MTR Corporation Limited

Shatin to Central Link –
Tai Wai to Hung Hom Section and
Stabling Sidings at Hung Hom Freight Yard

Fixed Plant Noise Audit Report

(Batch 6 Hin Keng Station (HIK))

(September 2019)

Certified by: Fredrick Leong

Position: Independent Environmental Checker

Date: 11/9/2019

MTR Corporation Limited

Shatin to Central Link

Tai Wai to Hung Hom Section

Fixed Plant Noise Audit Report (Batch 6 – HIK)

(September 2019)

Certified by: Lisa Poon

Signature: 

Position: Environmental Team Leader

Date: 10 September 2019

AECOM

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 6 – Hin Keng Station (HIK))

September 2019

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

Version:	B	Date: 9 September 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 Fixed Plant Sources (Batch 6 – Hin Keng Station (HIK)) (hereinafter referred to as "the Proposal (Batch 6 – HIK)") (**Appendix A** refers) was approved by DEP on 29 July 2019.

1.1.7 This Fixed Plant Noise Audit Report (Batch 6 – Hin Keng Station (HIK)) (hereinafter referred to as "the FPNAR (Batch 6 – HIK)") presents the noise measurement methodology and measurement results at the fixed plant noise sources of HIK and at the representative NSRs near HIK, for checking compliance with the maximum allowable sound power levels (SWLs) determined in the Proposal (Batch 6 – HIK).

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 HIK and at the representative NSRs near HIK.

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 HIK extracted from the Proposal (Batch 6 – HIK) are summarised in **Table 2.1**. The updated fixed plant noise sources locations at HIK are shown in **Figure No. C1103/C/SCL/ACM/M52/057**. 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 HIK

Location	Fixed Plant ID.	Fixed Plant Source	Maximum Allowable SWL, dB(A)(1)	
			Daytime & Evening(2)	Night-time(2)
HIK	HIK - 06	Station Ventilation Louver	82	75
	HIK - 09	Station Ventilation Louver	83	76
	HIK - 13	Station Ventilation Louver	79	72
	HIK - 15	Station Ventilation Louver	77	70
	HIK - 16	Station Ventilation Louver	76	69
	HIK - 17	Station Ventilation Louver	83	76
	HIK - 24	Tunnel Ventilation Louver	96	87
	HIK - 25	Tunnel Ventilation Louver	96	90
	HIK - 30	Station Ventilation Louver	74	67
	HIK - 35	Station Ventilation Louver	78	71
	HIK - 37	Station Ventilation Louver	77	70
	HIK - 40	Station Ventilation Louver	74	67
	HIK - 42	Station Ventilation Louver	87	80
	HIK - 45	Station Ventilation Louver	89	82
	HIK - 46	Station Ventilation Louver	70	63
	HIK - 49	Station Ventilation Louver	81	74
	HIK - 58	Station Ventilation Louver	77	70
	HIK - 62	Station Ventilation Louver	82	75
	HIK - 63	Station Ventilation Louver	81	74
	HIK - 75	Station Ventilation Louver	70	63
	HIK - 76	Station Ventilation Louver	82	75
	HIK - 91	Station Ventilation Louver	75	68
	Outdoor Unit A	Outdoor Unit	93	86
	Outdoor Unit B	Outdoor Unit	95	88
	Outdoor Unit C	Outdoor Unit	75	68
	Outdoor Unit 1	Outdoor Unit	95	88
	Outdoor Unit 2	Outdoor Unit	87	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 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 Supreme Acoustics Research Ltd and 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	Norsonic 140	1406038
	SVAN 979	46199
	Rion NL-52	00564841
Calibrator	B&K 4231	2084888
	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. Measurements may be accepted as valid only if the calibration levels from before and after the noise measurement agree to within 1.0 dB.

Measurement Date and Time

3.1.4 There will be daytime/evening and night-time operation modes for fixed plant sources at HIK. Nevertheless, the noise measurements at HIK were all conducted during night-time period at the fixed plant noise sources in order to minimise influence from background noise on measurement data. Details of the noise measurement schedule are shown in **Table 3.2**.

Table 3.2 Measurement Schedule

Location	Date
HIK	9, 10, 20, 21 & 22 April 2018
	1 April 2019
	17 June 2019

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 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 under unmanned condition (i.e. TAW-5-3 (Joyville)) due to limited access at night, and 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. Measurements may be accepted as valid only if the calibration levels from before and after the noise measurement agree to within 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/M52/058**. Photographs of measurement locations are shown in **Appendix C2**.

Table 3.4 Noise Measurement Locations

NSR ID	Representative NSR	Type	Measurement Height
TAW-5-2	L Louey	Residential	Public area near L Louey (free field condition)
TAW-5-3	Joyville	Residential	Rooftop of House A3, Joyville (1m from building façade)
TAW-6-5	Hin Yau House	Residential	1st floor of building (approx. 4m above

NSR ID	Representative NSR	Type	Measurement Height
			ground & 1m from building façade)

Measurement Date and Time

3.2.6 For daytime/evening and night-time operation modes, noise measurement at representative NSRs was conducted during evening and night-time periods respectively. The measurement schedule is presented in **Table 3.5.**

Table 3.5 Measurement Schedule

NSR ID	Date
TAW-5-2, TAW-5-3 & TAW-6-5	9 & 10 July 2019

4 MEASUREMENT RESULTS

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

4.1.1 The measured SWLs for daytime and evening, and night-time periods are presented in **Table 4.1**. Photographs showing the examples of noise measurement for fixed plant noise are shown in **Appendix B3**. Details of the measurement results are shown in **Appendix B4**.

Table 4.1 Summary of Measured SWLs for Fixed Plants

Plant Item	Measured SWL[(1)], 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)]
HIK - 06	75	75	82	75	Y	Y
HIK - 09	76	76	83	76	Y	Y
HIK - 13	72	72	79	72	Y	Y
HIK - 15	70	70	77	70	Y	Y
HIK - 16	69	69	76	69	Y	Y
HIK - 17	76	76	83	76	Y	Y
HIK - 24	96	87	96	87	Y	Y
HIK - 25	96	88	96	90	Y	Y
HIK - 30	67	67	74	67	Y	Y
HIK - 35	71	71	78	71	Y	Y
HIK - 37	70	70	77	70	Y	Y
HIK - 40	67	67	74	67	Y	Y
HIK - 42	80	80	87	80	Y	Y
HIK - 45	82	82	89	82	Y	Y
HIK - 46	63	63	70	63	Y	Y
HIK - 49	74	74	81	74	Y	Y
HIK - 58	70	70	77	70	Y	Y
HIK - 62	75	75	82	75	Y	Y
HIK - 63	74	74	81	74	Y	Y
HIK - 75	63	63	70	63	Y	Y
HIK - 76	75	75	82	75	Y	Y
HIK - 91	68	68	75	68	Y	Y
Outdoor Unit A	86	86	93	86	Y	Y
Outdoor Unit B	86	86	95	88	Y	Y
Outdoor Unit C	67	67	75	68	Y	Y
Outdoor Unit 1	88	88	95	88	Y	Y
Outdoor Unit 2	80	80	87	80	Y	Y

Notes:
(1) As discussed in **Section 3.1.4**, some plants would be operated in different modes, namely daytime/evening and night-time operation modes. For those plants operating in the same mode during daytime/evening and night-time periods, the measured SWL is same for both daytime/evening and night-time periods.
(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 both evening and night-time periods. Measurement results are summarised in **Table 4.2** below. No characteristics of tonality,

impulsiveness and intermittency from the fixed plant sources was observed at the representative 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 indicated same characteristics of tonality, impulsiveness and intermittency were found during both the background and fixed plant noise measurement periods at TAW-5-2, while there were no characteristics of tonality, impulsiveness and intermittency were found during fixed plant noise measurement periods at TAW-5-3 and TAW-6-5. Based on site observation and findings of data analysis, it is concluded that no characteristics of tonality, impulsiveness and intermittency are expected from the fixed plant sources. Detailed noise measurements results are presented in **Appendix C3**.

Table 4.2 Noise Measurement Results at Measurement Locations

NSR ID	Representing NSRs	Time Period[1]&[2]	Measurement Results			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)		
TAW-5-2	L Louey	Daytime & Evening	61.4	59.3	2.1	Background noise was dominated by train noise from East Rail and buzzing sound from insects (crickets and cicadas) throughout the measurement periods. Noise from SCL fixed plant was not noticeable at the measurement locations.	N[3]
		Night-time	57.1	55.4	1.7		N[3]
TAW-5-3	Joyville	Daytime & Evening	57.9	57.9	0.0		N[4]
		Night-time	57.1	55.5	1.6		N[4]
TAW-6-5	Hin Yau House	Daytime & Evening	63.2	62.3	0.9	Noise environment was dominated by traffic noise. Noise from SCL fixed plant was not noticeable at measurement location.	N
		Night-time	59.5	61.5	-2.0		N

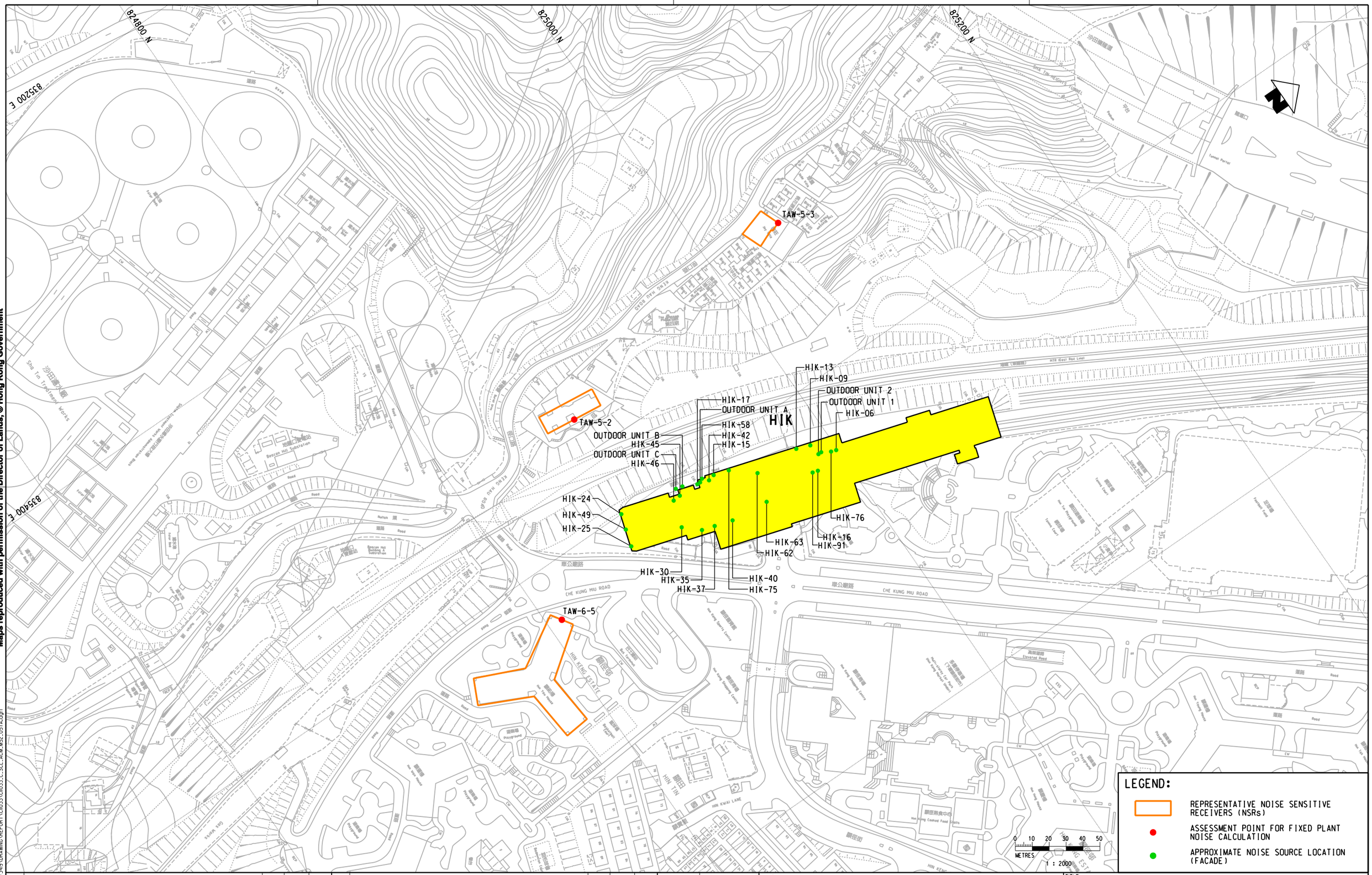
Notes:
(1) Day: 0700 to 1900 hours, Evening: 1900 to 2300 hours, Night: 2300 to 0700 hours
(2) Fixed plant noise operation during daytime/evening and night-time periods have been included according to corresponding fixed plant noise measurement.
(3) Tonal peaks at 8k Hz and 6.3k Hz & 8k Hz pair were found during daytime & evening background and fixed plant noise measurement periods, while tonal peak at 8k Hz was found during night-time background and fixed plant noise measurement periods. Buzzing sound from insects (crickets and cicadas) was observed throughout the measurement periods and no other noticeable high frequency source was identified on-site. These tonal peaks are expected to be related to insect buzzing sound. No characteristics of tonality, impulsiveness and intermittency from the SCL fixed plant sources was observed during the measurement.
(4) Tonal peaks at 5k Hz & 6.3k Hz pair were found during daytime/evening background period only, while no tonal peak was found during daytime/evening fixed plant noise measurement period, night-time background and fixed plant noise measurement periods. Buzzing sound from insects (crickets and cicadas) was observed during the daytime/evening background measurement

period. This tonal peak is expected to be related to insect buzzing sound. No characteristics of tonality, impulsiveness and intermittency from the SCL fixed plant sources was observed during the measurement.

5 CONCLUSION

5.1.1 The fixed plant noise verification was undertaken and the measurement results indicated all the fixed plant noise levels in HIK comply with the updated maximum allowable SWLs. Result of data analysis indicated same characteristics of tonality, impulsiveness and intermittency were found during both the background and fixed plant noise measurement periods at TAW-5-2, while there were no characteristics of tonality, impulsiveness and intermittency were found during fixed plant noise measurement periods at TAW-5-3 and TAW-6-5. With no characteristics of tonality, impulsiveness and intermittency from the fixed plant sources observed at the measurement locations, it is therefore concluded that no characteristics of tonality, impulsiveness and intermittency are expected from the fixed plant sources.

Figures



LEGEND:

- REPRESENTATIVE NOISE SENSITIVE RECEIVERS (NSRs)
- ASSESSMENT POINT FOR FIXED PLANT NOISE CALCULATION
- APPROXIMATE NOISE SOURCE LOCATION (FACADE)

REV	DESCRIPTION	BY	DATE	APPROVED
REV	DESCRIPTION	BY	DATE	APPROVED

DRAWN	XH
DESIGNED	LCLL
CHECKED	LCLL
APPROVED	IMW
DATE	27/JUN/2019

MTR

SHATIN TO CENTRAL LINK

ORIGINATOR

AECOM

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TITLE

C11033

SCL (TAW - HUH)

LOCATIONS OF NSRs AND FIXED NOISE SOURCES (HIN KENG STATION)

SCALE 1 : 2000 (A3)

FIGURE NO. C11033/C/SCL/ACM/M52/057

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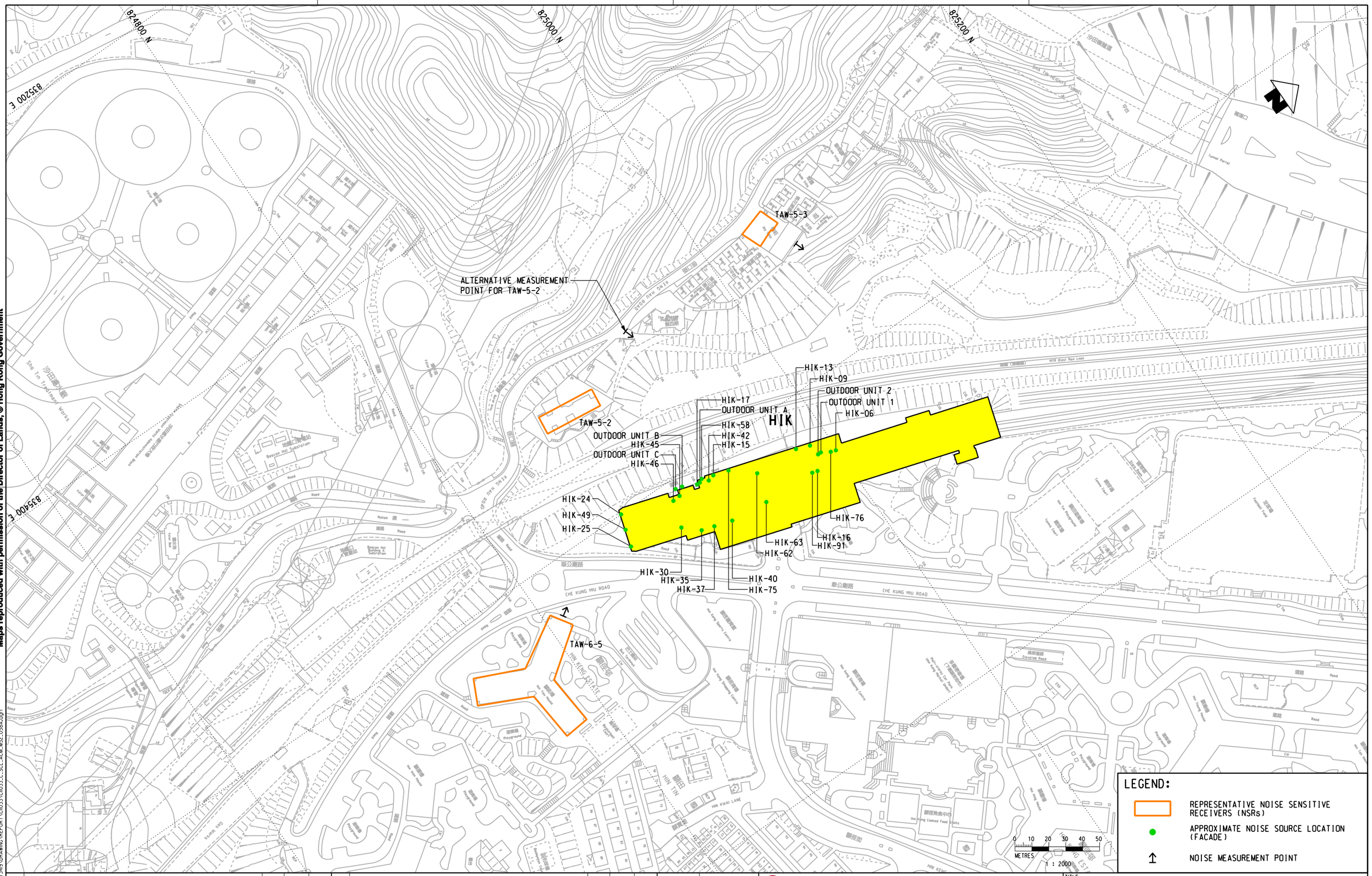

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APPROVED	IMW
DATE	11/JUL/2019

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SHATIN TO CENTRAL LINK

ORIGINATOR

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TITLE

C11033
SCL (TAW - HUH)
LOCATIONS OF NOISE MEASUREMENT POINTS (HIN KENG STATION)

SCALE	FIGURE NO.	REV.
1 : 2000 (A3)	C11033/C/SCL/ACM/M52/058	A

Appendix A

Proposal for Updating Maximum Allowable Sound Power Levels of Fixed Plant Sources (Batch 6 – Hin Keng Station (HIK))

MTR Corporation Limited

Shatin to Central Link –
Tai Wai to Hung Hom Section and
Stabling Sidings at Hung Hom Freight Yard

Proposal for Updating Maximum Allowable

Sound Power Levels of Fixed Plant Sources

(Batch 6 – Hin Keng Station (HIK))

(July 2019)

Certified by: 

Position: Independent Environmental Checker

Date: 17 July 2019

MTR Corporation Limited

Shatin to Central Link –
Tai Wai to Hung Hom Section and
Stabling Sidings at Hung Hom Freight Yard

Fixed Plant Noise Audit Report

(Batch 6 – Hin Keng Station (HIK))

(July 2019)

Certified by: Lisa Poon

Position: Environmental Team Leader

Date: 17 July 2019

AECOM

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 6 – Hin Keng Station (HIK))

July 2019

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Reviewed & Approved:	Josh Lam	

Version:	A	Date: 11 July 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 have been updated to reflect the latest design of the Project. This Proposal (Batch 6 – Hin Keng Station (HIK)) presents the updated maximum allowable SWLs of the fixed plant noise sources at HIK.

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 HIK 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 Report)

Area (NSR No.)	Time Period (1)	Prevailing Background Noise Levels, dB(A) (2)	ASR	ANL-5, dB(A) (3)	Criteria, dB(A) (4)
Hin Keng Station					
L Louey (TAW-5-2), Joyville (TAW-5-3)	Day & evening	58	B	60	58
	Night	50	B	50	50
Hin Yau House (TAW-6-5)	Day & evening	58	B	60	58
	Night	56	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 Report.
(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 HIK are shown in **Figure No. C1103/C/SCL/ACM/M52/057**. Based on latest design information, the maximum allowable SWLs for ventilation louvers and outdoor 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]
HIK	HIK - 06	Station Ventilation Louver	82	75
	HIK - 09	Station Ventilation Louver	83	76
	HIK - 13	Station Ventilation Louver	79	72
	HIK - 15	Station Ventilation Louver	77	70
	HIK - 16	Station Ventilation Louver	76	69
	HIK - 17	Station Ventilation Louver	83	76
	HIK - 24	Tunnel Ventilation Louver	96	87
	HIK - 25	Tunnel Ventilation Louver	96	90
	HIK - 30	Station Ventilation Louver	74	67
	HIK - 35	Station Ventilation Louver	78	71
	HIK - 37	Station Ventilation Louver	77	70
	HIK - 40	Station Ventilation Louver	74	67
	HIK - 42	Station Ventilation Louver	87	80
	HIK - 45	Station Ventilation Louver	89	82
	HIK - 46	Station Ventilation Louver	70	63
	HIK - 49	Station Ventilation Louver	81	74
	HIK - 58	Station Ventilation Louver	77	70
	HIK - 62	Station Ventilation Louver	82	75
	HIK - 63	Station Ventilation Louver	81	74
	HIK - 75	Station Ventilation Louver	70	63
	HIK - 76	Station Ventilation Louver	82	75
	HIK - 91	Station Ventilation Louver	75	68
	Outdoor Unit A	Outdoor Unit	93	86
	Outdoor Unit B	Outdoor Unit	95	88
	Outdoor Unit C	Outdoor Unit	75	68
	Outdoor Unit 1	Outdoor Unit	95	88
	Outdoor Unit 2	Outdoor Unit	87	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, $L_{eq,30mins}$, dB(A)[1]	
		Daytime & Evening[2]	Night-time[2]	Daytime & Evening[2]	Night-time[2][3]
TAW-5-2	L Louey	58	50	58	50
TAW-5-3	Joyville	58	50	52	45
TAW-6-5	Hin Yau House	58	50	58	50

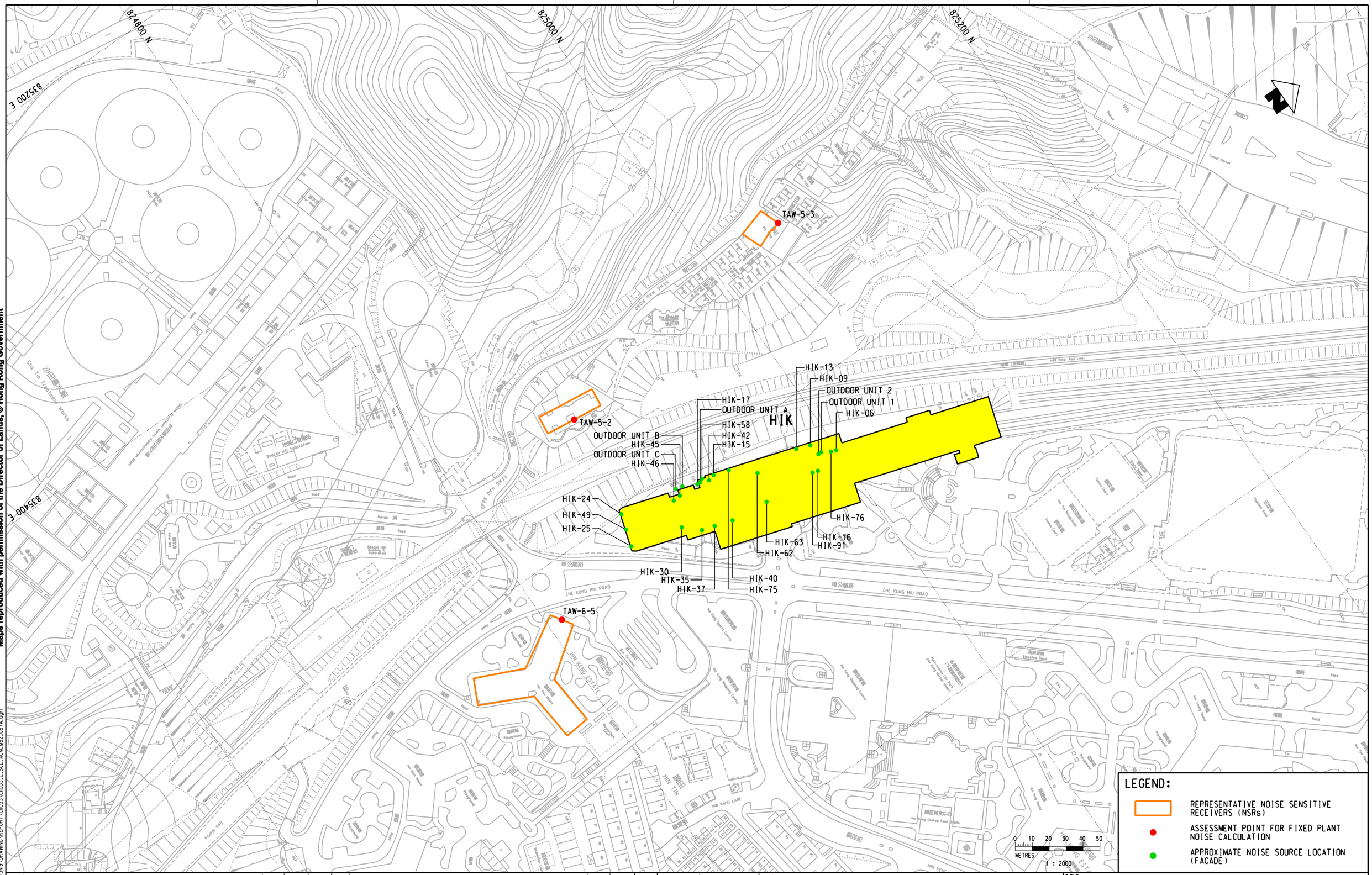
Notes:
(1) The predicted fixed plant noise levels have due regard to the characteristics of tonality, intermittency and impulsiveness.
(2) Day: 0700 to 1900 hours, Evening: 1900 to 2300 hours, Night: 2300 to 0700 hours.
(3) Maximum of the predicted SPL of each NSR in Annex A is presented.

4 CONCLUSION

4.1.1 The maximum allowable SWLs of fixed plant noise sources at HIK 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 fixed plant noise source 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)
- ASSESSMENT POINT FOR FIXED PLANT NOISE CALCULATION
- APPROXIMATE NOISE SOURCE LOCATION (FACADE)

REV	DESCRIPTION	BY	DATE	APPROVED
REV	DESCRIPTION	BY	DATE	APPROVED

DRAWN	XH
DESIGNED	LCLL
CHECKED	LCLL
APPROVED	IMW
DATE	27/JUN/2019

MTR

SHATIN TO CENTRAL LINK

ORIGINATOR

AECOM

CADD REF. C11033_C_SCL_ACM_M52_057A.dgn

TITLE

C11033

SCL (TAW - HUH)

LOCATIONS OF NSRs AND FIXED NOISE SOURCES (HIN KENG STATION)

SCALE 1 : 2000 (A3)

FIGURE NO. C11033/C/SCL/ACM/M52/057

REV. A

PLOT DRV: V:\customset\MTR\PLOTDRIVER\WINDOWS\A3_COLOUR.ctb
MODEL: PRINTED BY: ZENGPA 2019/6/28 9:58:05
FILENAME: P:\projects\602734\DRAWING\REPORT\C11033\C_SCL_ACM_M52_057A.dgn

Annex A

Detail Calculation of Fixed Plant Noise Assessment

Annex A Detail Calculation of Fixed Plant Noise Assessment

Fixed Plant Noise Calculation - HIK NSRs (Daytime & Evening 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, dB(A)	Façade Correction, dB(A)	Predicted SPL, dB(A)	Total SPL, dB(A)	Daytime Noise Criteria, dB(A)
Hin Keng Station											
TAW-5-2											
TAW-5-2	L Louey	HIK - 06	West	156	82	0	-52	3	33		
		HIK - 09	West	140	83	0	-51	3	35		
		HIK - 13	West	132	79	0	-51	3	31		
		HIK - 15	West	89	77	0	-47	3	33		
		HIK - 16	East	147	76	-10	-51	3	18		
		HIK - 17	West	82	83	0	-47	3	39		
		HIK - 24	South	62	96	0	-44	3	55		
		HIK - 25	South	82	96	-5	-46	3	48		
		HIK - 30	East	90	74	-10	-47	3	20		
		HIK - 35	East	100	78	-10	-48	3	23		
		HIK - 37	East	104	77	-10	-49	3	21		
		HIK - 40	East	111	74	-10	-49	3	18		
		HIK - 42	West	87	87	0	-47	3	43		
		HIK - 45	South	77	89	0	-46	3	46		
		HIK - 46	West	76	70	0	-46	3	27		
		HIK - 49	South	72	81	0	-46	3	38		
		HIK - 58	West	83	77	0	-47	3	33		
		HIK - 62	East	113	82	-5	-49	3	31		
		HIK - 63	West	124	81	0	-50	3	34		
		HIK - 75	West	96	70	0	-48	3	25		
		HIK - 76	West	153	82	0	-52	3	33		
		HIK - 91	East	144	75	-10	-51	3	17		
		Outdoor Unit A	-	83	93	0	-47	3	49		
		Outdoor Unit B	-	75	95	0	-46	3	52		
		Outdoor Unit C	-	73	75	0	-46	3	32		
		Outdoor Unit 1	-	147	95	-10	-51	3	37		
		Outdoor Unit 2	-	146	87	-10	-51	3	29	**58**	**58**
TAW-5-3											
TAW-5-3	Joyville	HIK - 06	West	138	82	0	-51	3	34		
		HIK - 09	West	132	83	0	-51	3	35		
		HIK - 13	West	133	79	0	-51	3	31		
		HIK - 15	West	154	77	0	-52	3	28		
		HIK - 16	East	148	76	-10	-52	3	17		
		HIK - 17	West	161	83	0	-52	3	34		
		HIK - 24	South	195	96	-10	-54	3	35		
		HIK - 25	South	210	96	-10	-55	3	34		
		HIK - 30	East	188	74	-10	-54	3	13		
		HIK - 35	East	187	78	-10	-54	3	17		
		HIK - 37	East	183	77	-10	-53	3	17		
		HIK - 40	East	177	74	-10	-53	3	14		
		HIK - 42	West	157	87	0	-52	3	38		
		HIK - 45	South	171	89	0	-53	3	39		
		HIK - 46	West	175	70	0	-53	3	20		
		HIK - 49	South	202	81	0	-54	3	30		
		HIK - 58	West	157	77	0	-52	3	28		
		HIK - 62	East	148	82	-5	-52	3	28		
		HIK - 63	West	165	81	0	-52	3	32		
		HIK - 75	West	149	70	0	-52	3	21		
		HIK - 76	West	138	82	0	-51	3	34		
		HIK - 91	East	148	75	-10	-52	3	16		
		Outdoor Unit A	-	160	93	0	-52	3	44		
		Outdoor Unit B	-	165	95	0	-53	3	45		
		Outdoor Unit C	-	168	75	0	-53	3	25		
		Outdoor Unit 1	-	137	95	0	-51	3	47		
		Outdoor Unit 2	-	138	87	0	-51	3	39	**52**	**58**
TAW-6-5											
TAW-6-5	Hin Keng Estate - Hin Yau House	HIK - 06	West	190	82	-10	-54	3	21		
		HIK - 09	West	179	83	-10	-53	3	23		
		HIK - 13	West	171	79	-10	-53	3	19		
		HIK - 15	West	123	77	-10	-50	3	20		
		HIK - 16	East	174	76	-5	-53	3	21		
		HIK - 17	West	112	83	-10	-49	3	27		
		HIK - 24	South	71	96	0	-45	3	54		
		HIK - 25	South	59	96	0	-43	3	56		
		HIK - 30	East	89	74	-5	-47	3	25		
		HIK - 35	East	98	78	0	-48	3	33		
		HIK - 37	East	105	77	0	-48	3	32		
		HIK - 40	East	116	74	0	-49	3	28		
		HIK - 42	West	119	87	-10	-50	3	30		
		HIK - 45	South	100	89	-10	-48	3	34		
		HIK - 46	West	96	70	-10	-48	3	15		
		HIK - 49	South	65	81	0	-44	3	40		
		HIK - 58	West	117	77	-10	-49	3	21		
		HIK - 62	East	144	82	0	-51	3	34		
		HIK - 63	West	139	81	-5	-51	3	28		
		HIK - 75	West	132	70	-10	-50	3	13		
		HIK - 76	West	187	82	-10	-53	3	22		
		HIK - 91	East	171	75	-5	-53	3	20		
		Outdoor Unit A	-	114	93	-10	-49	3	37		
		Outdoor Unit B	-	105	95	-10	-48	3	40		
		Outdoor Unit C	-	102	75	-10	-48	3	20		
		Outdoor Unit 1	-	182	95	-10	-53	3	35		
		Outdoor Unit 2	-	180	87	-10	-53	3	27	**58**	**58**

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 - HIK 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, dB(A)	Façade Correction, dB(A)	Predicted SPL, dB(A)	Total SPL, dB(A)	Night-time Noise Criteria, dB(A)
Hin Keng Station											
TAW-5-2											
TAW-5-2 (Scenario 1) [2]	L Louey	HIK - 06	West	156	75	0	-52	3	26		
		HIK - 09	West	140	76	0	-51	3	28		
		HIK - 13	West	132	72	0	-51	3	24		
		HIK - 15	West	89	70	0	-47	3	26		
		HIK - 16	East	147	69	-10	-51	3	11		
		HIK - 17	West	82	76	0	-47	3	32		
		HIK - 24	South	62	87	0	-44	3	46		
		HIK - 25	South	82	-	-5	-46	3	-		
		HIK - 30	East	90	67	-10	-47	3	13		
		HIK - 35	East	100	71	-10	-48	3	16		
		HIK - 37	East	104	70	-10	-49	3	14		
		HIK - 40	East	111	67	-10	-49	3	11		
		HIK - 42	West	87	80	0	-47	3	36		
		HIK - 45	South	77	82	0	-46	3	39		
		HIK - 46	West	76	63	0	-46	3	20		
		HIK - 49	South	72	74	0	-46	3	31		
		HIK - 58	West	83	70	0	-47	3	26		
		HIK - 62	East	113	75	-5	-49	3	24		
		HIK - 63	West	124	74	0	-50	3	27		
		HIK - 75	West	96	63	0	-48	3	18		
		HIK - 76	West	153	75	0	-52	3	26		
		HIK - 91	East	144	68	-10	-51	3	10		
		Outdoor Unit A	-	83	86	0	-47	3	42		
		Outdoor Unit B	-	75	88	0	-46	3	45		
		Outdoor Unit C	-	73	68	0	-46	3	25		
		Outdoor Unit 1	-	147	88	-10	-51	3	30		
		Outdoor Unit 2	-	146	80	-10	-51	3	22	**50**	**50**
TAW-5-2											
TAW-5-2 (Scenario 2) [2]	L Louey	HIK - 06	West	156	75	0	-52	3	26		
		HIK - 09	West	140	76	0	-51	3	28		
		HIK - 13	West	132	72	0	-51	3	24		
		HIK - 15	West	89	70	0	-47	3	26		
		HIK - 16	East	147	69	-10	-51	3	11		
		HIK - 17	West	82	76	0	-47	3	32		
		HIK - 24	South	62	-	0	-44	3	-		
		HIK - 25	South	82	90	-5	-46	3	42		
		HIK - 30	East	90	67	-10	-47	3	13		
		HIK - 35	East	100	71	-10	-48	3	16		
		HIK - 37	East	104	70	-10	-49	3	14		
		HIK - 40	East	111	67	-10	-49	3	11		
		HIK - 42	West	87	80	0	-47	3	36		
		HIK - 45	South	77	82	0	-46	3	39		
		HIK - 46	West	76	63	0	-46	3	20		
		HIK - 49	South	72	74	0	-46	3	31		
		HIK - 58	West	83	70	0	-47	3	26		
		HIK - 62	East	113	75	-5	-49	3	24		
		HIK - 63	West	124	74	0	-50	3	27		
		HIK - 75	West	96	63	0	-48	3	18		
		HIK - 76	West	153	75	0	-52	3	26		
		HIK - 91	East	144	68	-10	-51	3	10		
		Outdoor Unit A	-	83	86	0	-47	3	42		
		Outdoor Unit B	-	75	88	0	-46	3	45		
		Outdoor Unit C	-	73	68	0	-46	3	25		
		Outdoor Unit 1	-	147	88	-10	-51	3	30		
		Outdoor Unit 2	-	146	80	-10	-51	3	22	**49**	**50**
TAW-5-3											
TAW-5-3 (Scenario 1) [2]	Joyville	HIK - 06	West	138	75	0	-51	3	27		
		HIK - 09	West	132	76	0	-51	3	28		
		HIK - 13	West	133	72	0	-51	3	24		
		HIK - 15	West	154	70	0	-52	3	21		
		HIK - 16	East	148	69	-10	-52	3	10		
		HIK - 17	West	161	76	0	-52	3	27		
		HIK - 24	South	195	87	-10	-54	3	26		
		HIK - 25	South	210	-	-10	-55	3	-		
		HIK - 30	East	188	67	-10	-54	3	6		
		HIK - 35	East	187	71	-10	-54	3	10		
		HIK - 37	East	183	70	-10	-53	3	10		
		HIK - 40	East	177	67	-10	-53	3	7		
		HIK - 42	West	157	80	0	-52	3	31		
		HIK - 45	South	171	82	0	-53	3	32		
		HIK - 46	West	175	63	0	-53	3	13		
		HIK - 49	South	202	74	0	-54	3	23		
		HIK - 58	West	157	70	0	-52	3	21		
		HIK - 62	East	148	75	-5	-52	3	21		
		HIK - 63	West	165	74	0	-52	3	25		
		HIK - 75	West	149	63	0	-52	3	14		
		HIK - 76	West	138	75	0	-51	3	27		
		HIK - 91	East	148	68	-10	-52	3	9		
		Outdoor Unit A	-	160	86	0	-52	3	37		
		Outdoor Unit B	-	165	88	0	-53	3	38		
		Outdoor Unit C	-	168	68	0	-53	3	18		
		Outdoor Unit 1	-	137	88	0	-51	3	40		
		Outdoor Unit 2	-	138	80	0	-51	3	32	**45**	**50**

Annex A Detail Calculation of Fixed Plant Noise Assessment

Fixed Plant Noise Calculation - HIK 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, dB(A)	Façade Correction, dB(A)	Predicted SPL, dB(A)	Total SPL, dB(A)	Night-time Noise Criteria, dB(A)
TAW-5-3											
TAW-5-3 (Scenario 2) [2]	Joyville	HIK - 06	West	138	75	0	-51	3	27		
		HIK - 09	West	132	76	0	-51	3	28		
		HIK - 13	West	133	72	0	-51	3	24		
		HIK - 15	West	154	70	0	-52	3	21		
		HIK - 16	East	148	69	-10	-52	3	10		
		HIK - 17	West	161	76	0	-52	3	27		
		HIK - 24	South	195	-	-10	-54	3	-		
		HIK - 25	South	210	90	-10	-55	3	28		
		HIK - 30	East	188	67	-10	-54	3	6		
		HIK - 35	East	187	71	-10	-54	3	10		
		HIK - 37	East	183	70	-10	-53	3	10		
		HIK - 40	East	177	67	-10	-53	3	7		
		HIK - 42	West	157	80	0	-52	3	31		
		HIK - 45	South	171	82	0	-53	3	32		
		HIK - 46	West	175	63	0	-53	3	13		
		HIK - 49	South	202	74	0	-54	3	23		
		HIK - 58	West	157	70	0	-52	3	21		
		HIK - 62	East	148	75	-5	-52	3	21		
		HIK - 63	West	165	74	0	-52	3	25		
		HIK - 75	West	149	63	0	-52	3	14		
		HIK - 76	West	138	75	0	-51	3	27		
		HIK - 91	East	148	68	-10	-52	3	9		
		Outdoor Unit A	-	160	86	0	-52	3	37		
		Outdoor Unit B	-	165	88	0	-53	3	38		
		Outdoor Unit C	-	168	68	0	-53	3	18		
		Outdoor Unit 1	-	137	88	0	-51	3	40		
		Outdoor Unit 2	-	138	80	0	-51	3	32	**45**	**50**
TAW-6-5											
TAW-6-5 (Scenario 1) [2]	Hin Keng Estate - Hin Yau House	HIK - 06	West	190	75	-10	-54	3	14		
		HIK - 09	West	179	76	-10	-53	3	16		
		HIK - 13	West	171	72	-10	-53	3	12		
		HIK - 15	West	123	70	-10	-50	3	13		
		HIK - 16	East	174	69	-5	-53	3	14		
		HIK - 17	West	112	76	-10	-49	3	20		
		HIK - 24	South	71	87	0	-45	3	45		
		HIK - 25	South	59	-	0	-43	3	-		
		HIK - 30	East	89	67	-5	-47	3	18		
		HIK - 35	East	98	71	0	-48	3	26		
		HIK - 37	East	105	70	0	-48	3	25		
		HIK - 40	East	116	67	0	-49	3	21		
		HIK - 42	West	119	80	-10	-50	3	23		
		HIK - 45	South	100	82	-10	-48	3	27		
		HIK - 46	West	96	63	-10	-48	3	8		
		HIK - 49	South	65	74	0	-44	3	33		
		HIK - 58	West	117	70	-10	-49	3	14		
		HIK - 62	East	144	75	0	-51	3	27		
		HIK - 63	West	139	74	-5	-51	3	21		
		HIK - 75	West	132	63	-10	-50	3	6		
		HIK - 76	West	187	75	-10	-53	3	15		
		HIK - 91	East	171	68	-5	-53	3	13		
		Outdoor Unit A	-	114	86	-10	-49	3	30		
		Outdoor Unit B	-	105	88	-10	-48	3	33		
		Outdoor Unit C	-	102	68	-10	-48	3	13		
		Outdoor Unit 1	-	182	88	-10	-53	3	28		
		Outdoor Unit 2	-	180	80	-10	-53	3	20	**46**	**50**
TAW-6-5											
TAW-6-5 (Scenario 2) [2]	Hin Keng Estate - Hin Yau House	HIK - 06	West	190	75	-10	-54	3	14		
		HIK - 09	West	179	76	-10	-53	3	16		
		HIK - 13	West	171	72	-10	-53	3	12		
		HIK - 15	West	123	70	-10	-50	3	13		
		HIK - 16	East	174	69	-5	-53	3	14		
		HIK - 17	West	112	76	-10	-49	3	20		
		HIK - 24	South	71	-	0	-45	3	-		
		HIK - 25	South	59	90	0	-43	3	50		
		HIK - 30	East	89	67	-5	-47	3	18		
		HIK - 35	East	98	71	0	-48	3	26		
		HIK - 37	East	105	70	0	-48	3	25		
		HIK - 40	East	116	67	0	-49	3	21		
		HIK - 42	West	119	80	-10	-50	3	23		
		HIK - 45	South	100	82	-10	-48	3	27		
		HIK - 46	West	96	63	-10	-48	3	8		
		HIK - 49	South	65	74	0	-44	3	33		
		HIK - 58	West	117	70	-10	-49	3	14		
		HIK - 62	East	144	75	0	-51	3	27		
		HIK - 63	West	139	74	-5	-51	3	21		
		HIK - 75	West	132	63	-10	-50	3	6		
		HIK - 76	West	187	75	-10	-53	3	15		
		HIK - 91	East	171	68	-5	-53	3	13		
		Outdoor Unit A	-	114	86	-10	-49	3	30		
		Outdoor Unit B	-	105	88	-10	-48	3	33		
		Outdoor Unit C	-	102	68	-10	-48	3	13		
		Outdoor Unit 1	-	182	88	-10	-53	3	28		
		Outdoor Unit 2	-	180	80	-10	-53	3	20	**50**	**50**

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.
[2] HIK-24 and HIK-25 will not be operated at the same time. HIK-24 will only be in operation in scenario 1, while HIK-25 will only be in operation in scenario 2. Either scenario 1 or 2 will be operated at a time.

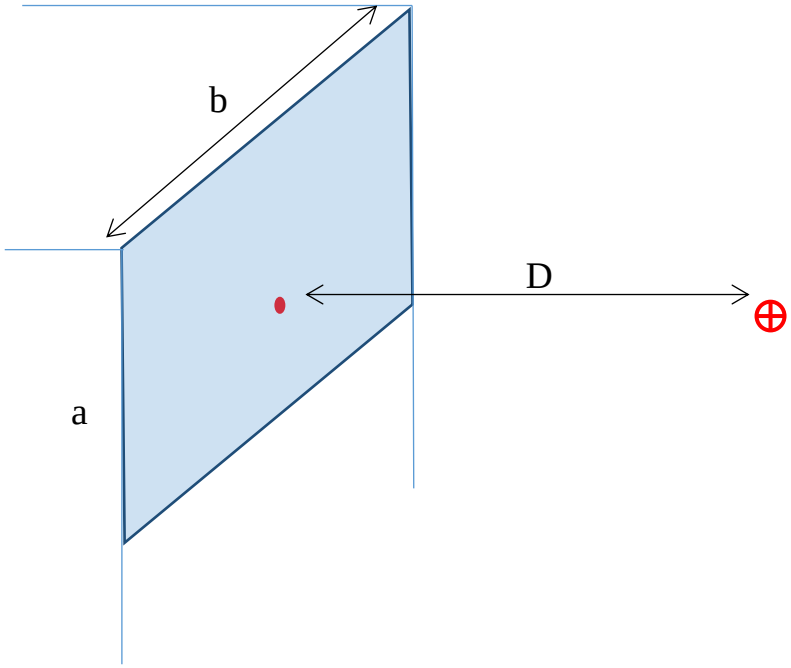
Appendix B

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.

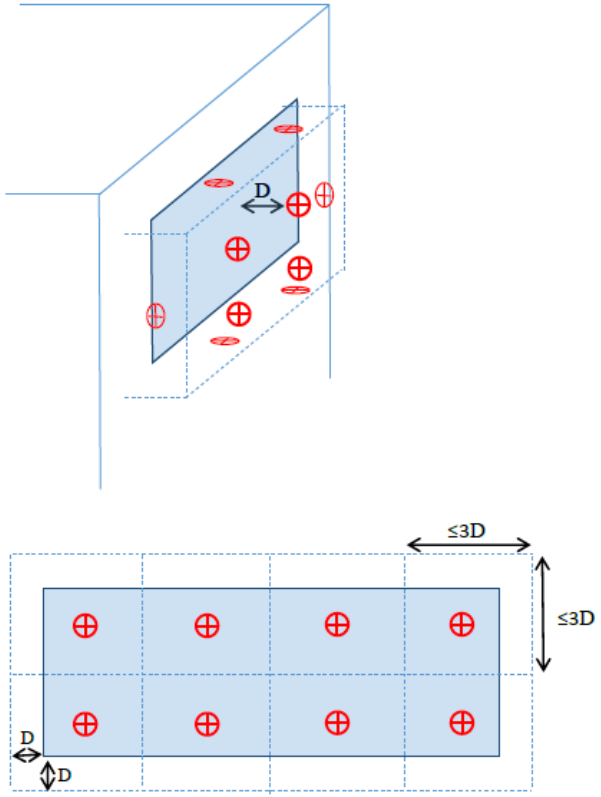
Louver opening
Proposed measurement point (microphone pointing perpendicular to the center of the louvre)

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 $L_{Aeq,\ 1\ min}$ 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 characheristics at representative NSRs.

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

Method 2: Near-Field Testing Method for Louver



D: Measurement distance

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

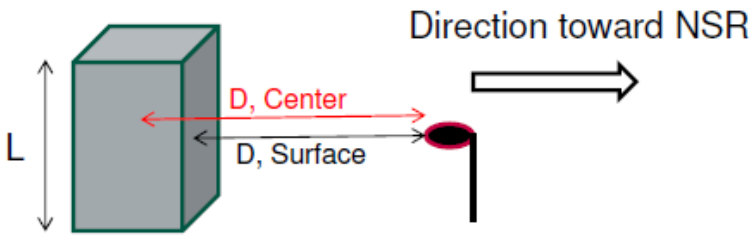
For method 2 (developed based on the principle of ISO3746:2010),

- 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 louver.
- For louvre with largest dimension ≤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 louver 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 characheristics at representative NSRs.

SWL = Mean LAeq over all measurement points + 10 log (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



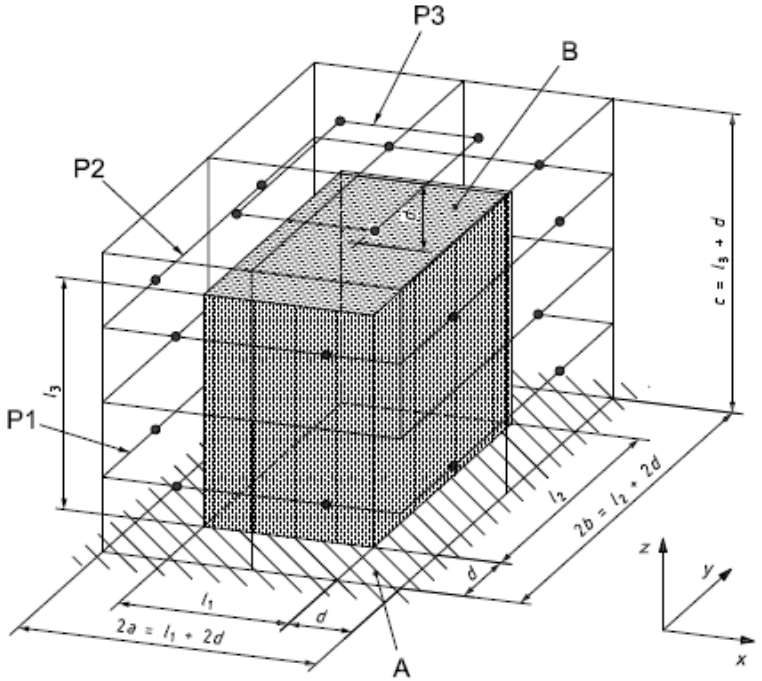
"L" is the longest side of the plant item
"D, Center" is the separation between center of the plant item and microphone
"D, Surface" is the separation between surface of the plant item and microphone

- "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 $L_{Aeq,\ 1\ min}$ 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 characheristics at representative NSRs.

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

Method 4 – Near Field Testing Method for Plant Item



Key

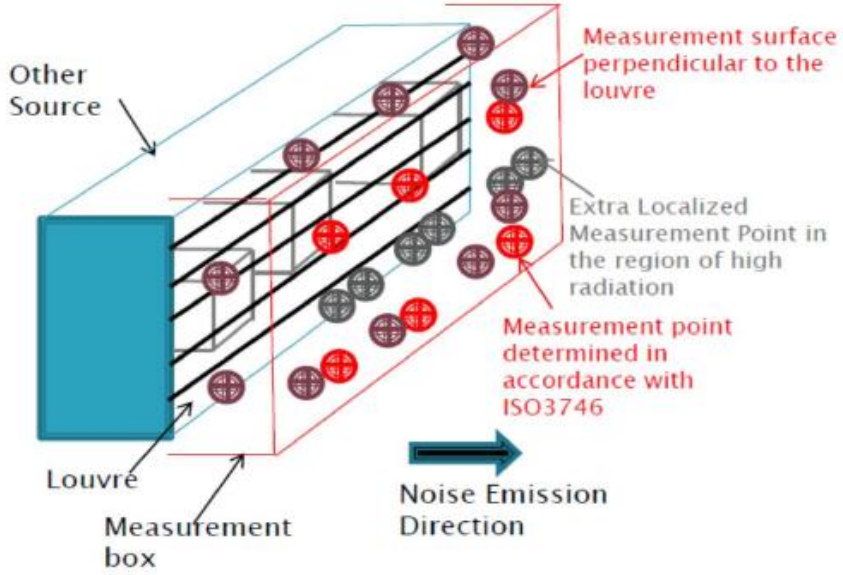
For Method 4 (based on ISO3746:2010),

- 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 characheristics at representative NSRs.

SWL = Mean L_{Aeq} over all measurement points + 10 log (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 louver.
- 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 characheristics at representative NSRs.

SWL = Mean L_{Aeq} over all measurement points + 10 log (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

Cert B1: Calibration Certificate of Sound Level Meter **SVAN979**(SN: 46199)

FACTORY CALIBRATION DATA OF THE SVAN 979 *No. 46199*

with preamplifier SVANTEK type SV17 No. 57845 and microphone G.R.A.S. type 40AE No. 266219.

SOUND LEVEL METER

1. CALIBRATION (electrical)

LEVEL METER function; Characteristic: A; f_{an}=1kHz; Input signal =114 dB;

Range	Low (120dB)	High (137dB)
Indication [dB]	114.0	114.0
Error [dB]	0.0	-0.0

2. CALIBRATION* (acoustical)

LEVEL METER function; Range: High; Reference frequency: 1000Hz; Sound Pressure Level: 113.95 dB

Characteristic	Correct value [dB]	Indication [dB]	Error [dB]
Z	113.77	113.76	-0.01
A	113.77	113.76	-0.01
C	113.77	113.76	-0.01

Calibration measured with the microphone G.R.A.S. type 40AE No. 266219. Calibration factor: -0.66 dB

3. LINEARITY TEST* (electrical)

LEVEL METER function; Range: Low; Characteristic: A; f_{an}= 31.5 Hz

Nominal result LEQ [dB]	20.0	21.0	22.0	30.0	40.0	60.0	80.0
Error [dB]	0.1	0.1	0.1	0.0	0.0	0.0	0.0

LEVEL METER function; Range: Low; Characteristic: A; f_{an}= 1000 Hz

Nominal result LEQ [dB]	20.0	21.0	22.0	30.0	40.0	60.0	80.0	100.0	120.0
Error [dB]	0.1	0.1	0.0	-0.0	-0.0	-0.0	-0.0	0.0	-0.0

LEVEL METER function; Range: Low; Characteristic: A; f_{an}= 8000 Hz

Nominal result LEQ [dB]	20.0	21.0	22.0	30.0	40.0	60.0	80.0	100.0	119.0
Error [dB]	0.1	0.1	0.1	-0.0	-0.0	0.0	0.0	0.0	0.0

LEVEL METER function; Range: High; Characteristic: A; f_{an}= 31.5 Hz

Nominal result LEQ [dB]	28.0	29.0	30.0	40.0	60.0	80.0	97.0
Error [dB]	0.2	0.2	0.1	0.0	0.0	-0.0	0.0

LEVEL METER function; Range: High; Characteristic: A; f_{an}= 1000 Hz

Nominal result LEQ [dB]	28.0	29.0	30.0	40.0	60.0	80.0	100.0	120.0	137.0
Error [dB]	0.2	0.2	0.1	0.0	0.0	0.0	-0.0	-0.0	-0.0

LEVEL METER function; Range: High; Characteristic: A; f_{an}= 8000 Hz

Nominal result LEQ [dB]	28.0	29.0	30.0	40.0	60.0	80.0	100.0	120.0	136.0
Error [dB]	0.2	0.1	0.1	-0.0	0.0	0.0	0.0	0.0	0.0

1/3 OCTAVE (1kHz); Range: High; f_{an}= 1000 Hz

Nominal result [dB]	35.0	40.0	60.0	80.0	100.0	120.0	135.0	137.0
Error [dB]	0.1	0.0	0.0	0.0	-0.0	-0.0	-0.0	-0.0

4. TONE BURST RESPONSE*

LEVEL METER function; Characteristic: A; F_{sin}= 4000 Hz; Burst duration: 2s

Range: Low; Steady level nominal result = 117dB

Result	Detector	Duration [ms]	1000	500	200	100	50	20	10	5	2	1	0.5	0.25
MAX	Fast	Indication [dB]	117.0	116.9	116.0	114.4	112.2	108.7	105.8	102.9	99.0	95.9	92.9	89.9
		Error [dB]	0.0	0.0	0.0	0.0	-0.0	-0.0	-0.0	0.0	-0.0	-0.0	-0.1	-0.1
	Slow	Indication [dB]	115.0	112.9	109.6	106.8	103.9	100.0	97.0	94.0	90.0	-	-	-
		Error [dB]	0.0	0.1	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-	-	-
SEL	-	Indication [dB]	117.0	114.0	110.0	107.0	104.0	100.0	97.0	94.0	90.0	86.9	83.9	80.8
		Error [dB]	0.0	-0.0	0.0	0.0	-0.0	0.0	-0.0	-0.0	-0.0	-0.0	-0.1	-0.1

Range: Low; Steady level nominal result = 57dB

Result	Detector	Duration [ms]	1000	500	200	100	50	20	10	5	2	1	0.5
MAX	Fast	Indication [dB]	57.0	56.9	56.0	54.4	52.2	48.7	45.9	42.9	39.0	35.9	32.9
		Error [dB]	0.0	0.0	0.0	-0.0	-0.0	-0.0	-0.0	0.0	-0.0	-0.1	-0.1
	Slow	Indication [dB]	55.0	53.0	49.6	46.8	43.9	40.0	37.0	34.0	30.0	-	-
		Error [dB]	0.0	0.1	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-	-
SEL	-	Indication [dB]	57.0	54.0	50.0	47.0	44.0	40.0	37.0	34.0	30.0	27.0	24.0
		Error [dB]	0.0	-0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.0	0.0

Range: Low; Steady level nominal result = 32dB

Result	Detector	Duration [ms]	1000	500	200
MAX	Fast	Indication [dB]	31.9	31.9	31.0
		Error [dB]	-0.0	-0.0	0.1
	Slow	Indication [dB]	29.9	27.9	24.6
		Error [dB]	-0.0	0.0	0.0
SEL	-	Indication [dB]	31.9	28.9	25.1
		Error [dB]	-0.0	-0.0	0.1

Range: High; Steady level nominal result = 134dB

Result	Detector	Duration [ms]	1000	500	200	100	50	20	10	5	2	1	0.5	0.25
MAX	Fast	Indication [dB]	134.0	133.9	133.0	131.4	129.2	125.7	122.8	119.9	116.0	112.9	109.9	106.9
		Error [dB]	0.0	0.0	0.0	0.0	-0.0	-0.0	-0.1	0.0	-0.0	-0.1	-0.1	-0.1
	Slow	Indication [dB]	132.0	129.9	126.6	123.8	120.9	117.0	114.0	111.0	107.0	-	-	-
		Error [dB]	0.0	0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-	-	-
SEL	-	Indication [dB]	134.0	131.0	127.0	124.0	121.0	117.0	114.0	111.0	107.0	103.9	100.9	97.9
		Error [dB]	0.0	-0.0	0.0	0.0	-0.0	0.0	-0.0	-0.0	-0.0	-0.1	-0.1	-0.1

Range: High; Steady level nominal result = 54dB

Result	Detector	Duration [ms]	1000	500	200	100	50	20	10
MAX	Fast	Indication [dB]	54.0	53.9	53.0	51.4	49.2	45.7	42.9
		Error [dB]	-0.0	-0.0	0.0	-0.0	-0.0	-0.0	-0.0
	Slow	Indication [dB]	52.0	49.9	46.6	43.8	40.9	37.0	33.9
		Error [dB]	-0.0	0.0	-0.0	-0.0	-0.0	0.0	-0.1
SEL	-	Indication [dB]	54.0	51.0	47.0	44.0	41.0	37.0	34.1
		Error [dB]	-0.0	-0.0	0.0	0.0	-0.0	0.0	0.1

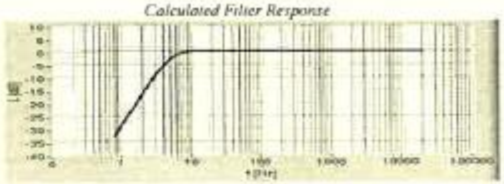
Range: High; Steady level nominal result = 40dB

Result	Detector	Duration [ms]	1000	500	200
MAX	Fast	Indication [dB]	40.1	39.9	39.0
		Error [dB]	0.1	0.0	0.0
	Slow	Indication [dB]	38.0	35.9	32.4
		Error [dB]	0.1	0.0	-0.2
SEL	-	Indication [dB]	40.0	37.0	33.1
		Error [dB]	0.1	0.1	0.2

5. FREQUENCY RESPONSE* (electrical)

LEVEL METER function; Characteristic: Z; Range: High; Input signal =135 dB;

Calculated Filter Response



Measured Filter Response with Preamplifier SV17
(f-frequency, L-level)

f [Hz]	L [dB]	f [Hz]	L [dB]	f [Hz]	L [dB]
10	-0.2	63	-0.0	4000	0.0
12.5	-0.1	125	0.0	8000	0.9
16	-0.0	250	0.0	16000	0.1
20	-0.0	500	0.0	20000	0.0
25	-0.0	1000	0.0		
31.5	-0.0	2000	0.0		

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

6. INTERNAL NOISE LEVEL* (electrical - compensated)

LEVEL METER function; Range: Low; (Back-light – off) ; Calibration factor: 0dB

Characteristic	Z	A	C
Level [dB]	<20	<10	<11

* measured with preamplifier SVANTEK type SV17 No. 57845.

7. INTERNAL NOISE LEVEL (acoustical - compensated)

LEVEL METER function; Characteristic: A; (Backlight – off)

Range	Low	High
Indication [dB]	<12	14.4

Noise measured in special chamber, with reference microphone G.R.A.S type 40AN No. 73421

VIBRATION LEVEL METER

1. CALIBRATION (electrical)

LEVEL METER function; Characteristic: HP10; f=79,6Hz; Input signal =140dB;

Range	Low	High
Indication [dB]	140.0	140.0
Error [dB]	0.0	-0.0

2. CALIBRATION (vibrational)

LEVEL METER function; Range: High; Input signal: 120dB;

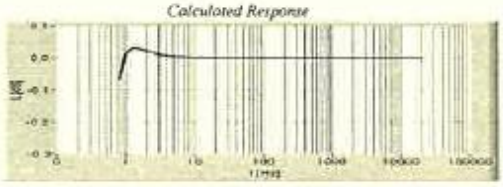
Characteristic	Reference frequency [Hz]	Correct value [dB]	Indication [dB]	Error [dB]
HP1	79,577	120.0	119.9	-0.1
HP10	79,577	120.0	119.9	-0.1
H-A	79,577	106.1	106.0	-0.1
W-Bxy	15,915	102.0	101.9	-0.1
W-Bc	15,915	110.6	110.5	-0.1

Calibration measured with the accelerometer SVANTEK type SV80 No. D5669. Calibration factor: -0.31dB

3. FREQUENCY RESPONSE (electrical)

1/3 OCTAVE function; Characteristic: HP; Range: High; input=175 dB;

Calculated Response



Measured Response (f-frequency, L-level)

f [Hz]	L [dB]	f [Hz]	L [dB]	f [Hz]	L [dB]
0.8	-0.1	5	0.0	500	0.0
1	-0.0	6.3	0.0	1000	0.0
1.25	0.0	8	0.0	2000	0.0
1.6	0.0	10	0.0	4000	0.0
2	0.0	31.5	0.0	8000	0.0
2.5	0.0	63	0.0	16000	0.0
3.15	0.0	125	0.0	20000	0.0
4	0.0	250	0.0		

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

4. INTERNAL NOISE LEVEL (electrical)

LEVEL METER function; Range: Low; Back-light – off

Characteristic	HP1	HP10	H-A	WBx-y	WBc
Indication [dB]	50.8	50.7	34.6	40.9	40.6

ENVIRONMENTAL CONDITIONS

Temperature	Relative humidity	Ambient pressure
23.2 °C	43%	1004 hPa

TEST EQUIPMENT

Item	Manufacturer	Model	Serial no.	Description
1.	SVANTEK	SVAN 401	87	Signal generator
2.	SVANTEK	SVAN 912A	6120	Sound &Vibration Analyser
3.	KEITHLEY	2000	0910165	Digital multimeter
4.	SVANTEK	SV33	48878	Acoustic calibrator
5.	SVANTEK	ST02	-	Microphone equivalent electrical impedance (18pF)
6.	DYTRAN	3233A	436	Reference accelerometer

CONFORMITY & TEST DECLARATION

1. Herewith Svantek company declares that this instrument has been calibrated and tested in compliance with the internal ISO9001 procedures and meets all specification given in the Manual(s) or respectively surpass them

2. The acoustic calibration was performed using the Sound Calibrator and is traceable to the GUM (Central Office of Measures) reference standard - sound level calibrator type 4231 No 2292773.

3. The vibrational calibration was performed using the Back-to-Back Comparison method and is traceable to the GUM (Central Office of Measures) reference standard - accelerometer type 8305 No 1435233.

4. The information appearing on this sheet has been compiled specifically for this instrument. This form is produced with advanced equipment & procedures which permit comprehensive quality assurance verification of all data supplied herein.

5. This calibration sheet shall not be reproduced except in full, without written permission of the SVANTEK Ltd.

Calibration specialist: Krzysztof Czachor .....

Test date: 2017-05-04

Cert B2: Calibration Certificate of Sound Level Meter **Rion NL-52**(SN: 00564841)

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:

Equipment No.	Description	Cert. No.	Traceable to
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., Wall Fung Industrial Centre, No. 58-76, Ta Chuen Ping Street,Kwai Chung, NT,Hong Kong.
Tel: 2425 8601 Fax: 2425 8646

Calibration Certificate

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

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 ----------

Cert B3: Calibration Certificate of Sound Level Meter **Norsonic 140** (SN: 1406038)

ESG Matters

Certificate of Calibration

Certificate No.: A180012

Test object:	Manufacturer :	Type :	Serial No.:
Sound level meter :	Norsonic	140	1406038
Microphone :	Norsonic	1225	271073
Preamplifier :	Norsonic	1209	20087
Sound calibrator :	none		

Customer: Supreme Acoustics Research Ltd.
Address: Room 3915, 39/F, Hong Kong Plaza, 188 Connaught Road West, Hong Kong

The measurements are performed according to the IEC 61260 (1995).
Acoustical levels are stated relative to 20µPa. Other dB levels are relative values.
The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k, which with the reported effective degree of freedom corresponds to coverage probability of approximately 95%. The standard uncertainty of measurement has been determined in accordance with EA publication EA-4/02

Reference equipment used in the calibration

Description:	Model:	Serial No.	Expiry Date:	Traceable to:
Multi-function sound calibrator	SME Calibration Unit 483B	31065	18-Jun-2019	PTB, Braunschweig, Germany
Signal generator	DS 360	123901	13-Dec-2018	National Institute of Standards and Technology

Statement of Conformity.
The sound level meter submitted for testing has successfully completed the class 1 tests of IEC 61260 (1995), for the environmental conditions under which the tests were performed. As public evidence was available, from an independent testing organization responsible for approving the results of pattern evaluation tests performed in accordance with IEC 61260(1995), to demonstrate that the model of sound level meter fully conforms to the requirements in the IEC 61260(1995), the sound level meter submitted for testing conforms to the class 1 requirements of IEC 61260.

Environmental conditions:	Pressure :	Temperature :	Humidity :
Reference conditions:	101,325 kPa	23,0 °C	50 %RH
Measurement conditions :	101,2 ±0,50 kPa	23,9°±1,0 °C	51,4 ±2,0 %RH

Date of calibration: 2018-08-28
Date of issue: 2018-08-29
Engineer Jacky Chow
Supervisor James Cho

ESG Matters Limited
1818-19, Tower A, Regent Centre, 63 Wo Yi Hop Road, Hong Kong
Tel : 2525 8033 Website : www.esgmatters.asia Email : info@esgmatters.asia

Preconditioning :
The equipment was preconditioned for more than 12 hours at the specified calibration temperature and humidity.

Measurement method :
A description of the calibration procedure (ESG-NOISE-001) is available separately from the calibration laboratory.

Summary of Measurement Results

Filter Test - IEC 61260 1/1octave:	Anti Alias Filter - IEC 61260, Clause 4.8 & #5.7	Passed
Filter Test - IEC 61260 1/1octave:	Filter integrated response - IEC 61260, Clause 4.5 & 5.4	Passed
Filter Test - IEC 61260 1/1octave:	Linear operating range - IEC 61260, Clause 4.6 & #5.5	Passed
Filter Test - IEC 61260 1/1octave:	Relative attenuation - IEC 61260, Clause 4.4 & #5.3	Passed
Filter Test - IEC 61260 1/1octave:	Real time operation - IEC 61260, Clause 4.7 & #5.6	Passed
Filter Test - IEC 61260 1/1octave:	Flat frequency response - IEC 61260, Clause 4.10 & #5.9	Passed
Filter Test - IEC 61260 1/3octave:	Filter integrated response - IEC 61260, Clause 4.5 & 5.4	Passed
Filter Test - IEC 61260 1/3octave:	Linear operating range - IEC 61260, Clause 4.6 & #5.5	Passed
Filter Test - IEC 61260 1/3octave:	Relative attenuation - IEC 61260, Clause 4.4 & #5.3	Passed
Filter Test - IEC 61260 1/3octave:	Real time operation - IEC 61260, Clause 4.7 & #5.6	Passed
Filter Test - IEC 61260 1/3octave:	Summation of output signals - IEC 61260, Clause 4.9 & #5.8	Passed
Filter Test - IEC 61260 1/3octave:	Flat frequency response - IEC 61260, Clause 4.10 & #5.9	Passed

Records:
D:\Calibration\slmcal\Nor140_1406038_M5.nmf

Verification:
The verification measurements have been performed using the calibration system Nor1504A with software type Nor1019.
Most of the verification tests are electrical tests. Test signals are fed to the sound measuring device through an adapter that resembles the microphone signal. A special adapter with a suitable electrical characteristic is used.

Detailed measurement results are printed on the following pages.
Each of the verification test points has a Result indication (P, U, or N) that tells the obtained result of the actual test.
P = the result is Passed
U = the result is not passed due to the high Uncertainty of the measurement.
N = the result is Not passed
All verification tests must have a Passed indication in order to fulfill the requirements in the IEC61260(1995) standard.

ESG Matters Limited
1818-19, Tower A, Regent Centre, 63 Wo Yi Hop Road, Hong Kong
Tel : 2525 8033 Website : www.esgmatters.asia Email : info@esgmatters.asia

Cert B4: Calibration Certificate of Acoustic Calibrator **SVANTEK SV35A** (SN: 58708)

Hong Kong Calibration Ltd.
香 港 校 正 有限公司

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:

Equipment No.	Description	Cert. No.	Traceable to
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

Date: 16-Apr-18

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

E

Hong Kong Calibration Ltd.
香 港 校 正 有限公司

Calibration Certificate

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 : $\pm 3.6 \times 10^{-6}$

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 ----------

Cert B5: Calibration Certificate of Acoustic Calibrator **B&K 4231** (SN: 2084888)

ESG Matters

Certificate of Calibration

Certificate No.: B180001

Test object:	Sound Calibrator
Manufacturer:	Brüel and Kjær
Type:	4231
Serial no:	2084888
Customer:	Supreme Acoustics Research Ltd.
Address:	Room 3915, 39/F, Hong Kong Plaza, 188 Connaught Road West, Hong Kong

All tests are performed according to IEC 60942 : 2003, Annex B.

The stated levels are relative to 20µPa. The distortion value (in %) is the signal to total noise ratio.

The calibrator was placed on top of the reference microphone, only held in place by gravity. At least three repetitions have been performed. No adapter ring was needed to obtain half inch configuration.

	Level	Level stability	Frequency	Frequency stability	Distortion
Nominal	94 dB dB		1 kHz		
Result (Average):	**93,91 dB**	**0,01 dB**	**999,90 Hz**	**0,00 %**	**0,85 %**
Expanded Uncertainty:	0,10 dB	0,02 dB	1,0 Hz	0,0 %	0,3 %

The calibrator level was not adjusted.

Statement of Conformity. No evidence is found showing that this test object is type approved.
The sound calibrator has been shown to conform to the class 1 requirements for periodic testing, described in Annex B of IEC 60942:2002 for the sound pressure level(s) and frequency(ies) stated, for the environmental conditions under which the tests were performed. However, as public evidence was not available, from a testing organization responsible for pattern approval, to demonstrate that the model of sound calibrator conformed to the requirements for pattern evaluation described in Annex A of IEC 60942:2003, no general statement or conclusion can be made about conformance of the sound calibrator to the requirements of IEC 60942:2003.

Date of calibration:	2018-08-21
Date of issue:	2018-08-27

Environmental conditions:	Pressure:	Temperature:	Relative humidity:
Reference conditions:	101,325 kPa	23,0 °C	50 %RH
Measurement conditions:	101,20 ± 0,50 kPa	23,8 ± 1,0 °C	51,5 ± 2,0 %RH

Records: D:\calibration\calcal\BNK4231_2084888_M2.nmf

The verification measurements were performed using the calibration system Nor1504A with software type Nor1018, software version: 6.2 NCL. As acoustical reference was used WSM1 - Nor1225-208202 with sensitivity: 49,14 mV/Pa.

A detailed description of the calibration procedure is separately available. ESG-NOISE-002: Procedure for Calibration of Acoustic Calibrators

Engineer Jacky Chow
Supervisor James Choi

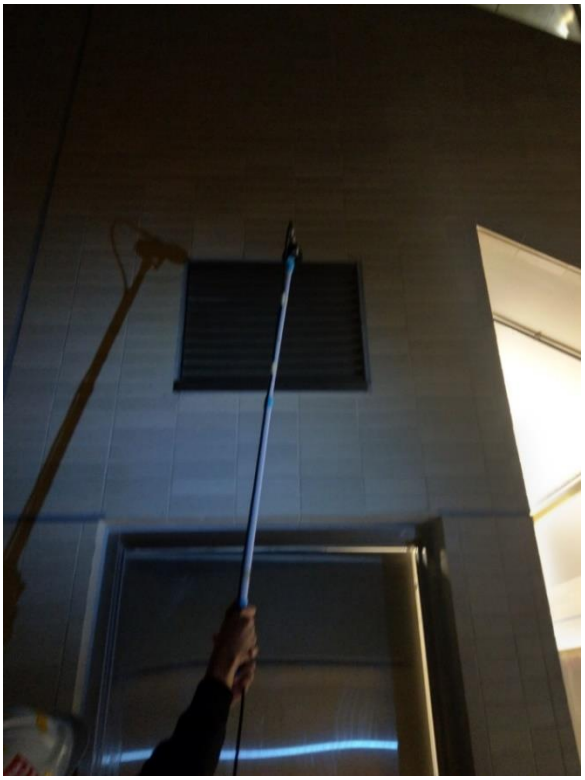
ESG Matters Limited
1818-9, Tower A, Regent Centre, 63 Wo Yi Hop Road, Hong Kong
Tel: 2525 8033 Website: www.esgmatters.asia Email: info@esgmatters.asia

Appendix B3

Photographs showing the Examples of Noise Measurement for Fixed Plant Noise

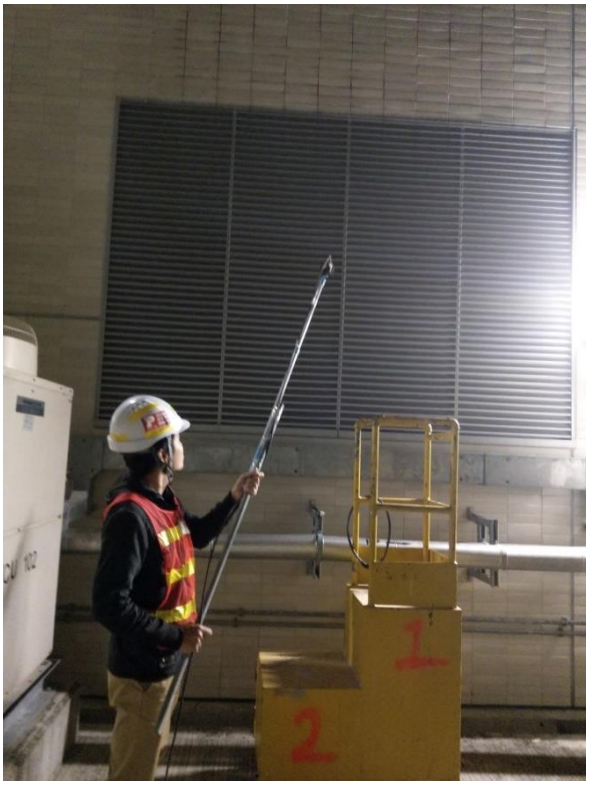
Appendix B3 Photographs showing the Examples of Noise Measurement for Fixed Plant Noise

SWL Measurement for HIK-13



SWL Measurement for HIK-16

SWL Measurement for HIK-17



SWL Measurement for HIK-45

SWL Measurement for HIK-91

SWL Measurement for Outdoor Unit B

Appendix B4

Noise Measurement Results

Appendix B4 Noise Measurement Results

Fixed Plant Source ID	Plant Type	Method	Size of Louvre/Outdoor Unit (mm)			Measurement Distance (m) D [a]	Averaged Measured L_{Aeq} ,dB(A) [b] [1]	Background L_{Aeq} ,dB(A)	Difference L_{Aeq} ,dB(A)	Background Noise Correction Factor, K_{1A} ,dB(A) [2]	Background Corrected L_{Aeq} ,dB(A)[c] [1]-[2]	Total Measurement Surface Area (S), m^2 [e]	Area Correction ,dB(A) [f] [3]	Calculated SWL, dB(A) [1]-[2]+[3]
			Length	Width	Height									
HIK - 06	Louvre	2	1600	900	N/A	1.0	61.40	45.10	16.30	0.00	61.40	23.44	13.70	75
HIK - 09	Louvre	2	1520	3150	N/A	1.0	60.17	48.52	11.65	0.00	60.17	35.47	15.50	76
HIK - 13	Louvre	2	600	750	N/A	1.0	59.06	46.18	12.88	0.00	59.06	17.85	12.52	72
HIK - 15	Louvre	2	1050	480	N/A	1.0	57.80	48.90	8.90	0.60	57.20	18.62	12.70	70
HIK - 16	Louvre	2	600	600	N/A	1.0	57.85	51.69	6.16	1.21	56.64	17.16	12.35	69
HIK - 17	Louvre	2	3200	2200	N/A	1.0	60.38	46.23	14.15	0.00	60.38	40.64	16.09	76
HIK - 24[d]	Louvre	2	4500	8040	N/A	1.0	77.04	62.80	14.24	0.00	77.04	76.26	18.82	96
HIK - 24	Louvre	2	4500	8040	N/A	1.0	69.28	63.40	5.88	1.30	67.98	76.26	18.82	87
HIK - 25[d]	Louvre	2	4500	8040	N/A	1.0	76.68	61.90	14.78	0.00	76.68	76.26	18.82	96
HIK - 25	Louvre	2	4500	8040	N/A	1.0	69.79	62.10	7.69	0.81	68.98	76.26	18.82	88
HIK - 30	Louvre	2	2350	2100	N/A	1.0	52.70	46.60	6.10	1.22	51.48	34.74	15.41	67
HIK - 35	Louvre	2	3000	1870	N/A	1.0	57.91	51.94	5.97	1.27	56.64	25.09	14.00	71
HIK - 37	Louvre	2	3500	1870	N/A	1.0	56.96	51.72	5.24	1.54	55.42	27.03	14.32	70
HIK - 40	Louvre	2	590	1100	N/A	1.0	57.55	50.08	7.47	0.86	56.69	11.21	10.50	67
HIK - 42	Louvre	2	3900	3150	N/A	1.0	63.04	49.50	13.54	0.00	63.04	52.49	17.20	80
HIK - 45	Louvre	2	2840	2750	N/A	1.0	66.70	43.40	23.30	0.00	66.70	30.49	14.84	82
HIK - 46	Louvre	2	1100	750	N/A	1.0	51.90	48.10	3.80	2.34	49.56	20.23	13.06	63
HIK - 49	Louvre	2	1600	11030	N/A	1.0	57.03	52.97	4.06	2.17	54.86	80.17	19.04	74
HIK - 58	Louvre	2	1050	1050	N/A	1.0	59.62	57.31	2.31	3.00	56.62	21.50	13.32	70
HIK - 62	Louvre	2	1000	3000	N/A	1.0	60.47	50.35	10.12	0.00	60.47	31.00	14.91	75
HIK - 63	Louvre	2	1000	3000	N/A	1.0	59.54	45.50	14.04	0.00	59.54	31.00	14.91	74
HIK - 75	Louvre	2	300	300	N/A	1.0	54.02	50.21	3.81	2.33	51.69	14.49	11.61	63
HIK - 76	Louvre	2	600	600	N/A	1.0	63.51	54.11	9.40	0.53	62.98	17.16	12.35	75
HIK - 91	Louvre	2	1000	3100	N/A	1.0	54.50	48.65	5.85	1.31	53.19	31.50	14.98	68
Outdoor Unit A	Outdoor Unit	4	4150	1220	2150	0.5	71.37	48.76	22.61	0.00	71.37	31.62	15.00	86
Outdoor Unit B	Outdoor Unit	4	8150	760	2150	0.5	70.21	53.33	16.88	0.00	70.21	42.45	16.28	86
Outdoor Unit C	Outdoor Unit	4	1230	760	2150	0.5	56.91	51.85	5.06	1.63	55.28	15.40	11.87	67
Outdoor Unit 1	Outdoor Unit	4	2700	900	2300	1.0	70.23	57.78	12.45	0.00	70.23	63.79	18.05	88
Outdoor Unit 2	Outdoor Unit	2	1760	2400	N/A	1.0	65.36	55.50	9.86	0.47	64.89	32.86	15.17	80

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.
d) Operation scenario during daytime/evening period only and the measured SWL will be checked against the respective noise criterion.
e) HIK-24, 25, 35, 37, 40 and 45 and Outdoor Unit A,B and C are with two reflecting planes while the other louvres are with one reflecting plane.
f) Area Correction = 10 log (total surface area over the measurement box,(S))

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

綜合試驗有限公司
SOILS & MATERIALS ENGINEERING CO., LTD.
香港黃竹坑道37號利達中心12樓
12/F., Leader Centre, 37 Wong Chuk Hang Road, Aberdeen, Hong Kong.
E-mail: smec@cigismec.com Website: www.cigismec.com
Tel: (852) 2873 6860
Fax: (852) 2555 7533

HOKLAS 028
CAL

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

1, 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.

2, 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%.

3, 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 Junqi **Date:** 20-Oct-2018 **Company Chop:** SOILS AND MATERIALS ENGINEERING COMPANY LTD 綜合試驗有限公司

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.

綜合試驗有限公司
SOILS & MATERIALS ENGINEERING CO., LTD.
香港黃竹坑道37號利達中心12樓
12/F., Leader Centre, 37 Wong Chuk Hang Road, Aberdeen, Hong Kong.
E-mail: smec@cigismec.com Website: www.cigismec.com
Tel: (852) 2873 6860
Fax: (852) 2555 7533

HOKLAS 028
CAL

CERTIFICATE OF CALIBRATION

(Continuation Page)

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

1, Electrical Tests

The electrical tests were perfomed 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	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.

綜合試驗有限公司
SOILS & MATERIALS ENGINEERING CO., LTD.
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ilac-MRA HOKLAS 028 CAL

CERTIFICATE OF CALIBRATION

Certificate No.: 19CA0311 02

Item tested

Description:	Sound Level Meter (Type 1)	Microphone	Preamp
Manufacturer:	B & K	B & K	B & K
Type/Model No.:	2250-L	4189	ZC0032
Serial/Equipment No.:	2681366	3005374	23853
Adaptors used:	- (N.081.01)	-	-

Item submitted by

Customer Name: AECOM ASIA CO LTD
Address of Customer: -
Request No.: -
Date of receipt: 11-Mar-2019

Date of test: 18-Mar-2019

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	26-Dec-2019	CEPREI

Ambient conditions

Temperature: 21 ± 1 °C
Relative humidity: 55 ± 10 %
Air pressure: 1005 ± 5 hPa

Test specifications

1, 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.
2, 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%.
3, 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 responsesss 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: 19-Mar-2019 Company Chop: SOILS AND MATERIALS ENGINEERING COMPANY LTD. 綜合試驗有限公司

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.

 Form No.CARP152-1/Issue 1/Rev.C/01/02/2007

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CERTIFICATE OF CALIBRATION

(Continuation Page)

Certificate No.: 19CA0311 02 **Page** 2 **of** 2

1, Electrical Tests

The electrical tests were perfomed 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	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: Fong Chun Wai **Date:** 18-Mar-2019

Checked by: Fung Chi Yip **Date:** 19-Mar-2019

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.

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HOKLAS 028
CAL

CERTIFICATE OF CALIBRATION

Certificate No.: 19CA0228 02 **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:	28-Feb-2019

Date of test: 01-Mar-2019

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	26-Dec-2019	CEPREI

Ambient conditions

Temperature:	21 ± 1 °C
Relative humidity:	55 ± 10 %
Air pressure:	1005 ± 5 hPa

Test specifications

1, 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.

2, 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%.

3, 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 Junqi **Date:** 02-Mar-2019 **Company Chop:** SOILS AND MATERIALS ENGINEERING COMPANY LTD. 綜合試驗有限公司

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.

綜合試驗有限公司
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CAL

CERTIFICATE OF CALIBRATION

(Continuation Page)

Certificate No.: 19CA0228 02 **Page** 2 **of** 2

1, Electrical Tests

The electrical tests were perfomed 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	2.1
	Lin	Pass	2.0	2.2
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	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: Fong Chun Wai **Date:** 01-Mar-2019

Checked by: Fung Chi Yip **Date:** 02-Mar-2019

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.

綜合試驗有限公司
SOILS & MATERIALS ENGINEERING CO., LTD.
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CAL

CERTIFICATE OF CALIBRATION

Certificate No.: 19CA0327 01-02 **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

Curstomer:	AECOM ASIA CO LIMITED
Address of Customer:	-
Request No.:	-
Date of receipt:	27-Mar-2019

(N.004.03)

Date of test: 27-Mar-2019

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	33873	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:	22 ± 1 °C
Relative humidity:	55 ± 10 %
Air pressure:	1005 ± 5 hPa

Test specifications

1, 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.

2, The calibrator was tested with its axis vertical facing downwards at the specific frequency using insert voltage technique.

3, 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 Junqi **Date:** 29-Mar-2019 **Company Chop:**

SOILS AND MATERIALS ENGINEERING COMPANY LTD. 綜合試驗有限公司

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

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HOKLAS 028
CAL

CERTIFICATE OF CALIBRATION

(Continuation Page)

Certificate No.: 19CA0327 01-02 **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.

(Output level in dB re 20 μPa)

Frequency Shown Hz	Output Sound Pressure Level Setting dB	Measured Output Sound Pressure Level dB	Estimated Expanded Uncertainty dB
1000	94.00	94.23	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 = 0.014 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 = 1000.0 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 = 0.3 %**

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: Fung Chi Yip **Date:** 27-Mar-2019

Checked by: Fong Chun Wai **Date:** 29-Mar-2019

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.

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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

Curstomer:	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

1, 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.

2, The calibrator was tested with its axis vertical facing downwards at the specific frequency using insert voltage technique.

3, 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 Junqi **Date:** 10-Oct-2018 **Company Chop:** SOILS AND MATERIALS ENGINEERING COMPANY LTD. 綜合試驗有限公司

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

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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.

(Output level in dB re 20 μPa)

Frequency Shown Hz	Output Sound Pressure Level Setting dB	Measured Output Sound Pressure Level dB	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: Fung Chi Yip **Checked by:** Shek Kwong Tat

Date: 10-Oct-2018 **Date:** 10-Oct-2018

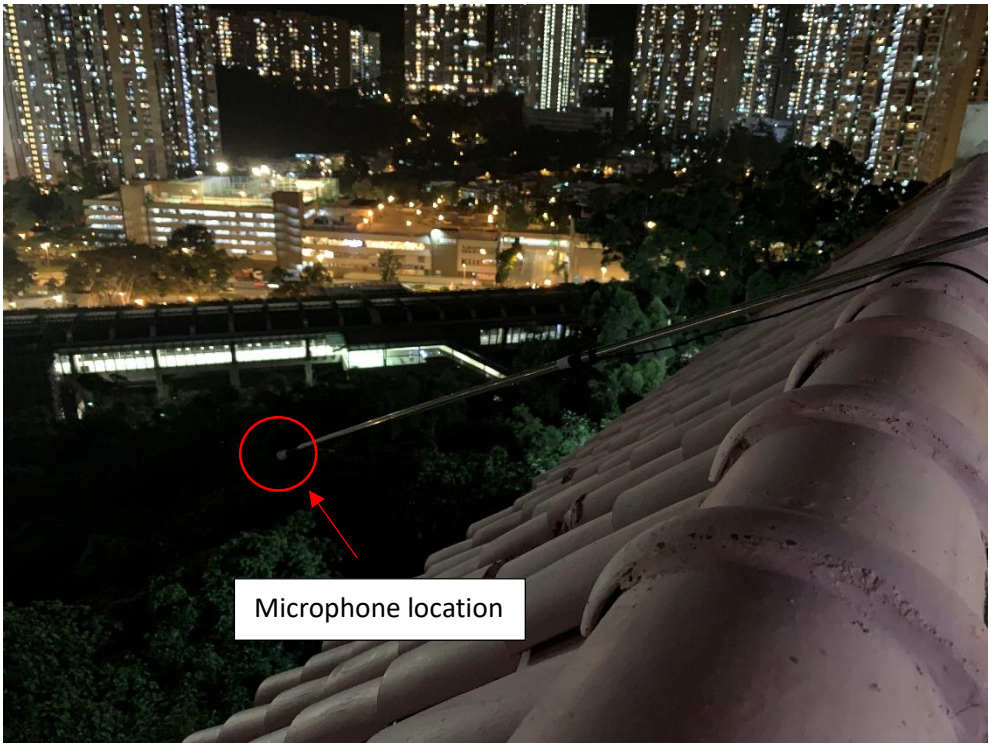
The standard(s) and equipment used in the calibration are traceable to national or international recognised standards and are calibrated on a schedule to maintain the required accuracy level.

Appendix C2

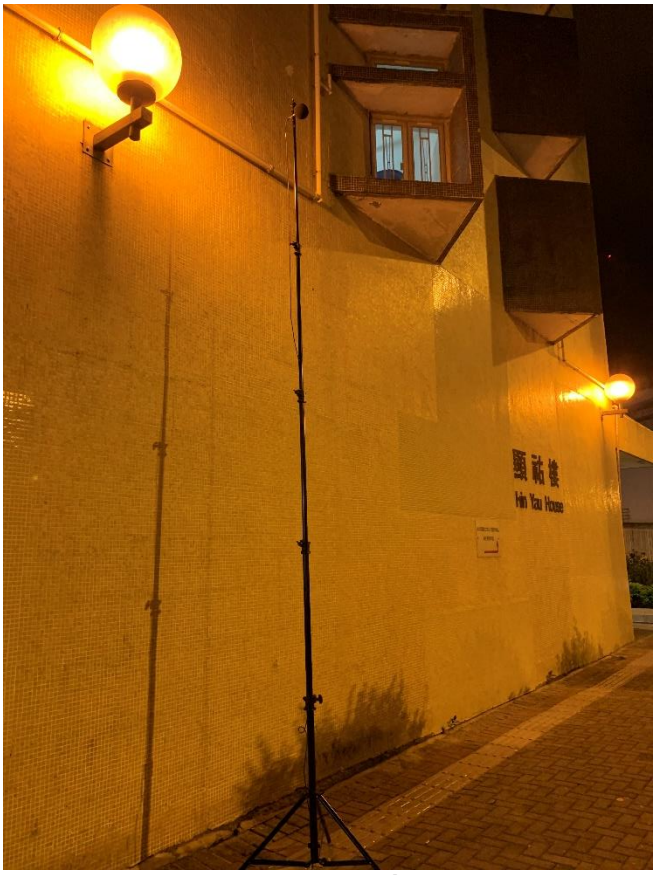
Photographs – Noise Measurement at Representative NSRs

Appendix C2 Photographs – Noise Measurement at Representative NSRs

NSR Measurement Location at TAW-5-2



NSR Measurement Location at TAW-5-3



NSR Measurement Location at TAW-6-5

Appendix C3

Measurement Results at Representative NSRs

Appendix C3 Noise Measurement Results at Measurement Locations

Measurement Location ID	Measurement Date	Operation Scenario [1][2]	Fixed Plant Noise		Background Noise		Difference between Measured Noise Level and Background Level, dB(A)
			Measurement Time	Measured Noise Level, $L_{Aeq\ 30mins}$, dB(A)	Measurement Time	Background Noise Level, $L_{Aeq\ 5mins}$, dB(A)	
TAW-5-2	9/7/2019 - 10/7/2019	Daytime and Evening	21:48:00 - 22:17:59	61.4	20:48:00 - 20:52:59	59.3	2.1
		Night-time	23:00:00 - 23:29:59	57.1	00:05:00 - 00:09:59	55.4	1.7
TAW-5-3	9/7/2019 - 10/7/2019	Daytime and Evening	21:48:00 - 22:17:59	57.9	20:55:00 - 20:59:59	57.9	0.0
		Night-time	23:00:00 - 23:29:59	57.1	00:05:00 - 00:09:59	55.5	1.6
TAW-6-5	9/7/2019 - 10/7/2019	Daytime and Evening	21:48:00 - 22:17:59	63.2	20:55:00 - 20:59:59	62.3	0.9
		Night-time	23:00:00 - 23:29:59	59.5	00:05:00 - 00:09:59	61.5	-2.0

Notes:

(1) Daytime and evening period (i.e 0700 to 2300 hours) and night-time period (i.e. Night: 2300 to 0700 hours).

(2) Fixed plant noise operation during daytime/evening and nigth-time periods have been included according to corresponding fixed plant noise measurement.