUREMENT RESULTS

4.1 Noise Measurement to obtain the SWLs of Fixed Plant Noise Sources

4.1.1 The measured SWLs during daytime and evening, and night-time periods are presented in **Table 4.1**. Details of the measurement results are shown in **Appendix B4**.

Table 4.1 Summary of Measured SWLs for Fixed Plants

Plant Item ⁽¹⁾	Measured SWL, dB(A)		Maximum allowable SWL, dB(A)		Compliance (Y/N)	
	Day/Evening-time ⁽²⁾	Night-time ⁽²⁾	Day/Evening-time ⁽²⁾	Night-time ⁽²⁾	Day/Evening-time ⁽²⁾	Night-time ⁽²⁾
VS-WTS-01	75	75	90	82	Y	Y
VS-WTS-02	82	82	97	89	Y	Y
VS-WTS-03	91	91	102	92	Y	Y
VS-WTS-6A	76	76	91	83	Y	Y
VS-WTS-6B	71	71	86	78	Y	Y
VS-WTS-08	76	76	90	82	Y	Y
VS-WTS-09	71	71	82	74	Y	Y
VCU 101	79	79	93	85	Y	Y
VCU 102	77	77	91	83	Y	Y
VCU 103	75	75	88	80	Y	Y

Note:

(1) The operation of fixed plant sources at FTA is identical for both daytime and night-time.

(2) Day: 0700 to 1900 hours, Evening: 1900 to 2300 hours, Night: 2300 to 0700 hours

4.2 Noise Measurement to Confirm any Tonal, Impulsive and Intermittent Characteristics from the Fixed Plant Noise Sources at NSRs

4.2.1 Noise measurement to confirm any characteristics of tonality, impulsiveness and intermittency at the representative NSRs were conducted during night-time period. Measurement results are summarised in **Table 4.2** below. No characteristics of tonality, impulsiveness and intermittency was observed at the selected NSRs. Data analysis has been carried out to determine the characteristics of tonality, impulsiveness and intermittency by assessing the logged 1/3 octave band spectra and time history profile. Result of data analysis also indicated no characteristics of tonality, impulsiveness and intermittency is found at the representative NSRs. Detailed noise measurements results are presented in **Appendix C3**.

Table 4.2 Noise Measurement Result at Representative NSRs

Measurement Location ID	Representing NSRs	Time Period ⁽¹⁾	Measurement Result			Site Observation	Characteristics of Tonality, Impulsiveness and Intermittency at NSRs (Y/N)
			Measured Noise Level $L_{Aeq(30mins)}$, dB(A)	Background Noise Level $L_{Aeq(5mins)}$, dB(A)	Difference between Measured Noise Level and Background Level, dB(A)		
FTA-FN1	Chui Yuen House	Night-time	59.1	59.6	-0.5	Noise environment was dominated by traffic noise. Noise from SCL fixed plant was not noticeable at measurement locations.	N
FTA-FN2	Wong Tai Sin Temple	Night-time	55.8	56.1	-0.3		N
FTA-FN3	Rainbow Home & Chuk Yuen United Village	Night-time	56.5	57.1	-0.6		N

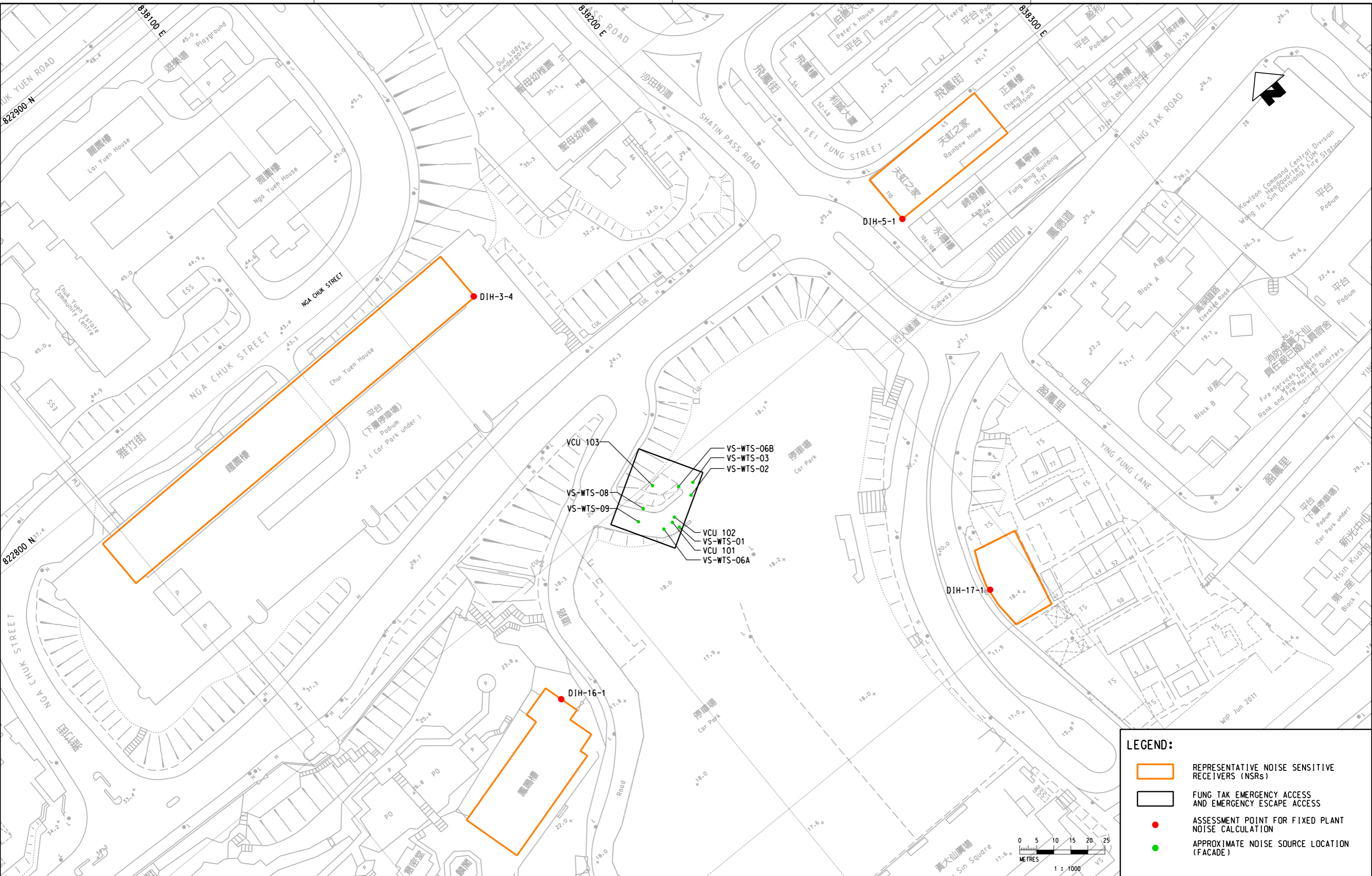
Note:

(1) Day: 0700 to 1900 hours, Evening: 1900 to 2300 hours, Night: 2300 to 0700 hours

5 CONCLUSION

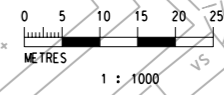
- 5.1.1 The fixed plant noise verification were undertaken and the measurement results indicated all the fixed plant noise levels in FTA comply with the updated maximum allowable SWLs. No characteristics of tonality, impulsiveness and intermittency was also observed at the representative NSRs. Result of data analysis also indicated no characteristics of tonality, impulsiveness and intermittency is found at the representative NSRs.

Figures



LEGEND:

- REPRESENTATIVE NOISE SENSITIVE RECEIVERS (NSRs)
- FUNG TAK EMERGENCY ACCESS AND EMERGENCY ESCAPE ACCESS
- ASSESSMENT POINT FOR FIXED PLANT NOISE CALCULATION
- APPROXIMATE NOISE SOURCE LOCATION (FACADE)



REV	DESCRIPTION	BY	DATE	APPROVED	REV	DESCRIPTION	BY	DATE	APPROVED

DRAWN	ZFX
DESIGNED	LCLL
CHECKED	LCLL
APPROVED	IMW
DATE	20/JUL/2016

MTR

SHATIN TO CENTRAL LINK

AECOM

ORIGINATOR

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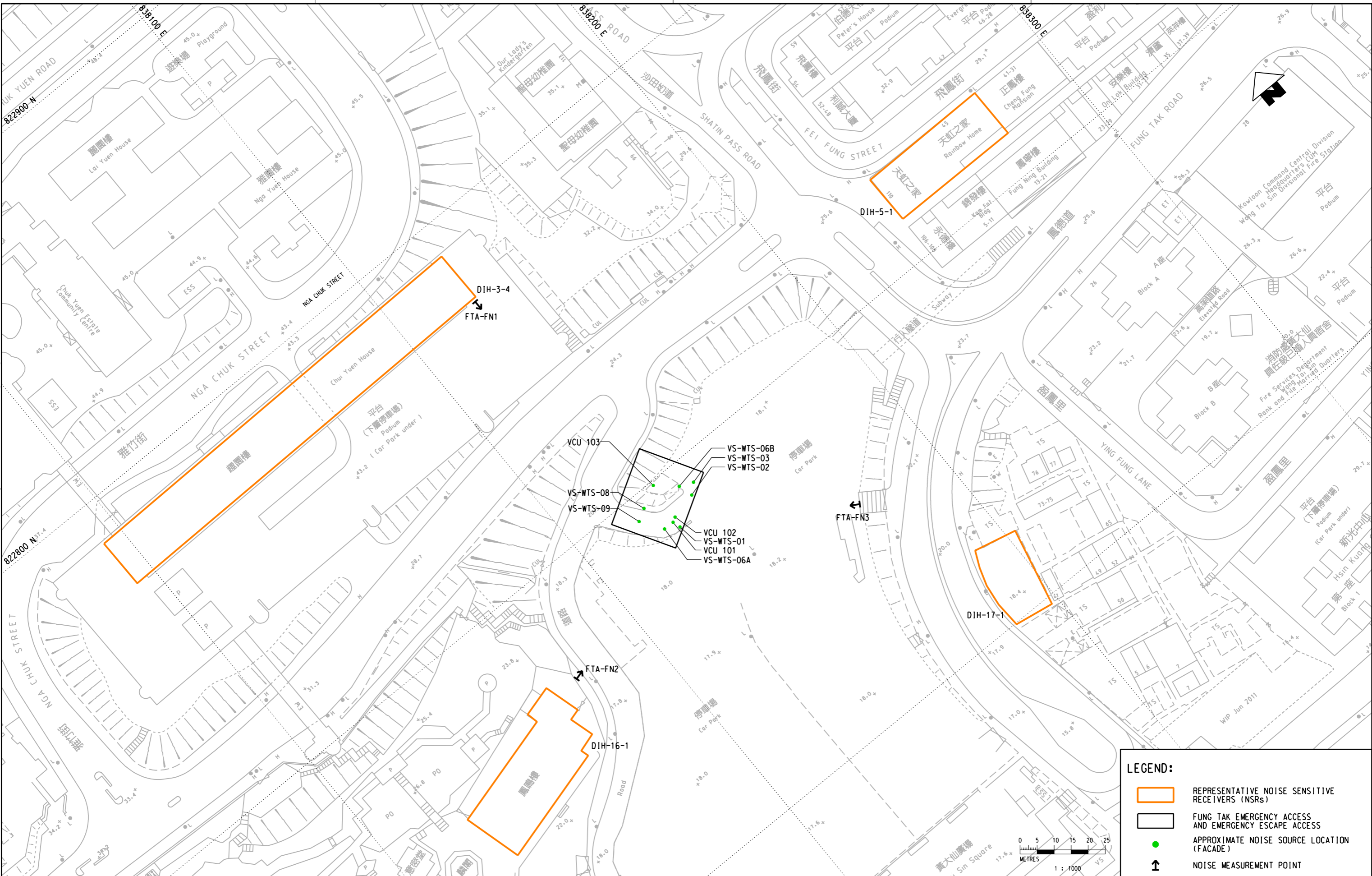
TITLE

C11033
SCL (TAW - HUH)
LOCATIONS OF NSRs AND FIXED NOISE SOURCES
(FUNG TAK EMERGENCY ACCESS AND EMERGENCY ESCAPE ACCESS)

SCALE 1 : 1000 (A3)

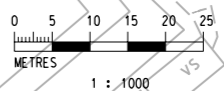
FIGURE NO. C11033/C/SCL/ACM/M52/043

REV. -



LEGEND:

- REPRESENTATIVE NOISE SENSITIVE RECEIVERS (NSRs)
- FUNG TAK EMERGENCY ACCESS AND EMERGENCY ESCAPE ACCESS
- APPROXIMATE NOISE SOURCE LOCATION (FACADE)
- ↑ NOISE MEASUREMENT POINT



REV	DESCRIPTION	BY	DATE	APPROVED	REV	DESCRIPTION	BY	DATE	APPROVED

DRAWN	ZFX
DESIGNED	LCLL
CHECKED	LCLL
APPROVED	IMW
DATE	20/JUL/2016
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SHATIN TO CENTRAL LINK

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ORIGINATOR

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TITLE

C11033
SCL (TAW - HUH)
 LOCATIONS OF NOISE MEASUREMENT POINTS
 (FUNG TAK EMERGENCY ACCESS AND EMERGENCY ESCAPE ACCESS)

SCALE 1 : 1000 (A3) FIGURE NO. C11033/C/SCL/ACM/M52/044 REV. A

Appendix A

**Proposal for Updating Maximum Allowable Sound Power
Levels of Louvers (Batch 2 – Fung Tak Emergency Access
and Emergency Escape Access (FTA))**

MTR Corporation Limited

Shatin to Central Link
Tai Wai to Hung Hom Section

Proposal for Updating Maximum Allowable
Sound Power Levels of Fixed Plant Sources

(Batch 2 – Fung Tak Emergency Access and Emergency
Escape Access (FTA))

(March 2019)

Certified by: Fredrick Leong

Signature: 

Position: Independent Environmental Checker

Date: 13 / 3 / 2019


MTR Corporation Limited

Shatin to Central Link
Tai Wai to Hung Hom Section

Proposal for Updating Maximum Allowable
Sound Power Levels of Fixed Plant Sources

(Batch 2 – Fung Tak Emergency Access and Emergency
Escape Access (FTA))

Certified by: Lisa Poon

Signature: 

Position: Environmental Team Leader




Date: 13 March 2019

MTR Corporation Limited

Consultancy Agreement No. C11033

**Shatin to Central Link - Tai Wai to Hung
Hom Section [SCL(TAW – HUH)] and
Stabling Sidings at Hung Hom Freight
Yard [SCL(HHS)]****Proposal for Updating Maximum Allowable
Sound Power Levels of Fixed Plant Sources
(Batch 2 – Fung Tak Emergency Access and
Emergency Escape Access (FTA))**

March 2019

	Name	Signature
Prepared & Checked:	Isaac Chu	
Reviewed & Approved:	 Josh Lam	

Version: A Date: 4 March 2019

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1 INTRODUCTION

1.1 Background

- 1.1.1 The Shatin to Central Link (SCL) is a 17km extension of the existing Ma On Shan Line (MOL) and East Rail Line (EAL) comprising (i) The East-West Corridor which extends the MOL from Tai Wai to Hung Hom via East Kowloon to connect with the West Rail Line (WRL) at Hung Hom Station (HUH) and Stabling Sidings at Hung Hom Freight Yard (HHS); and (ii) The North-South Corridor which is an extension of the EAL at Hung Hom across the harbour to Admiralty Station (ADM).
- 1.1.2 Environmental Impact Assessment (EIA) Reports for SCL – Tai Wai to Hung Hom Section [SCL (TAW-HUH)] (Register No. AEIAR-167/2012) and SCL Stabling Sidings at Hung Hom Freight Yard [SCL (HHS)] (Register No. AEIAR-164/2012) (hereinafter referred to as “the EIA Reports”) were approved on 17 February 2012 under the Environmental Impact Assessment Ordinance (EIAO). Following the approval of the EIA Reports, the Environmental Permit (EP) (EP No: EP-438/2012), covering the construction of both SCL (TAW-HUH) and SCL (HHS) (hereinafter referred to as “the Project”), was granted on 22 March 2012. Variations of Environmental Permit (VEP) were subsequently applied for EP-438/2012 and the latest Environmental Permit (EP No: EP-438/2012/K) was issued by Director of Environmental Protection (DEP) on 4 October 2016.
- 1.1.3 Pursuant to EP Condition 2.32, at least one month before commencement of operation of the Project, the Permit Holder, MTR Corporation Ltd (MTR), shall carry out fixed plant noise audit and deposit with the Director four hardcopies and one electronic copy of an audit report showing the design of the fixed plant noise sources associated with the Project complies with the maximum sound power levels determined in the approved SCL(TAW-HUH) EIA Report (Register No. AEIAR-167/2012) and SCL(HHS) EIA Report (Register No. AEIAR-164/2012) and all relevant documents in the Register, or otherwise approved by the Director in compliance with the requirements in Technical Memorandum on Environmental Impact Assessment Process (TM-EIAO) having due regard to the characteristics of tonality, impulsiveness and intermittency.
- 1.1.4 AECOM Asia Co. Ltd was commissioned by the MTR to prepare the fixed plant noise audit report to check the compliance of the maximum sound power levels (SWLs) and to undertake noise measurement at the identified Noise Sensitive Receivers (NSRs) for investigation of any characteristics of tonality, impulsiveness and intermittency from the fixed plant noise sources associated with the Project.
- 1.1.5 Based on the latest design information, the maximum allowable SWLs of fixed plant items has been updated to reflect the latest design of the Project, and therefore Proposal(s) will be prepared to present the updated maximum allowable sound power levels (SWLs) of the fixed plant items at different stations of the Project.

1.2 Purpose of This Proposal

- 1.2.1 As discussed in **Section 1.1.5**, the maximum allowable SWLs of fixed plant items has been updated to reflect the latest design of the Project. This Proposal (Batch 2 – Fung Tak Emergency Access and Emergency Escape Access (FTA)) presents the updated maximum allowable SWLs of the fixed plant noise sources at FTA.

2 NOISE CRITERIA AND NOISE SENSITIVE RECEIVERS

2.1 Environmental Legislation, Standard and Guidelines

2.1.1 The Noise Control Ordinance, Cap. 400 (NCO) and Environmental Impact Assessment Ordinance, Cap. 499 (EIAO) provide the statutory framework for noise control. Operational noise from fixed noise sources is controlled by Technical Memorandum for the Assessment of Noise from Places other than Domestic Premises, Public Places or Construction Sites (IND-TM) under NCO. To plan for a better environment, the Technical Memorandum on Environmental Impact Assessment Process (TM-EIAO) under EIAO has specified the following requirements:

- 5 dB below the appropriate ANLs in the IND-TM; or
- the prevailing background noise levels (For quiet areas with level 5dB or more below the ANL).

2.1.2 The Acceptable Noise Levels (ANLs) for different Area Sensitivity Ratings (ASRs) during different periods are summarized in the **Table 2.1**.

Table 2.1 ANLs for Assessment of Noise from Fixed Sources

Time Period	ANL, dB(A)		
	ASR "A"	ASR "B"	ASR "C"
Day (0700 to 1900 hours)	60	65	70
Evening (1900 to 2300 hours)	60	65	70
Night (2300 to 0700 hours)	50	55	60

2.2 Assessment Criteria and Representative Noise Sensitive Receivers

2.2.1 Table 8.8 of the approved SCL (TAW-HUH) EIA Report presents the identified Noise Sensitive Receivers (NSRs) and the adopted noise assessment criteria for fixed plant noise assessment. The assessment criteria at the NSRs selected for assessing the fixed plant noise impact from FTA are summarised in **Table 2.2**.

Table 2.2 Summary of noise criteria at representative NSRs for fixed noise sources (Reference from Table 8.8 of the approved EIA Reports)

Area (NSR No.)	Time Period ⁽¹⁾	Prevailing Background Noise Levels, dB(A) ⁽²⁾	ASR	ANL-5, dB(A) ⁽³⁾	Criteria, dB(A) ⁽⁴⁾
<i>Fung Tak Emergency Access and Emergency Escape Access (FTA)</i>					
Chui Yuen House (DIH-3-4)	Day & evening	58	B	60	58
	Night	55	B	50	50
Rainbow Home (DIH-5-1)	Day & evening	58	B	60	58
	Night	55	B	50	50
Wong Tai Sin Temple (DIH-16-1)	Day & evening	58	B	60	58
	Night	55	B	50	50
Chuk Yuen United Village (DIH-17-1)	Day & evening	58	B	60	58
	Night	55	B	50	50

Notes:

- (1) Day: 0700 to 1900 hours, Evening: 1900 to 2300 hours, Night: 2300 to 0700 hours.
- (2) Prevailing background noise levels are extracted from Table 8.8 of approved EIA Reports.
- (3) A 5 dB(A) has been deducted from ANL as specified in requirement of TM-EIAO.
- (4) The minimum of prevailing background noise level & ANL-5 is adopted.

2.3 Review of Area Sensitivity Rating

- 2.3.1 Area Sensitive Ratings (ASR) as defined in the approved EIA Reports were determined by the existence of any influencing factors (IFs) (e.g. major road, industrial area) according to IND-TM at the time of preparation of the EIA Reports. During the preparation of this Proposal, it is revealed that there was no major change on the land use in the vicinity of representative NSRs, and thus only the existence of any major road (i.e. annual average daily traffic flow in excess of 30,000) has been reviewed.
- 2.3.2 Based on best available information (i.e. The Annual Traffic Census 2017) during the preparation of this Proposal, there is no major road located in the vicinity of the identified NSRs and thus the ASR defined in **Table 2.2** remains unchanged.

3 UPDATE OF FIXED PLANT SOURCES AND PREDICTION OF FIXED PLANT NOISE LEVELS

3.1 Update of Fixed Plant Sources

3.1.1 The locations of updated fixed plant noise sources at FTA are shown in **Figure No. C1103/C/SCL/ACM/M52/043**. Based on latest design information, the maximum allowable SWLs for ventilation louvers and outdoor AC units are updated and summarized in **Table 3.1**.

Table 3.1 Summary of Updated Maximum Allowable SWLs for Fixed Plant Sources

Location	Fixed Plant ID.	Fixed Plant Source	Maximum Allowable SWL, dB(A) ⁽¹⁾	
			Daytime & Evening ⁽²⁾	Night-time ⁽²⁾
FTA	VS-WTS-01	Ventilation Louver	90	82
	VS-WTS-02	Ventilation Louver	97	89
	VS-WTS-03	Ventilation Louver	102	92
	VS-WTS-06A	Ventilation Louver	91	83
	VS-WTS-06B	Ventilation Louver	86	78
	VS-WTS-08	Ventilation Louver	90	82
	VS-WTS-09	Ventilation Louver	82	74
	VCU 101	Outdoor AC Unit	93	85
	VCU 102	Outdoor AC Unit	91	83
	VCU 103	Outdoor AC Unit	88	80

Notes:

- (1) The maximum allowable sound power levels have due regard to the characteristics of tonality, intermittency and impulsiveness.
(2) Day: 0700 to 1900 hours, Evening: 1900 to 2300 hours, Night: 2300 to 0700 hours.

3.2 Prediction of Fixed Plant Noise

3.2.1 With the updated maximum allowable SWLs presented in **Table 3.1**, the predicted noise levels at the representative NSRs comply with both daytime/evening and night-time criteria as presented in **Table 2.2**. The predicted noise levels are summarised in **Table 3.2** with details of calculation shown in **Annex A**.

Table 3.2 Predicted Fixed Plant Noise Levels at Representative NSRs

NSR ID	Description	Criteria, dB(A)		Predicted Sound Pressure Level, Leq,30mins, dB(A) ⁽²⁾	
		Daytime & Evening ⁽¹⁾	Night-time ⁽¹⁾	Daytime & Evening ⁽¹⁾	Night-time ⁽¹⁾
DIH-3-4	Chui Yuen House	58	50	57	48
DIH-5-1	Rainbow Home	58	50	58	49
DIH-16-1	Wong Tai Sin Temple	58	N/A ⁽³⁾	58	N/A ⁽³⁾
DIH-17-1	Chuk Yuen United Village	58	50	58	49

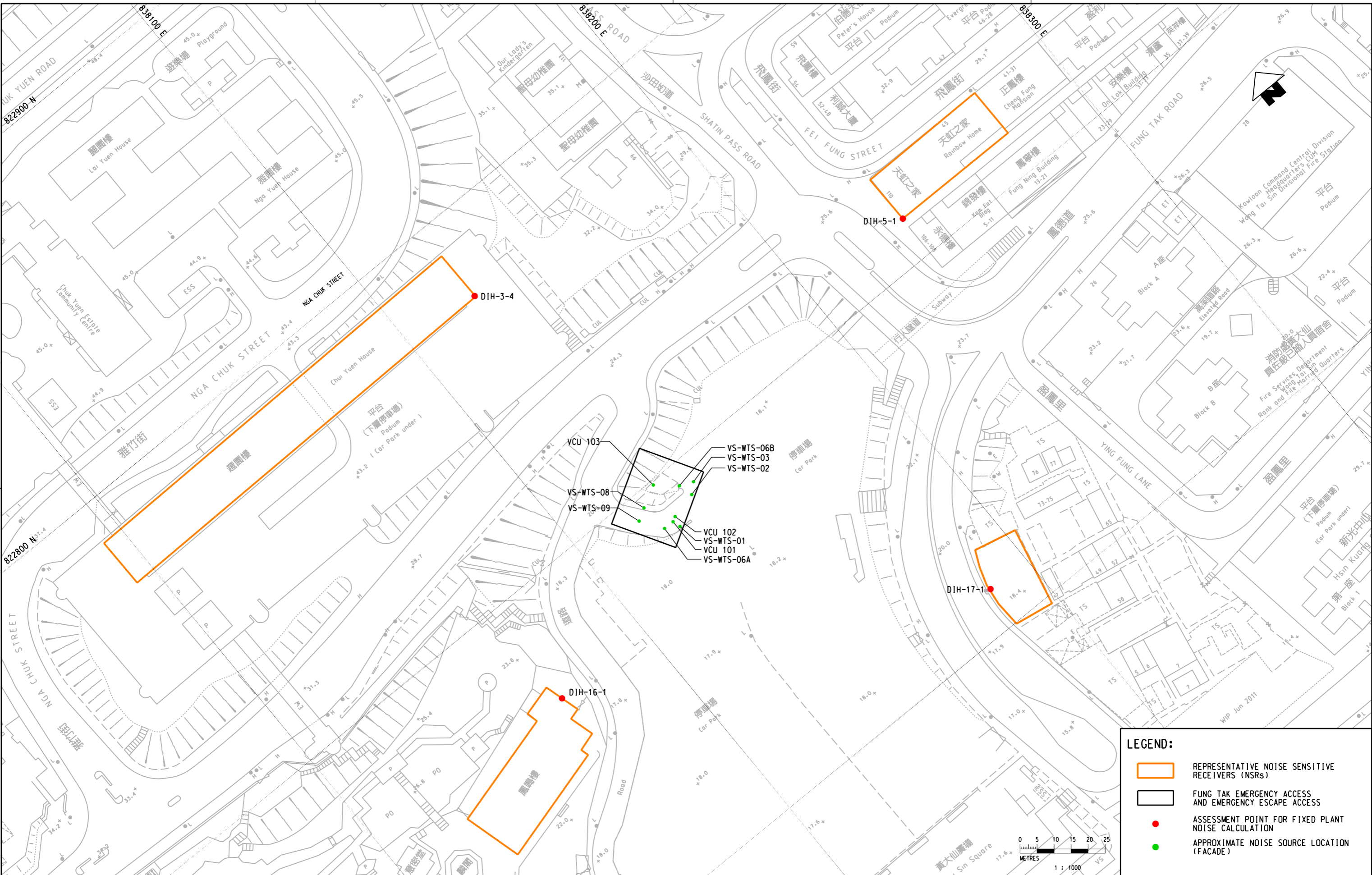
Notes:

- (1) Day: 0700 to 1900 hours, Evening: 1900 to 2300 hours, Night: 2300 to 0700 hours.
(2) The predicted fixed plant noise levels have due regard to the characteristics of tonality, intermittency and impulsiveness.
(3) Representative from Wong Tai Sin Temple (DIH-16-1) have confirmed that the temple is not opened for public worship during night-time period (i.e. 2300 - 0700 hours), and thus there is no sensitive use during night-time period.

4 CONCLUSION

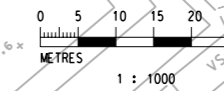
- 4.1.1 The maximum allowable SWLs of fixed plant noise sources at FTA has been updated based on the latest design information. The predicted noise levels at representative NSRs comply with the noise criteria based on the updated maximum allowable SWLs of fixed plant noise sources.
- 4.1.2 The measured SWLs at each louver and outdoor AC unit during the fixed plant noise audit shall comply with the maximum allowable SWLs as stated in the **Table 3.1**. Appropriate corrections in tonal, impulsive or intermittent characteristics should be applied, where applicable, in accordance with the IND-TM during the commissioning test.

Figure



LEGEND:

- REPRESENTATIVE NOISE SENSITIVE RECEIVERS (NSRs)
- FUNG TAK EMERGENCY ACCESS AND EMERGENCY ESCAPE ACCESS
- ASSESSMENT POINT FOR FIXED PLANT NOISE CALCULATION
- APPROXIMATE NOISE SOURCE LOCATION (FACADE)



REV	DESCRIPTION	BY	DATE	APPROVED	REV	DESCRIPTION	BY	DATE	APPROVED

DRAWN	ZFX
DESIGNED	LCLL
CHECKED	LCLL
APPROVED	IMW
DATE	20/JUL/2016

MTR

SHATIN TO CENTRAL LINK

AECOM

CADD REF. C11033_C_SCL_ACM_M52_043.dgn

TITLE
C11033
SCL (TAW - HUH)
LOCATIONS OF NSRs AND FIXED NOISE SOURCES
(FUNG TAK EMERGENCY ACCESS AND EMERGENCY ESCAPE ACCESS)

SCALE 1 : 1000 (A3) FIGURE NO. C11033/C/SCL/ACM/M52/043 REV. -

Annex A

Detail Calculation of Fixed Plant Noise Assessment

Annex A Detail Calculation of Fixed Plant Noise Assessment

Fixed Plant Noise Calculation - FTA NSRs (Day-time Period)

Noise Assessment Points	Description	Plant item	Direction Facing	Horizontal Distance , m	SWL, dB(A)	Correction for line of sight ^[1] , dB(A)	Distance Correction of Point Source ^[2] , dB(A)	Façade Correction, dB(A)	Predicted SPL, dB(A)	Total SPL, dB(A)	Daytime Noise Criteria, dB(A)
FTA Ventilation Shaft											
DIH 3-4											
DIH 3-4	Chui Yuen House	VS WTS-01	South	91	90	-10	-47	3	36	57	58
		VS WTS-02	South	86	97	-10	-47	3	43		
		VS WTS-03	East	84	102	-5	-47	3	53		
		VS WTS-06A	South	88	91	-10	-47	3	37		
		VS WTS-06B	South	82	86	-10	-46	3	33		
		VS WTS-08	North	80	90	0	-46	3	47		
		VS WTS-09	North	82	82	0	-46	3	39		
		VCU 101	-	88	93	0	-47	3	49		
		VCU 102	-	88	91	0	-47	3	47		
		VCU 103	-	76	88	0	-46	3	45		
DIH 5-1											
DIH 5-1	Rainbow Home	VS WTS-01	South	111	90	-5	-49	3	39	58	58
		VS WTS-02	South	102	97	-5	-48	3	47		
		VS WTS-03	East	98	102	0	-48	3	57		
		VS WTS-06A	South	114	91	-5	-49	3	40		
		VS WTS-06B	South	102	86	-5	-48	3	36		
		VS WTS-08	North	114	90	-5	-49	3	39		
		VS WTS-09	North	117	82	-5	-49	3	31		
		VCU 101	-	111	93	0	-49	3	47		
		VCU 102	-	110	91	0	-49	3	45		
		VCU 103	-	107	88	0	-49	3	42		
DIH 17-1											
DIH 17-1	Chuk Yuen United Village	VS WTS-01	South	93	90	0	-47	3	46	58	58
		VS WTS-02	South	92	97	0	-47	3	53		
		VS WTS-03	East	93	102	-5	-47	3	53		
		VS WTS-06A	South	97	91	0	-48	3	46		
		VS WTS-06B	South	96	86	0	-48	3	41		
		VS WTS-08	North	105	90	-10	-48	3	35		
		VS WTS-09	North	105	82	-10	-48	3	27		
		VCU 101	-	95	93	0	-48	3	48		
		VCU 102	-	95	91	0	-48	3	46		
		VCU 103	-	104	88	0	-48	3	43		
DIH 16-1											
DIH 16-1	Wong Tai Sin Temple - Fung Ming House	VS WTS-01	South	61	90	-5	-44	3	44	58	58
		VS WTS-02	South	71	97	-5	-45	3	50		
		VS WTS-03	East	74	102	-10	-45	3	50		
		VS WTS-06A	South	58	91	-5	-43	3	46		
		VS WTS-06B	South	71	86	-5	-45	3	39		
		VS WTS-08	North	61	90	-5	-44	3	44		
		VS WTS-09	North	57	82	-5	-43	3	37		
		VCU 101	-	61	93	0	-44	3	52		
		VCU 102	-	63	91	0	-44	3	50		
		VCU 103	-	68	88	0	-45	3	46		

Remark:

[1] A negative correction of 10 dB(A) has been adopted to the direction facing of the ventilation shaft totally screened by buildings and negative correction of 5 dB(A) for NSR do not have direct line of sight to the ventilation shaft.

Annex A Detail Calculation of Fixed Plant Noise Assessment

Fixed Plant Noise Calculation - FTA NSRs (Night-time Period)

Noise Assessment Points	Description	Plant item	Direction Facing	Horizontal Distance, m	SWL, dB(A)	Correction for line of sight ^[1] , dB(A)	Distance Correction of Point Source ^[2] , dB(A)	Façade Correction, dB(A)	Predicted SPL, dB(A)	Total SPL, dB(A)	Night-time Noise Criteria, dB(A)
FTA Ventilation Shaft											
DIH 3-4											
DIH 3-4	Chui Yuen House	VS WTS-01	South	91	82	-10	-47	3	28	48	50
		VS WTS-02	South	86	89	-10	-47	3	35		
		VS WTS-03	East	84	92	-5	-47	3	43		
		VS WTS-06A	South	88	83	-10	-47	3	29		
		VS WTS-06B	South	82	78	-10	-46	3	25		
		VS WTS-08	North	80	82	0	-46	3	39		
		VS WTS-09	North	82	74	0	-46	3	31		
		VCU 101	-	88	85	0	-47	3	41		
		VCU 102	-	88	83	0	-47	3	39		
		VCU 103	-	76	80	0	-46	3	37		
DIH 5-1											
DIH 5-1	Rainbow Home	VS WTS-01	South	111	82	-5	-49	3	31	49	50
		VS WTS-02	South	102	89	-5	-48	3	39		
		VS WTS-03	East	98	92	0	-48	3	47		
		VS WTS-06A	South	114	83	-5	-49	3	32		
		VS WTS-06B	South	102	78	-5	-48	3	28		
		VS WTS-08	North	114	82	-5	-49	3	31		
		VS WTS-09	North	117	74	-5	-49	3	23		
		VCU 101	-	111	85	0	-49	3	39		
		VCU 102	-	110	83	0	-49	3	37		
		VCU 103	-	107	80	0	-49	3	34		
DIH 17-1											
DIH 17-1	Chuk Yuen United Village	VS WTS-01	South	93	82	0	-47	3	38	49	50
		VS WTS-02	South	92	89	0	-47	3	45		
		VS WTS-03	East	93	92	-5	-47	3	43		
		VS WTS-06A	South	97	83	0	-48	3	38		
		VS WTS-06B	South	96	78	0	-48	3	33		
		VS WTS-08	North	105	82	-10	-48	3	27		
		VS WTS-09	North	105	74	-10	-48	3	19		
		VCU 101	-	95	85	0	-48	3	40		
		VCU 102	-	95	83	0	-48	3	38		
		VCU 103	-	104	80	0	-48	3	35		
DIH 16-1											
DIH 16-1	Wong Tai Sin Temple - Fung Ming House	VS WTS-01	South	61	82	-5	-44	3	36	N/A	N/A
		VS WTS-02	South	71	89	-5	-45	3	42		
		VS WTS-03	East	74	92	-10	-45	3	40		
		VS WTS-06A	South	58	83	-5	-43	3	38		
		VS WTS-06B	South	71	78	-5	-45	3	31		
		VS WTS-08	North	61	82	-5	-44	3	36		
		VS WTS-09	North	57	74	-5	-43	3	29		
		VCU 101	-	61	85	0	-44	3	44		
		VCU 102	-	63	83	0	-44	3	42		
		VCU 103	-	68	80	0	-45	3	38		

Remark:

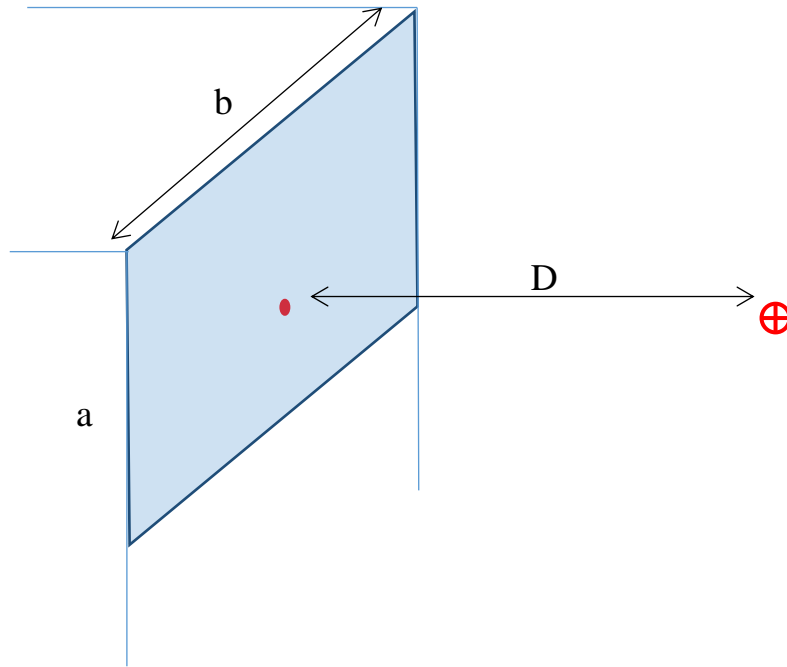
[1] A negative correction of 10 dB(A) has been adopted to the direction facing of the ventilation shaft totally screened by buildings and negative correction of 5 dB(A) for NSR do not have direct line of sight to the ventilation shaft.

Appendix B

**Noise Measurement to obtain the
SWLs of Fixed Plant Noise Sources**

Appendix B1
Measurement Methodology

Method 1: Far-Field Testing Method for Louver



a: Short side of the louver

b: Long side of the louver

D: Measurement distance (separation between louver and microphone), where D must be greater than (2b) and rounded up to interger.

■ Louver opening

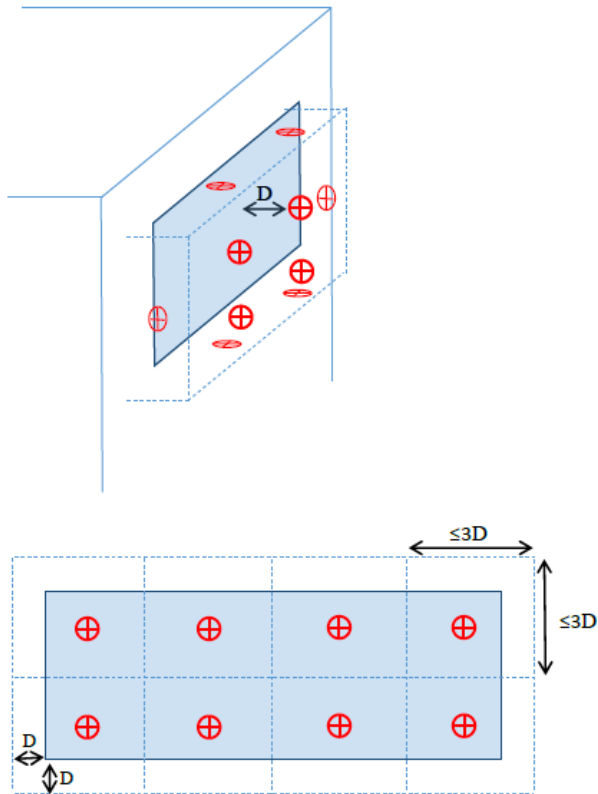
⊕ Proposed measurement point (microphone pointing perpendicular to the center of the louvre)

For method 1,

- “D” must be greater than 2b and round up to integer.
- The microphone must point to the center of the louver.
- At least 3 sets of $L_{Aeq, 1 \text{ min}}$ should be obtained.
- Background noise measurement should be obtained for determination of background correction factor.
- Any reason causing this method cannot be performed, noise measurement should then be conducted at near field in accordance with Method 2.
- If results of measurement reveal that difference in noise levels measured at far field with and without operation of fixed plant item is less than 3.0dB(A), noise measurement should then be conducted at near field in accordance with Method 2.
- Noise measurement to confirm any tonal, impulsive and intermittent characteristics at representative NSRs.

$$SWL = \text{Mean measured } L_{Aeq, 1 \text{ min}} + 20\log(D) + 8 + \text{background noise correction factor}$$

Method 2: Near-Field Testing Method for Louvre



D: Measurement distance

- Louver opening
- Measurement box
- + Proposed measurement point (microphone pointing perpendicular to the louvre)

For method 2 (developed based on the principle of ISO3746:2010),

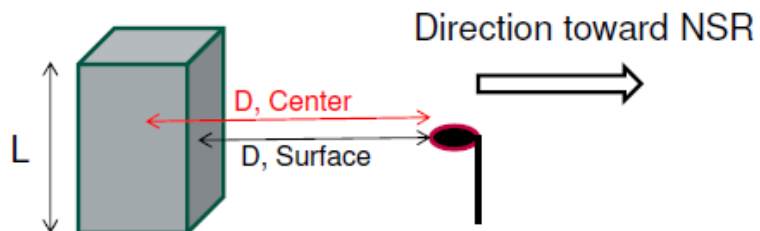
- First step is to determine a hypothetical measurement surfaces with at least 1m separation (D , measured from the centre of the louvre or its nearest edges as appropriate) from the louvre.
- For louvre with largest dimension $\leq 3D$, at least one measurement at the centre of the measurement surface parallel to the louvre should be conducted.
- Minimum 10 seconds of measurement interval should be obtained at each measurement point.
- Extra localized microphone positions on the measurement surfaces in the region of high radiation should be considered. In this case follow the procedures of ISO3744.
- For louvre with largest dimension $> 3D$, measurement surface and measurement position should follow ISO3746.
- Background noise level should be taken at each measurement point for determining the background correction ($K1A$).
- If the difference between the background noise and the measured noise level is less than 3.0dB, $K1A$ should be capped to 3.0dB.
- If necessary to obtain less conservative results, D should be reduced according to ISO3746 to obtain higher measured noise levels.
- Noise measurement to confirm any tonal, impulsive and intermittent characteristics at representative NSRs.

$$SWL = \text{Mean LAeq over all measurement points} + 10 \log (\text{total surface area over the measurement box}) + K1A + K2A$$

$K1A$ refers to background noise correction factor

$K2A$ refers to environmental correction for sound absorption and reflection

Method 3 – Far Field Testing Method for Plant Item



“L” is the longest side of the plant item

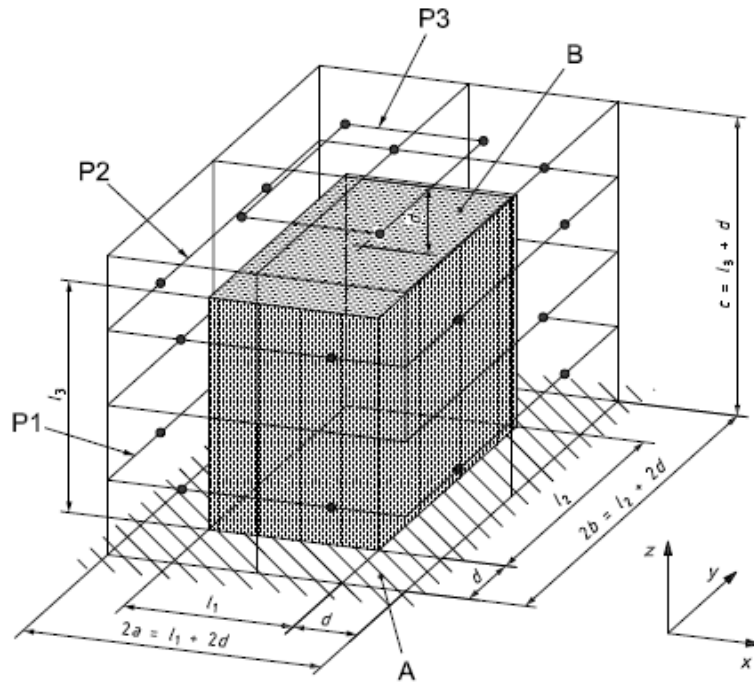
“D, Center” is the separation between center of the plant item and microphone

“D, Surface” is the separation between surface of the plant item and microphone

- “D, Surface” must be greater than twice of L (2L) and roundup to integer (e.g 6m ,7m, 8m...).
- The microphone must be pointing to the center of the plant.
- Measurement should be carried out at the direction toward all NSRs.
- At least 3 sets of $L_{Aeq, 1 \text{ min}}$ should be obtained at each the measurement point.
- Background noise measurement should be obtained for determination of background correction factor.
- Any reason causing this method cannot be performed, noise measurement should then be conducted at near field in accordance with latest edition of ISO3746 (Method 4).
- If results of measurement reveal that difference in noise levels measured at far field with and without operation of fixed plant item is less than 3.0 dB(A), noise measurement should then be conducted at near field in accordance with latest edition of ISO3746 (Method 4).
- Noise measurement to confirm any tonal, impulsive and intermittent characteristics at representative NSRs.

$$SWL = \text{Mean measured } L_{Aeq, 1 \text{ min}} + 20 \log (D, \text{Center}) + 8 + \text{background noise correction factor}$$

Method 4 – Near Field Testing Method for Plant Item



For Method 4 (based on ISO3746:2010),

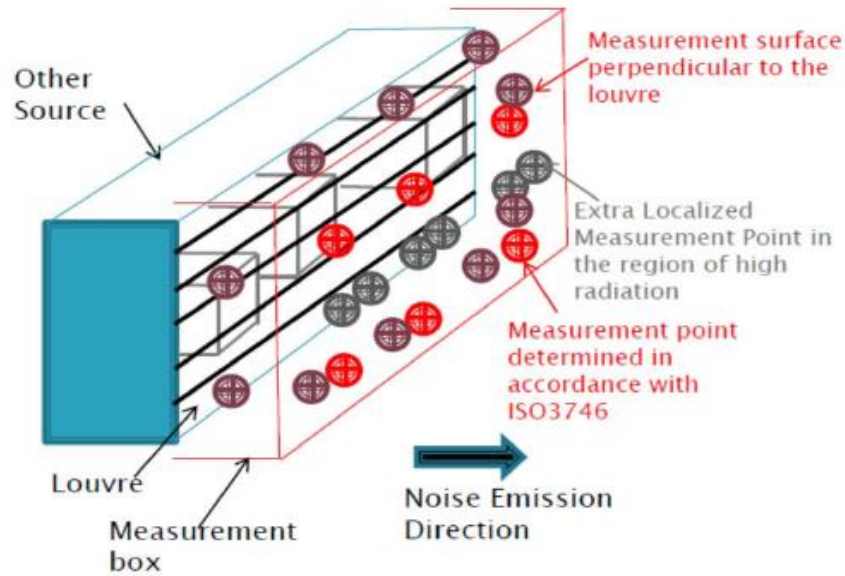
- Please refer to latest edition of ISO3746 for measurement requirement.
- The locations of measurement points are depended on the size of the plant, which cannot be easily generalized (see figure for example)
- Background noise measurement should be obtained for determination of background correction factor (K1A). According to ISO3746, if the source under test radiates noise predominantly in one direction or if the noise from a large source is emitted only from a small portion of the source, the usage of extra localized microphone positions on the measurement surface in the region of high radiation should be considered. In this case, follow the procedures specified in ISO3744.
- Minimum 10 seconds of measurement interval should be obtained at each measurement point.
- Detail calculation of the SWL should refer to the latest edition of ISO3746.
- Noise measurement to confirm any tonal, impulsive and intermittent characteristics at representative NSRs.

$$SWL = \text{Mean } L_{Aeq} \text{ over all measurement points} + 10 \log (\text{total surface area over the measurement box}) + K1A + K2A$$

K1A refers to background noise correction factor

K2A refers to environmental correction for sound absorption and reflection

Method 5 – Near Field Testing Method for Plant Room or other source



For Method 5 (developed based on the principle of ISO3746 -2010),

- First step is to determine a measurement box with at least 1m separation (measured from the centre of the louvre or its nearest edges as appropriate) from the louvre.
- Secondly, is to determine the location of measurement points on the measurement surface of the hypothetical box.
- Extra localized microphone positions on the measurement surface in the region of high radiation should be considered. In this case follow the procedures of ISO 3744.
- Background noise level should be taken for determination of background correction (K1A).
- Minimum 10 seconds of measurement interval should be obtained at each measurement point.
- If the difference between the BGL and the measured noise level (MNL) is less than 3.0dB, K1A should be capped to 3.0dB.
- If necessary to obtain less conservative results. D should be reduced according to ISO3746 to obtain higher MNLs.
- Noise measurement to confirm any tonal, impulsive and intermittent characteristics at representative NSRs.

$$SWL = \text{Mean } L_{Aeq} \text{ over all measurement points} + 10 \log (\text{total surface area over the measurement box}) + K1A + K2A$$

K1A refers to background noise correction factor

K2A refers to environmental correction for sound absorption and reflection

Appendix B2

**Calibration Certificates –
Noise Measurement for Fixed Plant Noise**

Appendix B2 Calibration Certificates – Noise Measurement for Fixed Plant Noise



Hong Kong Calibration Ltd.
香港校正有限公司

Calibration Certificate

Certificate No. **806605**

Page 1 of 3 Pages

Customer : Gammon Construction Limited

Address : 28/F, Devon House, Taikoo Place, 979 King's Road, Quarry Bay, Hong Kong.

Order No. : Q82354

Date of receipt : 29-Jun-18

Item Tested

Description : Sound Level Meter

Manufacturer : Rion

I.D. : --

Model : NL-52

Serial No. : 00564841

Test Conditions

Date of Test : 11-Jul-18

Supply Voltage : --

Ambient Temperature : (23 ± 3)°C

Relative Humidity : (50 ± 25) %

Test Specifications

Calibration check.

Ref. Document/Procedure: Z01, IEC 61672.

Test Results

All results were within the IEC 61672 Type 1 specification. (where applicable)

The results are shown in the attached page(s).

Main Test equipment used:

<u>Equipment No.</u>	<u>Description</u>	<u>Cert. No.</u>	<u>Traceable to</u>
S017	Multi-Function Generator	C170120	SCL-HKSAR
S240	Sound Level Calibrator	803357	NIM-PRC & SCL-HKSAR

The values given in this Calibration Certificate only relate to the values measured at the time of the test and any uncertainties quoted will not include allowance for the equipment long term drift, variations with environmental changes, vibration and shock during transportation, overloading, mis-handling, or the capability of any other laboratory to repeat the measurement. Hong Kong Calibration Ltd. shall not be liable for any loss or damage resulting from the use of the equipment.

The test equipment used for calibration are traceable to International System of Units (SI), or by reference to a natural constant.
The test results apply to the above Unit-Under-Test only

Calibrated by : 
Elva Chong

Approved by : 
Kin Wong

Date: 11-Jul-18

This Certificate is issued by:
Hong Kong Calibration Ltd.
Unit 8B, 24/F., Well Fung Industrial Centre, No. 58-75, Ta Chuen Ping Street, Kwai Chung, NT, Hong Kong.
Tel: 2425 8801 Fax: 2425 8846

The copyright of this certificate is owned by Hong Kong Calibration Ltd. It may not be reproduced except in full.

E



Calibration Certificate

Certificate No. 806605

Page 2 of 3 Pages

Results :

1. Self-generated noise: 17.3 dBA

2. Acoustical signal test

UUT Setting				Applied Value (dB)	UUT Reading (dB)	
Range (dB)	Frequency Weighting	Time Weighting	Octave Filter			
20 ~ 130	A	F	OFF	94.0	94.0	
		S	OFF		94.0	
	C	F	OFF	94.1		
	Z	F	OFF	94.1		
	A	F	OFF	114.0	114.1	
			S		OFF	114.1
		C	F		OFF	114.1
		Z	F		OFF	114.1

IEC 61672 Type 1 Spec. : ± 1.1 dB

Uncertainty : ± 0.1 dB

3 Electrical signal tests of frequency weightings (A weighting)

Frequency	Attenuation (dB)	IEC 61672 Type 1 Spec.
31.5 Hz	-39.8	- 39.4 dB, ± 2 dB
63 Hz	-26.4	- 26.2 dB, ± 1.5 dB
125 Hz	-16.2	- 16.1 dB, ± 1.5 dB
250 Hz	-8.7	- 8.6 dB, ± 1 dB
500 Hz	-3.3	- 3.2 dB, ± 1.4 dB
1 kHz	0.0 (Ref)	0 dB, ± 1.1 dB
2 kHz	+1.2	+ 1.2 dB, ± 1.6 dB
4 kHz	+0.9	+ 1.0 dB, ± 1.6 dB
8 kHz	-1.1	- 1.1 dB, +2.1 dB ~ -3.1 dB
16 kHz	-8.1	- 6.6 dB, + 3.5 dB ~ - 17.0 dB

Uncertainty : ± 0.1 dB



Calibration Certificate

Certificate No. **806605**

Page 3 of 3 Pages

4. Frequency & Time weightings at 1 kHz

4.1 Frequency Weighting (Fast)

UUT Setting	Applied Value (dB)	UUT Reading (dB)	Difference (dB)	IEC 61672 Type 1 Spec.
A	94.0	94.0 (Ref.)	--	± 0.4 dB
C	94.0	94.0	0.0	
Z	94.0	94.0	0.0	

4.2 Time Weighting (A-weighted)

UUT Setting	Applied Value (dB)	UUT Reading (dB)	Difference (dB)	IEC 61672 Type 1 Spec.
Fast	94.0	94.0 (Ref.)	--	± 0.3 dB
Slow	94.0	94.0	0.0	
Time-averaging	94.0	94.0	0.0	

Uncertainty : ± 0.1 dB

- Remarks :
1. UUT : Unit-Under-Test
 2. The uncertainty claimed is for a confidence probability of not less than 95%.
 3. Atmospheric Pressure : 1 000 hPa.
 4. Preamplifier model : NH-25 , S/N : 64967
 5. Firmware Version: 1.8
 6. Power Supply Check: OK
 7. The UUT was adjusted with the laboratory's sound calibrator at the reference sound pressure level before the calibration.

----- END -----



Calibration Certificate

Certificate No. **803296**

Page 1 of 2 Pages

Customer : Beexergy Consulting Limited

Address : Unit 2001-05, Apec Plaza, 49 Hoi Yuen Road, Kwun Tong, Kowloon, Hong Kong

Order No. : Q81278

Date of receipt : 5-Apr-18

Item Tested

Description : Acoustic Calibrator

Manufacturer : Svantek

I.D. : 217598

Model : SV35A

Serial No. : 58708

Test Conditions

Date of Test : 16-Apr-18

Supply Voltage : --

Ambient Temperature : (23 ± 3)°C

Relative Humidity : (50 ± 25) %

Test Specifications

Calibration check.

Ref. Document/Procedure: F21, Z02.

Test Results

All results were within the IEC 60942 Class 1 specifications.


The results are shown in the attached page(s).


Test equipment used:

<u>Equipment No.</u>	<u>Description</u>	<u>Cert. No.</u>	<u>Traceable to</u>
S014	Spectrum Analyzer	707126	NIM-PRC & SCL-HKSAR
S240	Sound Level Calibrator	703741	NIM-PRC & SCL-HKSAR
S041	Universal Counter	802061	SCL-HKSAR

The values given in this Calibration Certificate only relate to the values measured at the time of the test and any uncertainties quoted will not include allowance for the equipment long term drift, variations with environmental changes, vibration and shock during transportation, overloading, mis-handling, or the capability of any other laboratory to repeat the measurement. Hong Kong Calibration Ltd. shall not be liable for any loss or damage resulting from the use of the equipment.

The test equipment used for calibration are traceable to International System of Units (SI), or by reference to a natural constant. The test results apply to the above Unit-Under-Test only

Calibrated by : 
Elva Chong

Approved by : 
Kin Wong

This Certificate is issued by:

Hong Kong Calibration Ltd.

Unit 8B, 24/F., Well Fung Industrial Centre, No. 58-76, Ta Chuen Ping Street, Kwai Chung, NT, Hong Kong.

Tel: 2425 8801 Fax: 2425 8646

Date: 16-Apr-18



Calibration Certificate

Certificate No. 803296

Page 2 of 2 Pages

Results :

1. Generated Sound Pressure Level

UUT Nominal Value (dB)	Measured Value (dB)	IEC 60942 Class 1 Spec.
94.0	94.2	± 0.4 dB
114.0	114.1	

Uncertainty : ± 0.2 dB

2. Short-term Level Fluctuation : 0.0 dB

IEC 60942 Class 1 Spec. : ± 0.1 dB

Uncertainty : ± 0.01 dB

3. Frequency

UUT Nominal Value (kHz)	Measured Value (kHz)	IEC 60942 Class 1 Spec.
1	1.000	± 1 %

Uncertainty : ± 3.6 x 10⁻⁶

4. Total Distortion : < 0.4 %

IEC 60942 Class 1 Spec. : < 4 %

Uncertainty : ± 2.3 % of reading

Remark : 1. UUT : Unit-Under-Test

2. The uncertainty claimed is for a confidence probability of not less than 95%.

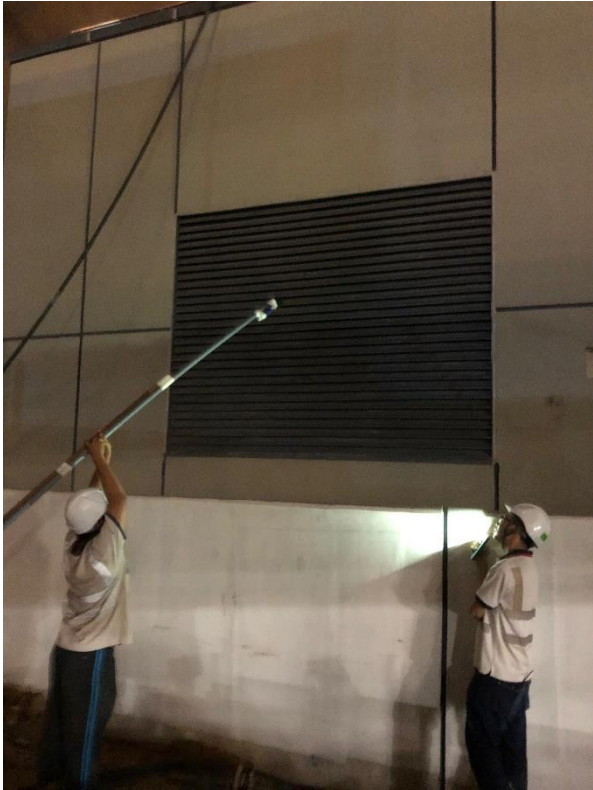
3. Atmospheric Pressure : 1 019 hPa.

----- END -----

Appendix B3

**Photographs showing the Examples of Noise Measurement
for Fixed Plant Noise**

Appendix B3 Photographs showing the Examples of Noise Measurement for Fixed Plant Noise



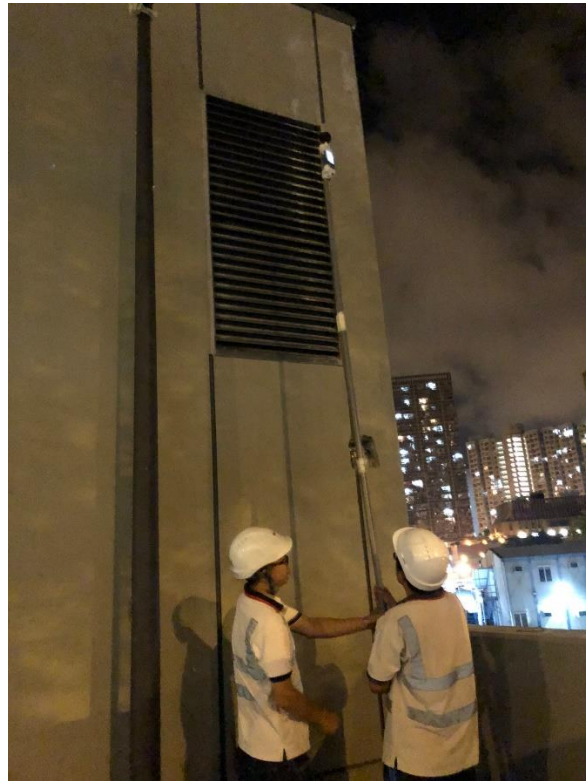
SWL Measurement Location for VS-WTS-01



SWL Measurement Location for VS-WTS-02



SWL Measurement Location for VS-WTS-03



SWL Measurement Location for VS-WTS-09

Appendix B4

Noise Measurement Results

Appendix B4 Noise Measurement Results

Fixed Plant Source ID	Plant Type	Method	Size of Louvre/Outdoor AC unit (mm)			Measurement Distance (m) D ^(a)	Averaged Measured L _{Aeq} , dB(A) ^(b)	Background L _{Aeq} , dB(A)	Difference L _{Aeq} , dB(A)	Background Corrected L _{Aeq} , dB(A) ^(c)	Calculated SWL, dB(A)
			Length	Width	Height						
VS WTS-01	Louvre	2	2200	2600	N/A	1.0	60.2	54.3	5.9	58.9	75
VS WTS-02	Louvre	2	2200	2600	N/A	1.0	66.4	57.4	9.0	65.8	82
VS WTS-03	Louvre	2	2800	2300	N/A	1.0	78.2	56.5	21.7	78.2	91
VS WTS-06A	Louvre	2	1200	2200	N/A	1.0	62.9	57.1	5.8	61.6	76
VS WTS-06B	Louvre	2	2250	1000	N/A	1.0	59.7	56.7	3.0	56.7	71
VS WTS-08	Louvre	2	2000	1000	N/A	1.0	62.9	57.0	5.9	61.6	76
VS WTS-09	Louvre	2	2000	1000	N/A	1.0	59.9	56.7	3.2	57.1	71
VCU 101	Outdoor AC Unit	4	760	920	1650	1.0	64.5	57.3	7.2	63.6	79
VCU 102	Outdoor AC Unit	4	760	1220	1650	1.0	62.5	57.5	5.0	60.8	77
VCU 103	Outdoor AC Unit	4	770	920	1650	1.0	62.0	58.3	3.7	59.6	75

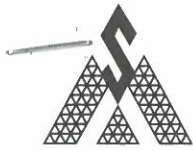
Remarks:

- a) Measurement Distance between louvre and microphone.
- b) Results are averaged from number of points in accordance with ISO3746.
- c) If the difference between the background and the measured noise level is less than 3.0 dB, background noise correction factor should be capped to 3.0dB.

Appendix C

**Noise Measurement to Confirm any Tonal, Impulsive and
Intermittent Characteristics from the Fixed Plant Noise
Sources at Representative NSRs**

Appendix C1
Calibration Certificates –
Noise Measurement at Representative NSRs



CERTIFICATE OF CALIBRATION

Certificate No.: 18CA1019 01-01 Page 1 of 2

Item tested

Description:	Sound Level Meter (Type 1)	Microphone	Preamp
Manufacturer:	B & K	B & K	B & K
Type/Model No.:	2250	4950	ZC0032
Serial/Equipment No.:	3001291	2665582	17190
Adaptors used:	-	-	-

Item submitted by

Customer Name: AECOM ASIA CO LIMITED
Address of Customer: -
Request No.: -
Date of receipt: 19-Oct-2018

Date of test: 19-Oct-2018

Reference equipment used in the calibration

Description:	Model:	Serial No.	Expiry Date:	Traceable to:
Multi function sound calibrator	B&K 4226	2288444	23-Aug-2019	CIGISMEC
Signal generator	DS 360	33873	24-Apr-2019	CEPREI
Signal generator	DS 360	61227	23-Apr-2019	CEPREI

Ambient conditions

Temperature: 20 ± 1 °C
Relative humidity: 50 ± 10 %
Air pressure: 1005 ± 5 hPa

Test specifications

- The Sound Level Meter has been calibrated in accordance with the requirements as specified in BS 7580: Part 1: 1997 and the lab calibration procedure SMTP004-CA-152.
- The electrical tests were performed using an electrical signal substituted for the microphone which was removed and replaced by an equivalent capacitance within a tolerance of $\pm 20\%$.
- The acoustic calibration was performed using an B&K 4226 sound calibrator and corrections was applied for the difference between the free-field and pressure responses of the Sound Level Meter.

Test results

This is to certify that the Sound Level Meter conforms to BS 7580: Part 1: 1997 for the conditions under which the test was performed.

Details of the performed measurements are presented on page 2 of this certificate.

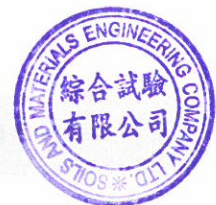
Actual Measurement data are documented on worksheets.

Approved Signatory:


Feng Junqi

Date: 20-Oct-2018

Company Chop:



Comments: The results reported in this certificate refer to the condition of the instrument on the date of calibration and carry no implication regarding the long-term stability of the instrument.



CERTIFICATE OF CALIBRATION

(Continuation Page)

Certificate No.: 18CA1019 01-01 Page 2 of 2

1, Electrical Tests

The electrical tests were performed using an equivalent capacitance substituted for the microphone. The results are given in below with test status and the estimated uncertainties. The "Pass" means the result of the test is inside the tolerances stated in the test specifications. The "-" means the result of test is outside these tolerances.

Test:	Subtest:	Status:	Expanded Uncertainty (dB)	Coverage Factor
Self-generated noise	A	Pass	0.3	
	C	Pass	0.8	
	Lin	Pass	1.6	
Linearity range for Leq	At reference range, Step 5 dB at 4 kHz	Pass	0.3	
	Reference SPL on all other ranges	Pass	0.3	
	2 dB below upper limit of each range	Pass	0.3	
	2 dB above lower limit of each range	Pass	0.3	
Linearity range for SPL	At reference range, Step 5 dB at 4 kHz	Pass	0.3	
	Frequency weightings			
Frequency weightings	A	Pass	0.3	
	C	Pass	0.3	
	Lin	Pass	0.3	
Time weightings	Single Burst Fast	Pass	0.3	
	Single Burst Slow	Pass	0.3	
Peak response	Single 100µs rectangular pulse	Pass	0.3	
	R.M.S. accuracy	Crest factor of 3	Pass	0.3
Time weighting I	Single burst 5 ms at 2000 Hz	Pass	0.3	
	Repeated at frequency of 100 Hz	Pass	0.3	
Time averaging	1 ms burst duty factor 1/10 ³ at 4kHz	Pass	0.3	
	1 ms burst duty factor 1/10 ⁴ at 4kHz	Pass	0.3	
Pulse range	Single burst 10 ms at 4 kHz	Pass	0.4	
Sound exposure level	Single burst 10 ms at 4 kHz	Pass	0.4	
Overload indication	SPL	Pass	0.3	
	Leq	Pass	0.4	

2, Acoustic tests

The complete sound level meter was calibrated on the reference range using a B&K 4226 acoustic calibrator with 1000Hz and SPL 94 dB. The sensitivity of the sound level meter was adjusted. The test result at 125 Hz and 8000 Hz are given in below with test status and the estimated uncertainties.

Test:	Subtest	Status	Expanded Uncertainty (dB)	Coverage Factor
Acoustic response	Weighting A at 125 Hz	Pass	0.3	
	Weighting A at 8000 Hz	Pass	0.5	

3, Response to associated sound calibrator

N/A

The expanded uncertainties have been calculated in accordance with the ISO Publication "Guide to the expression of uncertainty in measurement", and gives an interval estimated to have a level of confidence of 95%. A coverage factor of 2 is assumed unless explicitly stated.

- End -

Calibrated by:

Fung Chi Yip

Date:

19-Oct-2018

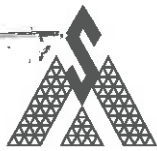
Checked by:

shek Kwong Tat

Date:

20-Oct-2018

The standard(s) and equipment used in the calibration are traceable to national or international recognised standards and are calibrated on a schedule to maintain the required accuracy level.



CERTIFICATE OF CALIBRATION

Certificate No.: 18CA0321 01-02 Page 1 of 2

Item tested

Description:	Sound Level Meter (Type 1)	Microphone	Preamp
Manufacturer:	B & K	B & K	B & K
Type/Model No.:	2250-L	4950	ZC0032
Serial/Equipment No.:	2681366	2665582	17190
Adaptors used:	(N 011 01)		

Item submitted by

Customer Name: AECOM ASIA CO LTD
 Address of Customer:
 Request No.:
 Date of receipt: 21-Mar-2018

Date of test: 23-Mar-2018

Reference equipment used in the calibration

Description:	Model:	Serial No.	Expiry Date:	Traceable to:
Multi function sound calibrator	B&K 4226	2288444	08-Sep-2018	CIGISMEC
Signal generator	DS 360	33873	25-Apr-2018	CEPREI
Signal generator	DS 360	61227	01-Apr-2018	CEPREI

Ambient conditions

Temperature: 21 ± 1 °C
 Relative humidity: 50 ± 10 %
 Air pressure: 1000 ± 5 hPa

Test specifications

- The Sound Level Meter has been calibrated in accordance with the requirements as specified in BS 7580: Part 1: 1997 and the lab calibration procedure SMTP004-CA-152.
- The electrical tests were performed using an electrical signal substituted for the microphone which was removed and replaced by an equivalent capacitance within a tolerance of ±20%.
- The acoustic calibration was performed using an B&K 4226 sound calibrator and corrections was applied for the difference between the free-field and pressure responsess of the Sound Level Meter.

Test results

This is to certify that the Sound Level Meter conforms to BS 7580: Part 1: 1997 for the conditions under which the test was performed.

Details of the performed measurements are presented on page 2 of this certificate.

Actual Measurement data are documented on worksheets.

Approved Signatory:


 Feng Jun Qi

Date: 24-Mar-2018

Company Chop:



Comments: The results reported in this certificate refer to the condition of the instrument on the date of calibration and carry no implication regarding the long-term stability of the instrument.



CERTIFICATE OF CALIBRATION

(Continuation Page)

Certificate No.: 18CA0321 01-02

Page 2 of 2

1, Electrical Tests

The electrical tests were performed using an equivalent capacitance substituted for the microphone. The results are given in below with test status and the estimated uncertainties. The "Pass" means the result of the test is inside the tolerances stated in the test specifications. The "-" means the result of test is outside these tolerances.

Test:	Subtest:	Status:	Expanded Uncertainty (dB)	Coverage Factor
Self-generated noise	A	Pass	0.3	
	C	Pass	0.8	
	Lin	Pass	1.6	
Linearity range for Leq	At reference range, Step 5 dB at 4 kHz	Pass	0.3	
	Reference SPL on all other ranges	Pass	0.3	
	2 dB below upper limit of each range	Pass	0.3	
	2 dB above lower limit of each range	Pass	0.3	
Linearity range for SPL	At reference range, Step 5 dB at 4 kHz	Pass	0.3	
	Frequency weightings			
Frequency weightings	A	Pass	0.3	
	C	Pass	0.3	
	Lin	Pass	0.3	
Time weightings	Single Burst Fast	Pass	0.3	
	Single Burst Slow	Pass	0.3	
Peak response	Single 100µs rectangular pulse	Pass	0.3	
R.M.S. accuracy	Crest factor of 3	Pass	0.3	
Time weighting I	Single burst 5 ms at 2000 Hz	Pass	0.3	
	Repeated at frequency of 100 Hz	Pass	0.3	
Time averaging	1 ms burst duty factor 1/10 ³ at 4kHz	Pass	0.3	
	1 ms burst duty factor 1/10 ⁴ at 4kHz	Pass	0.3	
Pulse range	Single burst 10 ms at 4 kHz	Pass	0.4	
Sound exposure level	Single burst 10 ms at 4 kHz	Pass	0.4	
Overload indication	SPL	Pass	0.3	
	Leq	Pass	0.4	

2, Acoustic tests

The complete sound level meter was calibrated on the reference range using a B&K 4226 acoustic calibrator with 1000Hz and SPL 94 dB. The sensitivity of the sound level meter was adjusted. The test result at 125 Hz and 8000 Hz are given in below with test status and the estimated uncertainties.

Test:	Subtest	Status	Expanded Uncertainty (dB)	Coverage Factor
Acoustic response	Weighting A at 125 Hz	Pass	0.3	
	Weighting A at 8000 Hz	Pass	0.5	

3, Response to associated sound calibrator

N/A

The expanded uncertainties have been calculated in accordance with the ISO Publication "Guide to the expression of uncertainty in measurement", and gives an interval estimated to have a level of confidence of 95%. A coverage factor of 2 is assumed unless explicitly stated.

End

Calibrated by:

Fung Chi Yip

Date: 23-Mar-2018

Checked by:

Lam Tze Wai

Date: 24-Mar-2018

The standard(s) and equipment used in the calibration are traceable to national or international recognised standards and are calibrated on a schedule to maintain the required accuracy level.



CERTIFICATE OF CALIBRATION

Certificate No.: 18CA0321 01-01 Page 1 of 2

Item tested

Description:	Sound Level Meter (Type 1)	Microphone	Pream
Manufacturer:	B & K	B & K	B & K
Type/Model No.:	2270	4950	ZC0032
Serial/Equipment No.:	2644597	2879980	19428
Adaptors used:	(N.012.01)		

Item submitted by

Customer Name: AECOM ASIA CO LTD
Address of Customer: -
Request No.: -
Date of receipt: 21-Mar-2018

Date of test: 24-Mar-2018

Reference equipment used in the calibration

Description:	Model:	Serial No.	Expiry Date:	Traceable to:
Multi function sound calibrator	B&K 4226	2288444	08-Sep-2018	CIGISMEC
Signal generator	DS 360	33873	25-Apr-2018	CEPREI
Signal generator	DS 360	61227	01-Apr-2018	CEPREI

Ambient conditions

Temperature: 21 ± 1 °C
Relative humidity: 50 ± 10 %
Air pressure: 1005 ± 5 hPa

Test specifications

- The Sound Level Meter has been calibrated in accordance with the requirements as specified in BS 7580: Part 1: 1997 and the lab calibration procedure SMTP004-CA-152.
- The electrical tests were performed using an electrical signal substituted for the microphone which was removed and replaced by an equivalent capacitance within a tolerance of ±20%.
- The acoustic calibration was performed using an B&K 4226 sound calibrator and corrections was applied for the difference between the free-field and pressure responsiveness of the Sound Level Meter.

Test results

This is to certify that the Sound Level Meter conforms to BS 7580: Part 1: 1997 for the conditions under which the test was performed.

Details of the performed measurements are presented on page 2 of this certificate.

Actual Measurement data are documented on worksheets.

Approved Signatory:



Feng Jun Qi

Date: 24-Mar-2018

Company Chop:



Comments: The results reported in this certificate refer to the condition of the instrument on the date of calibration and carry no implication regarding the long-term stability of the instrument.



CERTIFICATE OF CALIBRATION

(Continuation Page)

Certificate No.: 18CA0321 01-01 Page 2 of 2

1, Electrical Tests

The electrical tests were performed using an equivalent capacitance substituted for the microphone. The results are given in below with test status and the estimated uncertainties. The "Pass" means the result of the test is inside the tolerances stated in the test specifications. The "-" means the result of test is outside these tolerances.

Test:	Subtest:	Status:	Uncertainty (dB) / Coverage Factor
Self-generated noise	A	Pass	0.3
	C	Pass	1.0
	Lin	Pass	2.0
Linearity range for Leq	At reference range, Step 5 dB at 4 kHz	Pass	0.3
	Reference SPL on all other ranges	Pass	0.3
	2 dB below upper limit of each range	Pass	0.3
	2 dB above lower limit of each range	Pass	0.3
		Pass	0.3
Linearity range for SPL	At reference range, Step 5 dB at 4 kHz	Pass	0.3
		Pass	0.3
Frequency weightings	A	Pass	0.3
	C	Pass	0.3
	Lin	Pass	0.3
Time weightings	Single Burst Fast	Pass	0.3
	Single Burst Slow	Pass	0.3
Peak response	Single 100µs rectangular pulse	Pass	0.3
R.M.S. accuracy	Crest factor of 3	Pass	0.3
Time weighting I	Single burst 5 ms at 2000 Hz	Pass	0.3
	Repeated at frequency of 100 Hz	Pass	0.3
Time averaging	1 ms burst duty factor 1/10 ³ at 4kHz	Pass	0.3
	1 ms burst duty factor 1/10 ⁴ at 4kHz	Pass	0.3
Pulse range	Single burst 10 ms at 4 kHz	Pass	0.4
Sound exposure level	Single burst 10 ms at 4 kHz	Pass	0.4
Overload indication	SPL	Pass	0.3
	Leq	Pass	0.4

2, Acoustic tests

The complete sound level meter was calibrated on the reference range using a B&K 4226 acoustic calibrator with 1000Hz and SPL 94 dB. The sensitivity of the sound level meter was adjusted. The test result at 125 Hz and 8000 Hz are given in below with test status and the estimated uncertainties.

Test:	Subtest	Status	Uncertainty (dB) / Coverage Factor
Acoustic response	Weighting A at 125 Hz	Pass	0.3
	Weighting A at 8000 Hz	Pass	0.5

3, Response to associated sound calibrator

N/A

The uncertainties have been calculated in accordance with the ISO Publication "Guide to the expression of uncertainty in measurement", and gives an interval estimated to have a level of confidence of 95 %. A coverage factor of 2 is assumed unless explicitly stated.

End

Calibrated by:

Fung Chi Yip

Date: 24-Mar-2018

Checked by:

Lam Tze Wai

Date: 24-Mar-2018

The standard(s) and equipment used in the calibration are traceable to national or international recognised standards and are calibrated on a schedule to maintain the required accuracy level.



CERTIFICATE OF CALIBRATION

Certificate No.: 18CA0406 02-02

Page: 1 of 2

Item tested

Description: Acoustical Calibrator (Class 1)
Manufacturer: B & K
Type/Model No.: 4231
Serial/Equipment No.: 3006428 / N004.03
Adaptors used: -

Item submitted by

Customer: AECOM ASIA CO LIMITED
Address of Customer: -
Request No.: -
Date of receipt: 06-Apr-2018

Date of test: 09-Apr-2018

Reference equipment used in the calibration

Description:	Model:	Serial No.	Expiry Date:	Traceable to:
Lab standard microphone	B&K 4180	2341427	11-Apr-2018	SCL
Preamplifier	B&K 2673	2743150	05-May-2018	CEPREI
Measuring amplifier	B&K 2610	2346941	03-May-2018	CEPREI
Signal generator	DS 360	33873	25-Apr-2018	CEPREI
Digital multi-meter	34401A	US36087050	25-Apr-2018	CEPREI
Audio analyzer	8903B	GB41300350	21-Apr-2018	CEPREI
Universal counter	53132A	MY40003662	22-Apr-2018	CEPREI

Ambient conditions

Temperature: 21 ± 1 °C
Relative humidity: 50 ± 10 %
Air pressure: 1005 ± 5 hPa

Test specifications

- The Sound Calibrator has been calibrated in accordance with the requirements as specified in IEC 60942 1997 Annex B and the lab calibration procedure SMTP004-CA-156.
- The calibrator was tested with its axis vertical facing downwards at the specific frequency using insert voltage technique.
- The results are rounded to the nearest 0.01 dB and 0.1 Hz and have not been corrected for variations from a reference pressure of 1013.25 hectoPascals as the maker's information indicates that the instrument is insensitive to pressure changes.

Test results

This is to certify that the sound calibrator conforms to the requirements of annex B of IEC 60942: 1997 for the conditions under which the test was performed. This does not imply that the sound calibrator meets IEC 60942 under any other conditions.

Details of the performed measurements are presented on **page 2** of this certificate.

Approved Signatory:

Feng Jun Qi

Date: 11-Apr-2018

Company Chop:



Comments: The results reported in this certificate refer to the condition of the instrument on the date of calibration and carry no implication regarding the long term stability of the instrument.



CERTIFICATE OF CALIBRATION

(Continuation Page)

Certificate No.: 18CA0406 02-02

Page: 2 of 2

1, Measured Sound Pressure Level

The output Sound Pressure Level in the calibrator head was measured at the setting and frequency shown using a calibrated laboratory standard microphone and insert voltage technique. The results are given in below with the estimated uncertainties.

Frequency Shown Hz	Output Sound Pressure Level Setting dB	Measured Output Sound Pressure Level dB	(Output level in dB re 20 μ Pa)	
			Estimated Uncertainty dB	Expanded
1000	94.00	94.20	0.10	

2, Sound Pressure Level Stability - Short Term Fluctuations

The Short Term Fluctuations was determined by measuring the maximum and minimum of the fast weighted DC output of the B&K 2610 measuring amplifier over a 20 second time interval as required in the standard. The Short Term Fluctuation was found to be:

At 1000 Hz **STF = 0.015 dB**

Estimated expanded uncertainty 0.005 dB

3, Actual Output Frequency

The determination of actual output frequency was made using a B&K 4180 microphone together with a B&K 2673 preamplifier connected to a B&K 2610 measuring amplifier. The AC output of the B&K 2610 was taken to a universal counter which was used to determine the frequency averaged over 20 second of operation as required by the standard. The actual output frequency at 1 KHz was:

At 1000 Hz **Actual Frequency = 999.96 Hz**

Estimated expanded uncertainty 0.1 Hz Coverage factor k = 2.2

4, Total Noise and Distortion

For the Total Noise and Distortion measurement, the unfiltered AC output of the B&K 2610 measuring amplifier was connected to an Agilent Type 8903 B distortion analyser. The TND result at 1 KHz was:

At 1000 Hz **TND = 0.4 %**

Estimated expanded uncertainty 0.7 %

The expanded uncertainties have been calculated in accordance with the ISO Publication "Guide to the expression of uncertainty in measurement". and gives an interval estimated to have a level of confidence of 95%. A coverage factor of 2 is assumed unless explicitly stated.

- End -

Calibrated by:

Date: 09-Apr-2018

Fung Chi Yip

Checked by:

Date: 11-Apr-2018

Lam Tze Wai

The standard(s) and equipment used in the calibration are traceable to national or international recognised standards and are calibrated on a schedule to maintain the required accuracy level.



CERTIFICATE OF CALIBRATION

Certificate No.: 18CA1008 02 Page: 1 of 2

Item tested

Description: Acoustical Calibrator (Class 1)
Manufacturer: Rion Co., Ltd.
Type/Model No.: NC-74
Serial/Equipment No.: 34246490 / N.004.10
Adaptors used: -

Item submitted by

Customer: AECOM ASIA CO LIMITED
Address of Customer: -
Request No.: -
Date of receipt: 08-Oct-2018

Date of test: 10-Oct-2018

Reference equipment used in the calibration

Description:	Model:	Serial No.	Expiry Date:	Traceable to:
Lab standard microphone	B&K 4180	2341427	20-Apr-2019	SCL
Preamplifier	B&K 2673	2743150	27-Apr-2019	CEPREI
Measuring amplifier	B&K 2610	2346941	08-May-2019	CEPREI
Signal generator	DS 360	61227	24-Apr-2019	CEPREI
Digital multi-meter	34401A	US36087050	23-Apr-2019	CEPREI
Audio analyzer	8903B	GB41300350	23-Apr-2019	CEPREI
Universal counter	53132A	MY40003662	24-Apr-2019	CEPREI

Ambient conditions

Temperature: 21 ± 1 °C
Relative humidity: 50 ± 10 %
Air pressure: 1005 ± 5 hPa

Test specifications

- The Sound Calibrator has been calibrated in accordance with the requirements as specified in IEC 60942 1997 Annex B and the lab calibration procedure SMTP004-CA-156.
- The calibrator was tested with its axis vertical facing downwards at the specific frequency using insert voltage technique.
- The results are rounded to the nearest 0.01 dB and 0.1 Hz and have not been corrected for variations from a reference pressure of 1013.25 hectoPascals as the maker's information indicates that the instrument is insensitive to pressure changes.

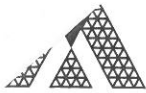
Test results

This is to certify that the sound calibrator conforms to the requirements of annex B of IEC 60942: 1997 for the conditions under which the test was performed. This does not imply that the sound calibrator meets IEC 60942 under any other conditions.

Details of the performed measurements are presented on **page 2** of this certificate.

Approved Signatory:  Date: 10-Oct-2018 Company Chop: 

Comments: The results reported in this certificate refer to the condition of the instrument on the date of calibration and carry no implication regarding the long-term stability of the instrument.



CERTIFICATE OF CALIBRATION

(Continuation Page)

Certificate No.: 18CA1008 02

Page: 2 of 2

1, Measured Sound Pressure Level

The output Sound Pressure Level in the calibrator head was measured at the setting and frequency shown using a calibrated laboratory standard microphone and insert voltage technique. The results are given in below with the estimated uncertainties.

Frequency Shown Hz	Output Sound Pressure Level Setting dB	Measured Output Sound Pressure Level dB	(Output level in dB re 20 μ Pa)
			Estimated Expanded Uncertainty dB
1000	94.00	93.89	0.10

2, Sound Pressure Level Stability - Short Term Fluctuations

The Short Term Fluctuations was determined by measuring the maximum and minimum of the fast weighted DC output of the B&K 2610 measuring amplifier over a 20 second time interval as required in the standard. The Short Term Fluctuation was found to be:

At 1000 Hz **STF = 0.030 dB**
Estimated expanded uncertainty 0.005 dB

3, Actual Output Frequency

The determination of actual output frequency was made using a B&K 4180 microphone together with a B&K 2673 preamplifier connected to a B&K 2610 measuring amplifier. The AC output of the B&K 2610 was taken to an universal counter which was used to determine the frequency averaged over 20 second of operation as required by the standard. The actual output frequency at 1 KHz was:

At 1000 Hz **Actual Frequency = 1002.0 Hz**
Estimated expanded uncertainty 0.1 Hz Coverage factor k = 2.2

4, Total Noise and Distortion

For the Total Noise and Distortion measurement, the unfiltered AC output of the B&K 2610 measuring amplifier was connected to an Agilent Type 8903 B distortion analyser. The TND result at 1 KHz was:

At 1000 Hz **TND = 2.3 %**
Estimated expanded uncertainty 0.7 %

The expanded uncertainties have been calculated in accordance with the ISO Publication "Guide to the expression of uncertainty in measurement", and gives an interval estimated to have a level of confidence of 95%. A coverage factor of 2 is assumed unless explicitly stated.

- End -

Calibrated by:

Date:

Fung Chi Yip
10-Oct-2018

Checked by:

Date:

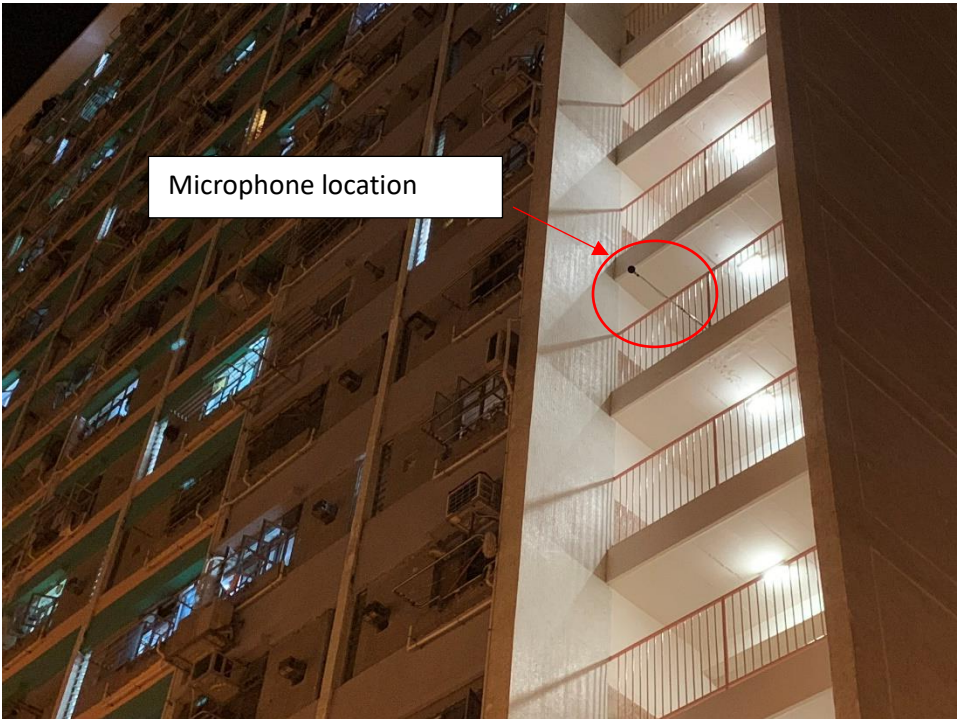
Shek Kwong Tat
10-Oct-2018

The standard(s) and equipment used in the calibration are traceable to national or international recognised standards and are calibrated on a schedule to maintain the required accuracy level.

Appendix C2

Photographs – Noise Measurement at Representative NSRs

Appendix C2 Photographs – Noise Measurement at Representative NSRs



NSR Measurement Location at FTA-FN1



NSR Measurement Location at FTA-FN2



NSR Measurement Location at FTA-FN3

Appendix C3

Measurement Results at Representative NSRs

Appendix C3 Noise Measurement Results at Representative NSRs

NSR ID	Measurement Date	Fixed Plant Noise		Background Noise		Difference, dB(A)
		Measurement Time	Measured Noise Level, $L_{Aeq, 30mins}$ dB(A)	Measurement Time	Background Level, $L_{Aeq, 5mins}$ dB(A)	
FTA-FN1	24/1/2019 - 25/1/2019	00:06:00 - 00:35:59	59.1	23:42:00 - 23:46:59	59.6	-0.5
FTA-FN2	24/1/2019 - 25/1/2019	00:06:00 - 00:35:59	55.8	23:42:00 - 23:46:59	56.1	-0.3
FTA-FN3	24/1/2019 - 25/1/2019	00:06:00 - 00:35:59	56.5	23:39:30 - 23:44:29	57.1	-0.6