MTR Corporation Limited

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

Performance Test Report for Train Noise

(March 2019)

Certified by Environmental Team Leader

Lisa Poon

Date: 27 March 2019

Verified by Independent Environmental Checker

Fredrick Leong

Date: 27.3.2019

Shatin to Central Link - Tai Wai to Hung Hom Section [SCL(TAW – HUH)] and Stabling Sidings at Hung Hom Freight Yard [SCL(HHS)]

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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)]

Performance Test Report for Train Noise (Batch 1 – Operational Airborne Railway Noise)

November 2018

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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 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) 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 2.31, at least one month before commencement of operation of the Project, the Permit Holder, MTR Corporation Ltd (MTR), shall carry out noise performance test and deposit with the Director four hard copies and one electronic copy of a Noise Performance Test Report to confirm the compliance of the operational airborne railway and ground-borne noise levels in accordance with the approved SCL (TAW-HUH) EIA Report (Register No. AEIAR-167/2012) and SCL (HHS) EIA Report (Register No. AEIAR-164/2012).

1.1.4 MTR Corporation Limited (MTR) therefore has commissioned AECOM Asia Co. Ltd to carry out the operational airborne and ground-borne railway noise performance test. As airborne and ground-borne railway noise performance tests would be conducted separately and thus the test reports would be submitted into 2 batches under EP Condition 2.31 to present the findings of airborne and ground-borne railway noise performance tests.

1.1.5 Operational airborne performance tests were conducted at the selected airborne noise sensitive receivers (ABNSRs) in March, June and July 2018.

1.2 Purpose of This Report

1.2.1 This Report (Batch 1 – Operational Airborne Railway Noise) presents the measurement results of the performance tests at the selected measurement locations, and the operational airborne railway noise levels evaluated based on the measurement results to demonstrate the compliance of these noise levels with the relevant noise criteria in the approved SCL (TAW-HUH) and SCL (HHS) EIA Reports.

1.3 Structure of This Report

1.3.1 This Report comprises the following sections:

- Section 1 presents the background information.
- Section 2 presents the train operation parameters during performance tests.
- Section 3 presents the details of the performance tests on operational airborne railway noise.
- Section 4 presents the conclusion.

2 TRAIN OPERATION PARAMETERS DURING PERFORMANCE TEST

2.1 Train Operation Parameters

2.1.1 The operation parameters during the performance test, including train configuration (i.e. 8-car SP1900/SP1950 train or other train type with equivalent noise performance (i.e. 8–car CRC train)) and train speed, aligns with those to be implemented for future operation of SCL(TAW-HUH) and SCL(HHS).

2.1.2 As stipulated in EP Condition 2.26, the maximum train frequency operating on the Project from 0700 to 2300 hours and from 2300 to 0700 hours of the following day shall not exceed 12 trains and 6 trains per 30 minutes in each direction respectively. The difference of maximum train frequency between daytime and night-time is 6 trains per 30 minutes in each direction. As the other operation factors remain constant, and the daytime railway airborne noise level would be 3 dB(A) higher than that during night-time operation, while the night-time noise criterion is 10 dB(A) more stringent than daytime, the compliance of night-time criterion would also represent the compliance of day-time noise criterion. In addition, considering that the intrusive noise and vibration from background vibration induced by road traffic and human activities is expected to be higher in daytime and evening period, the measurement is therefore proposed to be conducted during night-time period only. Airborne noise impact during night-time period would be evaluated by the adoption of appropriate correction factors to account for train frequency.

2.1.3 Based on the findings as discussed in Annex E of MTR South Island Line (East) - Operational Air-borne Noise Performance Test Report, train loading has no significant effect on airborne noise emission of electric multiple unit (EMU). In connection with this, the trains without loading would be employed for the airborne railway noise performance test.

2.2 Evaluation of Railway Noise Levels from Measurement Results of Performance tests

2.2.1 Assumptions of train operation for evaluating airborne railway noise from noise measurement results of performance tests are same as those stipulated in EP Condition 2.26, i.e. the maximum train frequency operating on the Project from hours 0700 to 2300 shall not exceed 12 trains per 30 minutes in each direction, while the maximum train frequency operating from hours 2300 to 0700 of the following day shall not exceed 6 trains per 30 minutes in each direction.

2.2.2 Details of the airborne railway noise performance tests are presented in **Section 3** this Report.

2.3 Implementation of Noise Mitigation Measures

2.3.1 Noise mitigation measures in the vicinity of the airborne noise measurement locations as listed in **Table 3.2** have been fully and properly implemented in accordance with Figures 9a, 9b and 11 of the latest EP (EP No: EP-438/2012/K) during the airborne railway noise performance tests.

3 OPERATIONAL AIRBORNE RAILWAY NOISE PERFORMANCE TEST

3.1 Operational Airborne Railway Noise Criteria

3.1.1 The operational airborne railway noise criteria stipulated in the SCL (TAW-HUH) and SCL (HHS) EIA Reports are shown in **Table 3.1**.

Table 3.1 Operational Airborne Railway Noise Criteria

ABNSR Description	Airborne Railway Noise Criteria								
	$L_{eq, 30min}$, dB(A)						L_{max}, dB(A)		
	Day and Evening Periods (0700 to 2300 hrs)			Night-time Period (2300 to 0700 hrs)			Night-time Period (2300 to 0700 hrs)		
	A	B	C	A	B	C	A	B	C
Churches/temples, schools, medical clinics, libraries, courts and performing arts	60	65	70	50	55	60	85	85	85
Domestic premises, hotels and hospitals	60	65	70	50	55	60	85	85	85

3.1.2 According to Table 8.17 and Table 8.15 of SCL (TAW-HUH) and SCL(HHS) EIA Reports respectively, a 10dB(A) was assumed as the noise contribution from existing East Rail Line and Intercity Train. To take into account the cumulative airborne noise impacts from the existing East Rail Line and Intercity Train, an assessment goal of ANL – 10 dB(A) has been adopted in the assessment. According to Section 8.9 of SCL (TAW-HUH) and SCL(HHS) EM&A Manuals, a performance test will be conducted to check the measured noise levels against the assessment goals and the compliance of the airborne noise levels with the Noise Control Ordinance (NCO) noise criteria.

3.2 Airborne Noise Measurement Locations for Performance test

Review of Area Sensitive Rating

3.2.1 Area Sensitive Ratings (ASR) as defined in the approved SCL(TAW-HUH) and SCL(HHS) EIA Reports were determined by the existence of any influencing factors (e.g. major road, industrial area) according to Technical Memorandum for the Assessment of Noise from Places other than Domestic Premises, Public Places or Construction Sites (IND-TM) at the time of preparation of the EIA Reports. During the performance test, 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.

3.2.2 Based on latest information, Annual Traffic Census 2017 (ATC 2017), Tsing Sha Highway located to the immediate north-south of Festival City (TAW-P1-2), as represented by the annual average daily traffic (AADT) of Eagle's Nest Tunnel, is considered as an Influencing Factor (IF) with the AADT of this road section more than 30,000 (i.e. 54,640 as recorded in ATC 2017). As TAW-P1-2 is located in "Urban Area", the ASR of Festival City (TAW-P1-2) has been assigned as ASR "C" in this evaluation.

3.2.3 ASR for other NSRs selected for the operational airborne railway noise impact assessment in the approved EIA Reports have also been reviewed with details of findings presented in **Appendix A**. It is revealed that the predicted airborne railway noise levels at the NSRs comply with the latest assessment goal.

Selection of Airborne Noise Measurement Locations

3.2.4 As discussed in Section 8 of the approved SCL (TAW-HUH) and SCL (HHS) EIA Reports, adverse operational airborne impacts from the tunnel section are not anticipated. With most of the alignment section under SCL(TAW-HUH) and SCL(HHS) will be in tunnels, airborne

railway noise impact is therefore expected only from the embankment and viaduct section between Hin Keng Station (HIK) and Tai Wai Depot, the at-grade section near HUH and the shunt neck to the north of HHS.

3.2.5 Two worst affected noise sensitive receivers (NSRs), namely Tower 1, Festival City Phase II (TAW-P1-2) and Wing Fung Building (HUH-1-3), have been identified for conducting the operational airborne railway noise performance test according to the prediction results in the approved EIA Reports and the proposed monitoring locations in the approved EM&A Manuals for SCL (TAW-HUH) and SCL (HHS).

3.2.6 Details of TAW-P1-2 and HUH-1-3 are presented in **Table 3.2**, with their locations shown in **Figure Nos. C1103/C/SCL/ACM/M52/016** and **C1103/C/SCL/ACM/M52/017**.

Table 3.2 Measurement Locations for Operational Airborne Railway Noise Performance Test

Measurement Station ID. / NSR ID in EIA	Description	Type	No. of Storey	Measurement Floor
SCL(TAW-HUH)				
NMS-OA-1 /TAW-P1-2	Tower 1, Festival City Phase II	Residential	44	Refuge Floor (19/F)
NMS-OA-2/ HUH-1-3	Wing Fung Building	Residential	8	1/F
SCL(HHS)				
NMS-OA-1/ HUH-1-3	Wing Fung Building	Residential	8	1/F

3.2.7 For TAW-P1-2, based on the railway noise impact assessment conducted for SCL (TAW-HUH) EIA Study, the predicted noise level (i.e. $L_{Aeq,\ 30min}$ 45dB(A) during night-time period) at the measurement floor (19/F) are same as those predicted at the worst affected floor (10/F). It is therefore considered that the noise level at the proposed measurement floor would be able to represent the worst affected floor. For HUH-1-3, the measurement has been conducted at the worst affected floor (i.e. 1/F) as identified in the SCL(HHS) EIA Report.

3.3 Measurement Instrumentation, Parameters and Procedures

3.3.1 The sound level meters used for the airborne railway noise performance test comply with the prevailing International Electrotechnical Commission Publications 651: 1979 (Type 1) and 804: 1985 (Type 1) and other noise measuring and analysis instrumentation are of a comparable professional quality. The measurement instruments adopted for airborne railway noise performance test are provided in **Table 3.3** and the calibration records of the instruments are provided in **Appendix B**.

Table 3.3 Measurement Instrumentation

Instrument	Model No.
Integrating Sound Level Meter	B&K Model 2250L(Serial No.:2681366)
	B&K Model 2270 (Serial No.: 3007965)
	B&K Model 2270 (Serial No.: 2644597)
Calibrator	Rion Model NC-74 (Serial No. 34246490)

3.3.2 During the noise measurement, the following procedures were followed:

- Sound level meters were set at each selected ABNSRs with the microphone positioned at 1m exterior of building facade of TAW-P1-2 and HUH-1-3. Photographs showing the measurement setup are provided in **Appendix C**.
- Parameter such as frequency weighting, the weighting and noise descriptors were set as follows:
  - Frequency weighting : A
  - Time weighting : Fast
  - Noise Descriptors : L_{eq} with 1 second or shorter logging interval and L_{max}, together with L10 and L90 as reference
- Immediately prior to and following each noise measurement the accuracy of the sound level meter was checked using an acoustic calibrator generating a known sound pressure level at a known frequency. Measurements were accepted as valid as the different between the calibration levels obtained before and after the noise measurement is less than 1.0 dB.
- The sound level meter logged the noise level continuously. In post-processing, noise level of each train passby was extracted from raw data as a single event. The definition of train passby measurement period (including head-tail period) was determined during the period when train noise was perceived, together with the recorded noise levels. Noise levels above background generally indicate train passby and its duration would be checked against the marking of train passby time. Background noise was also recorded during the whole measurement outside the train passby time.
- Details were recorded when any intrusive noise was observed for determining the representative of the measured noise levels.
- Weather was recorded during the airborne railway noise performance test. It was cloudy and the wind speed was less than 5ms^{-1} during the measurement.

3.4 Data Analysis and Evaluation of Airborne Railway Noise Impact

3.4.1 The collected noise data of train passbys and the evaluation of airborne noise impact ($L_{eq,30min}$) followed the steps as presented below.

i. Train passby data was extracted according to the perception of train noise, together with the recorded noise levels and the marked train passby time. Train passby noise level was considered representative if it was not affected by other intrusive noise.

ii. Background noise level was determined from averaging the noise level immediate before or after each passby by selecting those periods without effect from intrusive noise. The background noise level was considered to be representative when it was not affected by other intrusive noise.

iii. As the measured event noise levels would be used for further evaluation of $L_{Aeq,30min}$ to check against the relevant noise criteria, the measured event noise level should be corrected to account for the contribution from background. If the difference between the noise level during the passby event and the background noise level is equal to or greater than 3.0 dB(A), the measurements indicate that the event noise level is equal to or above the background noise level. In this case, the background corrected noise level could be determined by the following equation:

$$L_{eq,passby} = 10 \times log\left(10^{Leq,during\ passby/10} - 10^{Leq,background/10}\right)$$

Where $L_{eq,during\ passby}$ is the noise level during train passby, dB(A)
$L_{eq,background}$ is the background noise level, dB(A)
$L_{eq,passby}$ is the background corrected noise level, dB(A)

If the difference between the noise level during the passby event and the background noise level is less than 3.0 dB(A), the measurements indicate that the event noise level

is below the background noise level and the accuracy of the above equation would be reduced and any background correction, if made, should only be regarded as approximate. In such case, as a conservative approach, no background correction would be applied for the measured noise level during the passby event.

iv. Sound Exposure Level (SEL) for uptrack and downtrack trains was determined by the following equation:

$$SEL_{uptrack/downtrack} = 10\log[\frac{1}{n}\sum_{i=1}^{n} 10^{\frac{L_{Aeq,i}(T_i)+10\log(T_i)}{10}}] \text{ dB(A)}$$

where:

n	is total number of measured train pass-by events
T_i	is the time of train pass-by in the *i* th event, second
$L_{Aeq,\,i}\,(T_i)$	is the background corrected A-weighted equivalent continuous sound pressure level in decibel over "T" second in the *i* th event.

v. Airborne railway noise level ($L_{eq,30min}$) for compliance check was determined by the following equations:

$$L_{Aeq,30min} = 10 \log (10^{(\text{SEL uptrack})/10} + 10^{(\text{SEL downtrack})/10}) - 10 \log (1800) + 10 \log N_1 \text{ dB(A)}$$

where:

$SEL_{uptrack}$	is averaged SEL over the train pass-by events arising from Uptrack, dB(A)
$SEL_{downtrack}$	is averaged SEL over the train pass-by events arising from Downtrack, dB(A)
N_1	is the train frequency per direction in 30 minutes

3.5 Evaluation Results of Performance test

3.5.1 As discussed in **Section 3.4.1 (iii)**, correction for background noise would only be adopted at TAW-P1-2 to account for the contribution of background noise. As shown in the noise measurement results presented in **Appendix D**, most measured noise levels during train passby at TAW-P1-2 were higher than the background noise levels by more than 3dB(A), as such background correction factor has been included in the evaluation. Based on the evaluation results, the predicted railway noise levels at TAW-P1-2 comply with both the assessment goal and the criteria in daytime/evening and night-time periods.

3.5.2 It was observed that the noise measurement at HUH-1-3 was dominated by the traffic noise with marginally noticeable of railway noise recorded during the measurement. Some of train passby data recorded at HUH-1-3 were less than or equal to 1 dB(A) above the background noise levels. Since some measured noise levels during train passby were less than or equal to 1 dB(A) above the background noise levels, as a conservative approach, all the measured noise level during train passby were not corrected for background noise in evaluating the airborne railway noise level (i.e. with inclusion of background noise) for noise criteria compliance check. It is anticipated that the actual operational airborne railway noise levels at the HUH-1-3 would be lower than the evaluation results. Based on this conservative approach, the evaluated operational airborne railway noise levels, with the inclusion of background noise, at HUH-1-3 comply with both the assessment goal and the criteria in daytime/evening and night-time periods.

3.5.3 The evaluation results during daytime/evening and night-time periods are summarised in **Table 3.4** and **Table 3.5** respectively, while the maximum measured L_{max} of event passby (i.e. with inclusion of background noise) during night-time period is presented in **Table 3.6**. Measurement results and detailed calculations are provided in **Appendix D**.

Table 3.4 Airborne Railway Noise Calculation Results during Daytime/Evening Period (0700-2300 hrs)

Measurement Station ID. / NSR ID in EIA	Location	Train Frequency per 30 minutes	Airborne Railway Noise Level, $L_{eq\ 30min}$, dB(A)	Noise Criterion, $L_{eq\ 30min}$, dB(A)	Assessment Goal, dB(A)	Compliance (Y/N)
SCL(TAW-HUH)						
NMS-OA-1 /TAW-P1-2	Tower 1, Festival City Phase II	12 up and 12 down	52	70	60	Y
NMS-OA-2/ HUH-1-3	Wing Fung Building		< 53(1)	70	60	Y
SCL(HHS)						
NMS-OA-1 /HUH-1-3	Wing Fung Building	6 up and 6 down	< 50(1)	70	60	Y

Note:
(1) Since some measured noise levels during train passby were less than 3 dB(A) above the background noise levels, as a conservative approach, all the measured noise level during train passby were not corrected for background noise in evaluating the airborne railway noise level (i.e. with inclusion of background noise) for noise criteria compliance check. It is anticipated that the actual operational airborne railway noise levels at the ABNSR would be lower than the evaluation results.

Table 3.5 Airborne Railway Noise Calculation Results during Night-time period (2300-0700 hrs)

Measurement Station ID. / NSR ID in EIA	Location	Train Frequency per 30 minutes	Airborne Railway Noise Level, $L_{eq\ 30min}$, dB(A)	Noise Criterion, $L_{eq\ 30min}$, dB(A)	Assessment Goal, dB(A)	Compliance (Y/N)
SCL(TAW-HUH)						
NMS-OA-1 /TAW-P1-2	Tower 1, Festival City Phase II	6 up and 6 down	49	60	50	Y
NMS-OA-2/ HUH-1-3	Wing Fung Building		< 50(1)	60	50	Y
SCL(HHS)						
NMS-OA-1 /HUH-1-3	Wing Fung Building	6 up and 6 down	< 50(1)	60	50	Y

Note:
(1) Since some measured noise levels during train passby were less than 3 dB(A) above the background noise levels, as a conservative approach, all the measured noise level during train passby were not corrected for background noise in evaluating the airborne railway noise level (i.e. with inclusion of background noise) for noise criteria compliance check. It is anticipated that the actual operational airborne railway noise levels at the ABNSR would be lower than the evaluation results.

Table 3.6 Measured Lmax during night-time period (2300-0700 hrs)

Measurement Station ID. / NSR ID in EIA	Location	Maximum Measured L_{max}, dB(A)	Noise Criterion, L_{max}, dB(A)	Compliance (Y/N)
SCL(TAW-HUH)				
NMS-OA-1 /TAW-P1-2	Tower 1, Festival City Phase II	64	85	Y
NMS-OA-2/ HUH-1-3	Wing Fung Building	65	85	Y
SCL(HHS)				
NMS-OA-1 /HUH-1-3	Wing Fung Building	65	85	Y

3.6 Cumulative Airborne Railway Noise Impact

3.6.1 Based on the performance test results in **Tables 3.4** and **3.5** above, the cumulative airborne railway noise levels at Wing Fung Building have been evaluated to check the compliance of NCO noise criteria and the prediction results are presented in **Table 3.7**.

Table 3.7 Cumulative Airborne Railway Noise Calculation

Time Period	Location	Airborne Railway Noise Level, $L_{eq\ 30min}$, dB(A)			Predicted Cumulative Noise Level, dB(A)	NCO Noise Criteria, dB(A) (ANL)	Compliance (Y/N)
		SCL (TAW-HUH)	SCL (HHS)	SCL (MKK-HUH) (1)			
Daytime/ Evening (0700-2300 hrs)	Wing Fung Building	<53	<50	36	<70	70	Y
Night-time (2300-0700hrs)		<50	<50	35	<60	60	Y

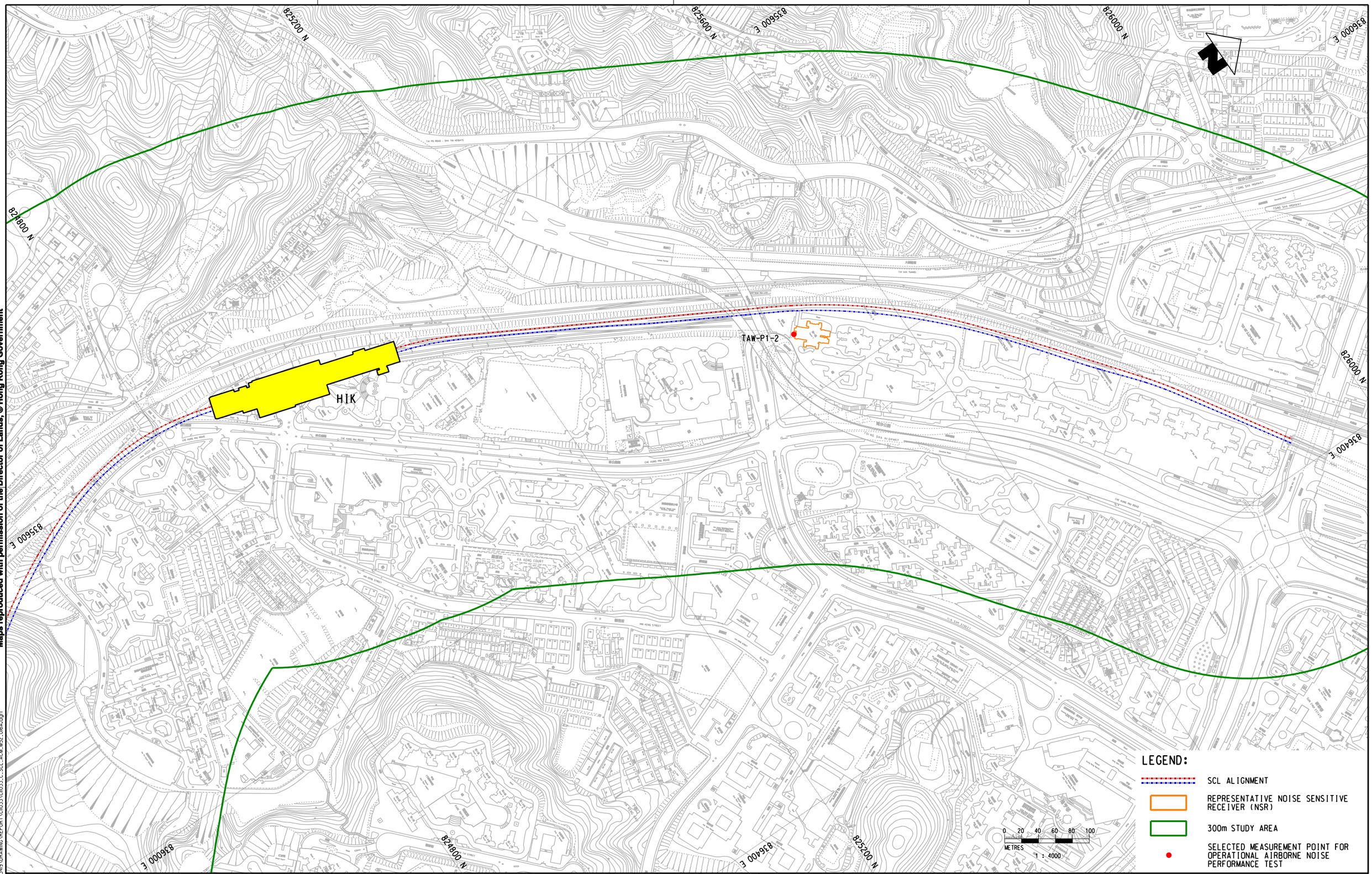
Note:
(1) Reference is made to the approved SCL(HHS) EIA report.

4 CONCLUSION

4.1.1 Airborne noise performance test was conducted at 2 representative ABNSRs in March, June and July 2018.

4.1.2 The results show that airborne railway noise levels at all selected ABNSRs comply with both the assessment goal and the stipulated noise criteria in daytime/evening and night-time period. Based on the findings of the airborne railway noise performance test, there would be no adverse railway noise impact arising from the operation of the Project to ABNSRs.

Figure



LEGEND:

- SCL ALIGNMENT
- REPRESENTATIVE NOISE SENSITIVE RECEIVER (NSR)
- 300m STUDY AREA
- SELECTED MEASUREMENT POINT FOR OPERATIONAL AIRBORNE NOISE PERFORMANCE TEST

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SCL (TAW - HUH)
LOCATION OF SELECTED MEASUREMENT POINT FOR OPERATIONAL AIRBORNE NOISE PERFORMANCE TEST (HIK)

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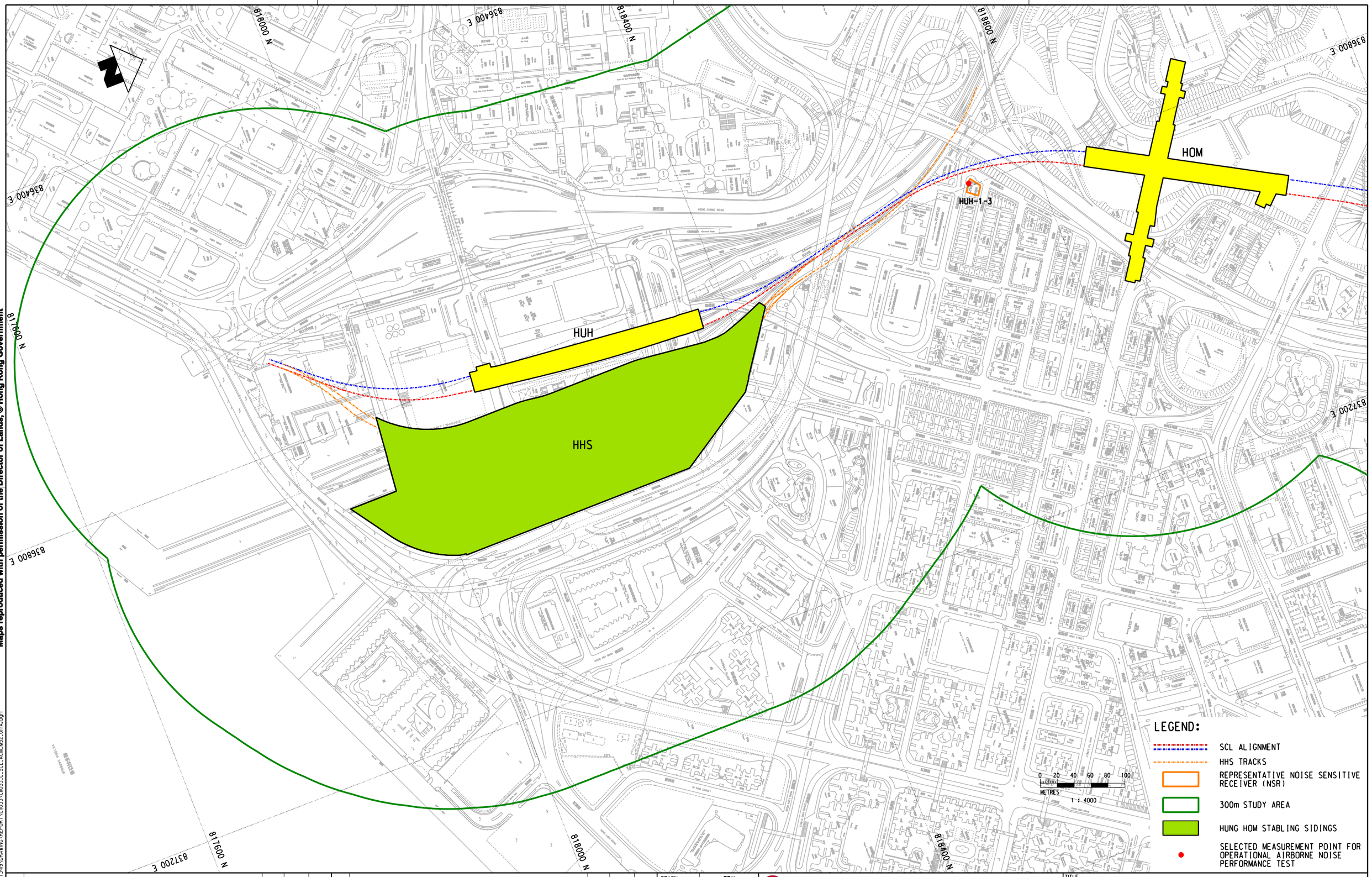

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SCL (TAW - HUH)

LOCATION OF SELECTED MEASUREMENT POINT FOR OPERATIONAL AIRBORNE NOISE PERFORMANCE TEST (HUH)

SCALE	FIGURE NO.	REV.
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Appendix A

Review of Area Sensitive Rating

Appendix A - SCL - Tai Wai to Hung Hom Section and Hung Hom Stabling Sidings
List of Airborne Railway Noise Sensitive Receivers (NSRs)

Tai Wai

NSR No.	Description	Use	No. of Storey	Type of Area Containing NSR [1]	Influencing Factor (IF)[2]	Degree to which NSR is affected by IF	Area Sensitivity Raiting	Remarks	Predicted Maximum Night-time Noise Level (mitigated), dB(A)	Assessment Goal, dB(A)
Tai Wai - Carado Garden 雲疊花園 - TAW-1										
TAW-1-1	Block 6	Residential	28	Urban Area	Nil	N/A	B	-	39 (28/F)	45[5]
Tai Wai - Shatin Heights 沙田花園 - TAW-2										
TAW-2-1	Shatin Heights	Residential	7	Other [3]	Nil	N/A	B	-	43 (8/F)	45[5]
Tai Wai - K K Terrace 雞記臺 - TAW-3										
TAW-3-1	KK Terrace	Residential	3	Other [3]	Nil	N/A	B	ASR "C" in SCL(TAW-HUH) EIA due to major road (i.e. Tai Po Road)	41 (3/F)	45[5]
Tai Wai - Woodcrest Hill 桂園 - TAW-4										
TAW-4-1	Block 2&3	Residential	2	Other [3]	Nil	N/A	B	ASR "C" in SCL(TAW-HUH) EIA due to major road (i.e. Tai Po Road)	38 (2/F)	45[5]
Tai Wai - Residential Premises along Keng Gau Road 沿徑口路的民居 - TAW-5										
TAW-5-1	Chan's Garden 陳園	Residential	2	Other [3]	Nil	N/A	B	-	41 (2/F)	45[5]
TAW-5-2	L Louey 熊盧	Residential	2		Nil	N/A	B	-	<20 (2/F)	45[5]
TAW-5-3	Joyville 華莊	Residential	2		Nil	N/A	B	-	41 (1/F)	45[5]
Tai Wai - Hin Keng Estate 顯徑邨 - TAW-6										
TAW-6-1	Hin Yiu House 顯耀樓	Residential	34	Urban Area	Nil	N/A	B	-	41 (34/F)	45[5]
TAW-6-2	Carmel Alison Lam Primary School 基督教興學會迦密愛禮信小學	Educational	7	Urban Area	Nil	N/A	B	-	NA[4]	55
TAW-6-3	Hin Tak House 顯德樓	Residential	34	Urban Area	Nil	N/A	B	-	42 (34/F)	45[5]
TAW-6-4	Hin Yeung House 顯揚樓	Residential	34	Urban Area	Nil	N/A	B	-	42 (34/F)	45[5]
Tai Wai - Residential Premises along Tsuen Nam Road 沿村南路的民居- TAW-7										
TAW-7-1	Kam Cheing Buildng 金昌樓	Residential	5	Urban Area	Nil	N/A	B	-	39 (5/F)	45[5]

NSR No.	Description	Use	No. of Storey	Type of Area Containing NSR [1]	Influencing Factor (IF)[2]	Degree to which NSR is affected by IF	Area Sensitivity Raiting	Remarks	Predicted Maximum Night-time Noise Level (mitigated), dB(A)	Assessment Goal, dB(A)
Tai Wai - Hgrandway Garden 富嘉花園 - TAW-8										
TAW-8-1	Block 2	Residential	24	Urban Area	Nil	N/A	B	-	34 (24/F)	45[5]
Tai Wai - Christian Alliance Cheng Wing Gee Building 宣道會鄭榮之中學 - TAW-9										
TAW-9-1	Christian Alliance Cheng Wing Gee Building	Educational	6	Urban Area	Nil	N/A	B	-	NA[4]	55
Tai Wai - Holford Garden 海福花園 - TAW-10										
TAW-10-1	Fook Siu Court 福兆閣	Residential	25	Urban Area	Nil	N/A	B	-	32 (1/F)	45[5]
Tai Wai - Top Side Residential Development - TAW-P1										
TAW-P1-1	Festival City Topside Property above Tai Wai Depot (Façade facing Mei Tin Road)	Residential	44	Urban Area	Mei Tin Road	Directly	C	ASR "B" in SCL(TAW-HUH) EIA without any IF	44 (5/F)	50[5]
TAW-P1-2	Festival City - Topside Property above Tai Wai Depot	Residential	44	Urban Area	Tsing Sha Highway	Directly	C	ASR "B" in SCL(TAW-HUH) EIA without any IF	45 (10/F)	50[5]
Tai Wai - Tai Wai Station Development (under planning)(by others) - TAW-P2										
TAW-P2-1	Property above Tai Wai Station (Façade facing Mei Tin Road)	Residential	N/A	Urban Area	Mei Tin Road	Directly	C	ASR "B" in SCL(TAW-HUH) EIA without any IF	44 (8/F)	50[5]

(1) Refer to Technical Memorandum for the Assessment of Noise from Places other than Domestic Premises, Public Places or Construction Sites Section 2.3.4

(2) Reference has been made on The Annual Traffic Census 2017 for determination of IF

(3) Area other than those below: (i)Rural area, including country parks or village type developments; (ii) Low density residential area consisting of low-rise or isloated high-rise developments; (iii) Urban area.

(4) It is assumed that there would be no noise sensitive uses for educational institutions during night-time (2300 – 0700 hours).

(5) A 10 dB(A) has been deducted from the ANL to take into account noise level from the East Rail Line and Intercity Train.

Hung Hom

NSR No.	Description	Use	No. of Storey	Type of Area Containing NSR [1]	Influencing Factor (IF)[2]	Degree to which NSR is affected by IF	Area Sensitivity Raiting	Remarks	Predicted Maximum Night-time Noise Level (mitigated), dB(A)	Assessment Goal, dB(A)
Hung Hom - Residential premises along J/O Chatham Road North and Hong Chong Road 沿漆咸道北及康莊道的建築物 - HUH-1										
HUH-1-3	Wing fung Building 榮豐大樓	Residential	8	Urban Area	Chatham Road North	Directly	C	-	48 (1/F)	50[4]
Hung Hom - Royal Penisula 半島豪庭 - HUH-3										
HUH-3-1	Block 2	Residential	42	Urban Area	Princess Margaret Road Link	Directly	C	-	48 (29/F)	50[4]

NSR No.	Description	Use	No. of Storey	Type of Area Containing NSR [1]	Influencing Factor (IF)[2]	Degree to which NSR is affected by IF	Area Sensitivity Raiting	Remarks	Predicted Maximum Night-time Noise Level (mitigated), dB(A)	Assessment Goal, dB(A)
Hung Hom - The Metropolis Residence 國際都會 - HUH-4										
HUH-4-1	Tower 2	Residential	18	Urban Area	Nil	N/A	B	with centralized fresh-air supply	43 (1/F)	45[4]
Hung Hom - Residential premises along Gillies Avenue South (HUH-8) 沿機利士南路的居民 - HUH-8										
HUH-8-1	No. 2	Residential	6	Urban Area	Princess Margaret Road Link	Directly	C	-	47 (1/F)	50[4]
Hung Hom - Harbourfront Horizon 海灣軒海景酒店 - HUH-10										
HUH-10-1	Harbourfront Horizon[3]	Residential	22	Urban Area	Nil	N/A	B	with centralized fresh-air supply	47 (1/F)	55

(1) Refer to Technical Memorandum for the Assessment of Noise from Places other than Domestic Premises, Public Places or Construction Sites Section 2.3.4

(2) Reference has been made on The Annual Traffic Census 2017 for determination of IF

(3) Harbourfront Horizon shall not rely on openable windows for ventilation. Nonetheless, for conservative consideration that occupier might open window under special circumstances, this premise has been considered as an assessment point.

(4) A 10 dB(A) has been deducted from the ANL to take into account noise level from the East Rail Line and Intercity Train.

Appendix B

Calibration Certificates of Monitoring Equipment

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

CERTIFICATE OF CALIBRATION

Certificate No.: 17CA0303 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-L	4950	ZC0032
Serial/Equipment No.:	2681366 N.011.01	2665582	17190
Adaptors used:	-	-	-

Item submitted by

Customer Name:	AECOM ASIA CO LTD
Address of Customer:	-
Request No.:	-
Date of receipt:	03-Mar-2017

Date of test: 07-Mar-2017

Reference equipment used in the calibration

Description:	Model:	Serial No.	Expiry Date:	Traceable to:
Multi function sound calibrator	B&K 4226	2288444	18-Jun-2017	CIGISMEC
Signal generator	DS 360	33873	18-Apr-2017	CEPREI
Signal generator	DS 360	61227	18-Apr-2017	CEPREI

Ambient conditions

Temperature:	21 ± 1 °C
Relative humidity:	60 ± 10 %
Air pressure:	1010 ± 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: Huang Jian Min/Feng Jun Qi **Date:** 08-Mar-2017 **Company Chop:** SOILS & 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.

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HOKLAS 028 CAL

CERTIFICATE OF CALIBRATION

(Continuation Page)

Certificate No.: 17CA0303 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:** 07-Mar-2017

Checked by: Lam Tze Wai **Date:** 08-Mar-2017

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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CERTIFICATE OF CALIBRATION

Certificate No.: 17CA0907 04 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	4189	ZC0032
Serial/Equipment No.:	3007965	2846461	17965
Adaptors used:	-	-	-

Item submitted by

Customer Name:	AECOM ASIA CO. LTD.
Address of Customer:	-
Request No.:	-
Date of receipt:	07-Sep-2017

Date of test: 09-Sep-2017

Reference equipment used in the calibration

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

Ambient conditions

Temperature:	21 ± 1 °C
Relative humidity:	50 ± 10 %
Air pressure:	1010 ± 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: Huang Jian Min/Feng Jun Qi **Date:** 11-Sep-2017 **Company Chop:** SOILS & 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.

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CERTIFICATE OF CALIBRATION

(Continuation Page)

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: Lai Sheng Jie **Date:** 09-Sep-2017

Checked by: Fung Chi Yip **Date:** 11-Sep-2017

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
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HOKLAS 028 CAL

CERTIFICATE OF CALIBRATION

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

Item tested

Description:	Sound Level Meter (Type 1)	Microphone	Pream
Manufacturer:	B & K	B & K	B & K
Type/Model No.:	2270	4950	ZC0032
Serial/Equipment No.:	2644597	2879980	19428
Adaptors used:	- (N.012.0)	-	-

Item submitted by

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

Date of test: 24-Mar-2018

Reference equipment used in the calibration

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

Ambient conditions

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

Test specifications

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 Jun Qi **Date:** 24-Mar-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.

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HOKLAS 028 CAL

CERTIFICATE OF CALIBRATION

(Continuation Page)

Certificate No.: 18CA0321 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:	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	Uncertanity (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 Chi Yip **Date:** 24-Mar-2018

Checked by: Lam Tze Wai **Date:** 24-Mar-2018

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

綜合試驗有限公司
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HOKLAS 028 CAL

CERTIFICATE OF CALIBRATION

Certificate No.: 17CA0922 03-02 **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:	22-Sep-2017

Date of test: 28-Sep-2017

Reference equipment used in the calibration

Description:	Model:	Serial No.	Expiry Date:	Traceable to:
Lab standard microphone	B&K 4180	2341427	11-Apr-2018	SCL
Preamplifier	B&K 2673	2743150	05-May-2018	CEPREI
Measuring amplifier	B&K 2610	2346941	03-May-2018	CEPREI
Signal generator	DS 360	61227	01-Apr-2018	CEPREI
Digital multi-meter	34401A	US36087050	25-Apr-2018	CEPREI
Audio analyzer	8903B	GB41300350	21-Apr-2018	CEPREI
Universal counter	53132A	MY40003662	22-Apr-2018	CEPREI

Ambient conditions

Temperature:	21 ± 1 °C
Relative humidity:	55 ± 10 %
Air pressure:	1000 ± 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: Huang Jian Min/Feng Jun Qi **Date:** 28-Sep-2017 **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.

綜合試驗有限公司
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Fax: (852) 2555 7533

CERTIFICATE OF CALIBRATION

(Continuation Page)

Certificate No.: 17CA0922 03-02 **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	94.07	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 = 0.011 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 = 1002.1 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 = 2.8 %**

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: Lai Sheng Jie **Date:** 28-Sep-2017

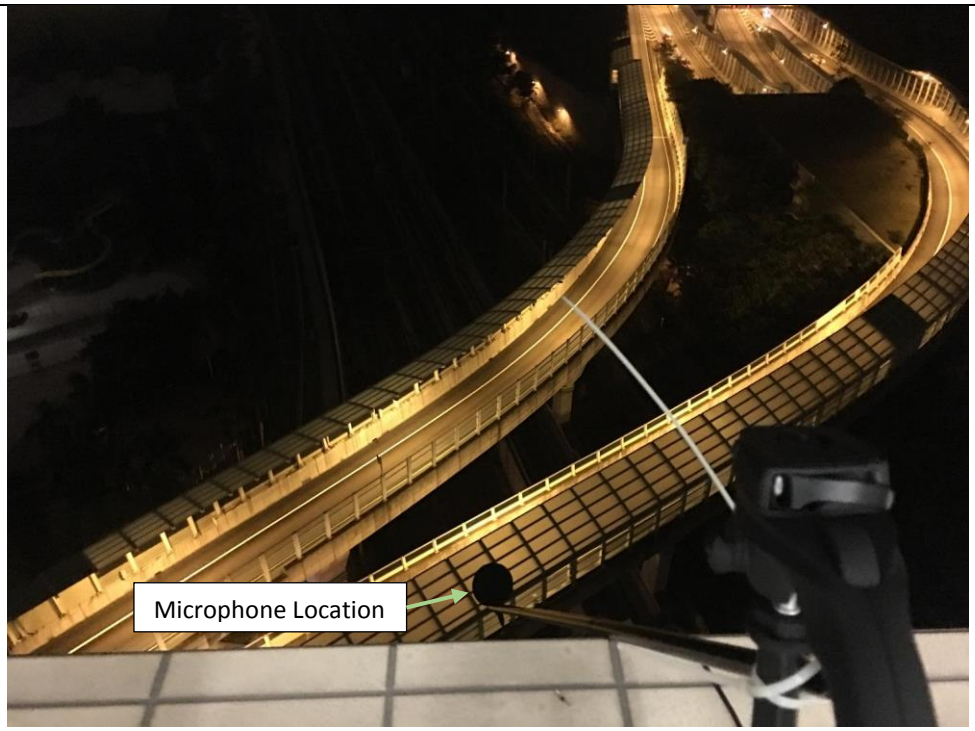
Checked by: Fung Chi Yip **Date:** 28-Sep-2017

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 C

Airborne Noise Measurement –
Photographs of Measurement Setup

Appendix C Airborne Railway Noise Measurement - Photographs of Measurement Setup



Measurement Location for TAW-P1-2

Measurement Location for HUH-1-3

Appendix D

Airborne Railway Noise Measurement Results and Detailed Calculation

Appendix D1 - Airborne Railway Noise Measurement Results and Detailed Calculation (SCL(TAW-HUH))

Measurement Location: **Tower 1, Festival City, Phase II (TAW-P1-2)**
Measurement Date and Time **3,14 & 30 Mar, 2018 02:00-04:00**
Weather Condition **Fine**

Calculation of Sound Exposure Level

NSR	Train Direction	Train Type [1]	Train Speed, kph [2]	Measured Event L_{Aeq}, dB(A)	Measured Event L_{max}, dB(A)	Background Noise Level, dB(A)	[A]-[B], dB(A)	Corrected Event L_{Aeq}, dB(A)	Event Duration, s	SEL, dB(A)	Averaged SEL, dB(A)
TAW-P1-2	UP	8-car SP1900	60	56.8	60.4	51.8	5.0	55.1	26	69.3	
		8-car SP1900	60	56.7	60.0	52.2	4.5	54.8	27	69.1	
		8-car SP1900	60	57.2	61.0	53.2	4.0	55.0	30	69.8	69.4
	Down	8-car CRC	60	59.6	64.2	55.6	4.0	57.4	34	72.7	
		8-car CRC	60	59.2	64.1	54.2	5.0	57.5	31	72.5	
		8-car SP1900	60	59.9	63.9	56.3	3.6	57.4	30	72.2	72.5
					Maximum Lmax	64.2					

Notes:
(1) The train type, which is in equivalent noise performance, adopted for the commissioning test is the same as the train type for future operation.
(2) The train speed adopted for the commissioning test is the same as the train speed for future operation.

Prediction of Airborne Railway Noise Level During Daytime/Evening period

NSR	Train Direction	Averaged SEL, dB(A)	Time Period	Train Frequency per 30mins	Correction for Train Frequency, dB(A)	Conversion Factor to $L_{Aeq\ 30mins}$, dB(A)	$L_{Aeq\ 30mins}$, dB(A)
TAW-P1-2	Up	69.4	Daytime & Evening (0700-2300)	12	10.8	-32.6	47.6
	Down	72.5		12	10.8	-32.6	50.7
						Predicted Noise Level, LAeq 30mins, dB(A)	52
						Assessment Goal, ANL-10, dB(A)	60
						Compliance	Yes

Prediction of Airborne Railway Noise Level During Night-time period

NSR	Train Direction	Averaged SEL, dB(A)	Time Period	Train Frequency per 30mins	Correction for Train Frequency, dB(A)	Conversion Factor to $L_{Aeq\ 30mins}$, dB(A)	$L_{Aeq\ 30mins}$, dB(A)
TAW-P1-2	Up	69.4	Night-time (2300-0700)	6	7.8	-32.6	44.6
	Down	72.5		6	7.8	-32.6	47.7
						Predicted Noise Level, LAeq 30mins, dB(A)	49
						Assessment Goal, ANL-10, dB(A)	50
						Compliance	Yes

Appendix D2 - Airborne Railway Noise Measurement Results and Detailed Calculation (SCL(TAW-HUH))

Measurement Location: **Wing Fung Building (HUH-1-3)**
Measurement Date and Time: **31 July, 2018 02:30 - 03:30**
Weather Condition: **Fine**

Calculation of Sound Exposure Level

NSR	Train Direction	Train Type (1)	Train Speed, kph (2)	Measured Event L_{Aeq}, dB(A) [A]	Measured Event L_{max}, dB(A)	Background Noise Level, dB(A) [B]	[A]-[B], dB(A)	LAeq, dB(A) (without bkg corr), dB(A)	Event Duration, s	SEL(3), dB(A)	Averaged SEL, dB(A)
HUH-1-3	UP	8-car SP1900	54	61.7	63.3	61.5	0.2	61.7	9	71.2	
		8-car CRC	54	61.4	63.0	60.8	0.6	61.4	10	71.4	
		8-car CRC	54	60.6	61.8	60.4	0.2	60.6	10	70.6	
		8-car SP1900	54	61.5	64.4	60.8	0.7	61.5	10	71.5	71.2
	Down	8-car SP1900	54	62.9	64.4	62.4	0.5	62.9	9	72.4	
		8-car CRC	54	62.4	64.9	62.0	0.4	62.4	10	72.4	
		8-car SP1900	54	62.2	63.7	61.7	0.5	62.2	9	71.7	
		8-car CRC	54	62.3	64.1	62.1	0.2	62.3	10	72.3	72.2
				Maximum Lmax	64.9						

Notes:

(1) The train type, which is in equivalent noise performance, adopted for the commissioning test is the same as the train type for future operation.

(2) The train speed adopted for the commissioning test is the same as the train speed for future operation.

(3) Since some measured noise levels during train passby were less than 3 dB(A) above the background noise levels, as a conservative approach, the measured event noise levels without background correction were adopted to determine the SEL.

Prediction of Airborne Railway Noise Level During Daytime/Evening period (without background correction)

NSR	Train Direction	Averaged SEL, dB(A)	Time Period	Train Frequency per 30mins	Correction for Train Frequency, dB(A)	Conversion Factor to $L_{Aeq\ 30mins}$, dB(A)	$L_{Aeq\ 30mins}$, dB(A)
HUH-1-3	Up	71.2	Daytime & Evening (0700-2300)	12	10.8	-32.6	49.4
	Down	72.2		12	10.8	-32.6	50.4
Predicted Noise Level, LAeq 30mins, dB(A)							<53
Assessment goal, ANL-10, dB(A)							60
Compliance							Yes

Prediction of Airborne Railway Noise Level During Night-time period (without background correction)

NSR	Train Direction	Averaged SEL, dB(A)	Time Period	Train Frequency per 30mins	Correction for Train Frequency, dB(A)	Conversion Factor to $L_{Aeq\ 30mins}$, dB(A)	$L_{Aeq\ 30mins}$, dB(A)
HUH-1-3	Up	71.2	Night-time (2300-0700)	6	7.8	-32.6	46.4
	Down	72.2		6	7.8	-32.6	47.4
Predicted Noise Level, LAeq 30mins, dB(A)							<50
Assessment goal, ANL-10, dB(A)							50
Compliance							Yes

Appendix D3 - Airborne Railway Noise Measurement Results and Detailed Calculation (SCL(HHS))

Measurement Location: **Wing Fung Building (HUH-1-3)**
Measurement Date and Time: **18 June, 2018 01:00 - 02:00**
Weather Condition: **Fine**

Calculation of Sound Exposure Level

NSR	Train Direction	Train Type [(1)]	Train Speed, kph [(2)]	Measured Event L_{Aeq}, dB(A) [A]	Measured Event L_{max}, dB(A)	Background Noise Level, dB(A) [B]	[A]-[B], dB(A)	LAeq, dB(A) (without bkg corr), dB(A)	Event Duration, s	SEL[(3)], dB(A)	Averaged SEL, dB(A)
HUH-1-3	UP	8-car CRC	20	61.0	62.1	59.9	1.1	61.0	10	71.0	
		8-car CRC	20	59.9	62.6	59.2	0.7	59.9	10	69.9	
		8-car CRC	20	61.0	64.3	61.0	0.0	61.0	9	70.6	70.5
	Down	8-car CRC	20	60.9	65.0	60.5	0.4	60.9	15	72.7	
		8-car CRC	20	62.5	65.3	62.2	0.3	62.5	16	74.5	
		8-car CRC	20	60.9	63.3	60.0	0.9	60.9	15	72.7	73.4
					Maximum Lmax	65.3					

Notes:
(1) The train type, which is in equivalent noise performance, adopted for the commissioning test is the same as the train type for future operation.
(2) The train speed adopted for the commissioning test is the same as the train speed for future operation.
(3) Since some measured noise levels during train passby were less than 3 dB(A) above the background noise levels, as a conservative approach, the measured event noise levels without background correction were adopted to determine the SEL.

Prediction of Airborne Railway Noise Levels (without background correction)

NSR	Train Direction	Averaged SEL, dB(A)	Time Period	Train Frequency per 30mins	Correction for Train Frequency, dB(A)	Conversion Factor to $L_{Aeq\ 30mins}$, dB(A)	$L_{Aeq\ 30mins}$, dB(A)
HUH-1-3	Up	70.5	Daytime, Evening and Night-time	6	7.8	-32.6	45.7
	Down	73.4		6	7.8	-32.6	48.6
						Predicted Noise Level, LAeq 30mins, dB(A)	<50
						Assessment goal, ANL-10 (Night-time), dB(A)	50
						Compliance	Yes

Performance Test Report for Train Noise (Batch 2 – Operational Ground-borne Railway Noise)

MTR Corporation Limited

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

Performance Test Report for Train Noise

(Batch 2 – Operational Ground-borne Railway Noise)

(March 2019)

Certified by: Fredrick Leong

Position: Independent Environmental Checker

Date: 27.3.2019

MTR Corporation Limited

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

Performance Test Report for Train Noise

(Batch 2 – Operational Ground-borne Railway Noise)

(March 2019)

Certified by: Lisa Poon

Position: Environmental Team Leader

Date: 27 March 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)]

Performance Test Report for Train Noise (Batch 2 – Operational Ground-borne Railway Noise)

March 2019

	Name	Signature
Prepared & Checked:	Angela Tong	
Reviewed & Approved:	Josh Lam	

Version:	B	Date: 27 March 2019

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1 INTRODUCTION

1.1 Background

1.1.1 The Shatin to Central Link (SCL) is a 17km extension of the existing Ma On Shan Line (MOL) and East Rail Line (EAL) comprising (i) The East-West Corridor which extends the MOL from Tai Wai to Hung Hom via East Kowloon to connect with the West Rail Line (WRL) at Hung Hom Station (HUH) and Stabling Sidings at Hung Hom Freight Yard (HHS); and (ii) The North-South Corridor which is an extension of the EAL at Hung Hom across the harbour to Admiralty Station (ADM).

1.1.2 Environmental Impact Assessment (EIA) Reports for SCL – Tai Wai to Hung Hom Section [SCL (TAW-HUH)] (Register No. AEIAR-167/2012) and SCL Stabling Sidings at Hung Hom Freight Yard [SCL (HHS)] (Register No. AEIAR-164/2012) 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 2.31, at least one month before commencement of operation of the Project, the Permit Holder, MTR Corporation Ltd (MTR), shall carry out noise performance test and deposit with the Director four hard copies and one electronic copy of a Noise Performance Test Report to confirm the compliance of the operational airborne railway and ground-borne noise levels in accordance with the approved SCL (TAW-HUH) EIA Report (Register No. AEIAR-167/2012) and SCL (HHS) EIA Report (Register No. AEIAR-164/2012).

1.1.4 MTR Corporation Limited (MTR) therefore has commissioned AECOM Asia Co. Ltd to carry out the operational airborne and ground-borne railway noise performance test. As airborne and ground-borne railway noise performance tests would be conducted separately and thus the test reports would be submitted into 2 batches under EP Condition 2.31 to present the findings of airborne and ground-borne railway noise performance tests.

1.1.5 Operational ground-borne performance tests were conducted at the selected ground-borne noise sensitive receivers (GBNSRs) in July and December 2018.

1.2 Purpose of This Report

1.2.1 This Report (Batch 2 – Operational Ground-borne Railway Noise) presents the measurement results of the performance tests at the selected measurement locations, and the operational ground-borne railway noise levels evaluated based on the measurement results to demonstrate the compliance of these noise levels with the relevant noise criteria in the approved SCL (TAW-HUH) and SCL (HHS) EIA Reports.

1.3 Structure of This Report

1.3.1 This Report comprises the following sections:

- Section 1 presents the background information.
- Section 2 presents the train operation parameters during performance tests.
- Section 3 presents the details of the performance tests on operational ground-borne railway noise.
- Section 4 presents the conclusion.

2 TRAIN OPERATION PARAMETERS DURING PERFORMANCE TEST

2.1 Train Operation Parameters

2.1.1 The operation parameters during the performance test, including train configuration (i.e. 8-car SP1900/SP1950 train or other train type with equivalent noise performance (i.e. 8–car CRC train)) and train speed, aligns with those to be implemented for future operation of SCL(TAW-HUH) and SCL(HHS).

2.1.2 As stipulated in EP Condition 2.26, the maximum train frequency operating on the Project from 0700 to 2300 hours and from 2300 to 0700 hours of the following day shall not exceed 12 trains and 6 trains per 30 minutes in each direction respectively. The difference of maximum train frequency between daytime and night-time is 6 trains per 30 minutes in each direction. As the other operation factors remain constant, and the daytime railway ground-borne noise level would be 3 dB(A) higher than that during night-time operation, while the night-time noise criterion is 10 dB(A) more stringent than daytime, the compliance of night-time criterion would also represent the compliance of day-time noise criterion. In addition, considering that the intrusive noise and vibration from background vibration induced by road traffic and human activities is expected to be higher in daytime and evening period, the measurement was therefore conducted during night-time period only. Ground-borne noise impact during night-time period would be evaluated by the adoption of appropriate correction factors to account for train frequency.

2.1.3 According to various literatures (Ref: "*Track-Based Control Measures for Ground Vibration – The Influence of Quasi-Static Loads and Dynamic Excitation*", and "*Ground Vibration Induced by Railway Traffic – The Influence of Vehicle Parameters*", Noise and Vibration Mitigation for Rail Transit System, NNFM 118, Springer 2012), train loading has little effect on vibration in audible frequency range, and thus unloaded trains were employed for performance test, same testing approach as adopted for both South Island Line (East) and Kwun Tong Line Extension.

2.2 Evaluation of Railway Noise Levels from Measurement Results of Performance tests

2.2.1 Assumptions of train operation for evaluating ground-borne railway noise from noise measurement results of performance tests are same as those stipulated in EP Condition 2.26, i.e. the maximum train frequency operating on the Project from hours 0700 to 2300 shall not exceed 12 trains per 30 minutes in each direction, while the maximum train frequency operating from hours 2300 to 0700 of the following day shall not exceed 6 trains per 30 minutes in each direction.

2.2.2 Details of the ground-borne railway noise performance tests are presented in **Section 3** of this Report.

2.3 Implementation of Noise Mitigation Measures

2.3.1 Final Operational Ground-borne Noise Mitigation Measures Plan (OGNMMP) was deposited to DEP in accordance with Section 2.27 of the EP (EP No: EP-438/2012/K) in June 2017 and was subsequently approved by EPD. The approved OGNMMP reviewed the assumptions adopted in the approved SCL(TAW-HUH) and SCL(HHS) EIA Reports and updated the ground-borne noise prediction based on the measured LSR results. The ground-borne noise levels predicted in the Final OGBNMMP have been reviewed (**Appendix A** refers) and the predicted ground-borne railway noise levels ($L_{eq,30min}$) at all representative GBNSRs are below 45dB(A) during daytime and night-time periods, comparing the daytime noise criteria of 55dB(A) and night time noise criteria of 45dB(A). Thus no mitigation measures are required.

3 OPERATIONAL GROUND-BORNE RAILWAY NOISE PERFORMANCE TEST

3.1 Operational Ground-borne Railway Noise Criteria

3.1.1 The operational ground-borne railway noise criteria as stipulated in the SCL (TAW-HUH) and SCL (HHS) EIA Reports for the representative ground-borne noise sensitive receivers (GBNSRs) along the Project alignment are presented in **Table 3.1** below.

Table 3.1 Operational Ground-borne Railway Noise Criteria

GBNSR Description	Ground-borne Railway Noise Criteria ($L_{eq, 30min}$, dB(A))					
	Day and Evening Periods (0700 to 2300 hrs)			Night-time Period (2300 to 0700 hrs)		
	A	B	C	A	B	C
Churches/temples, schools, medical clinics, libraries, courts and performing arts centres	50	55	60	40	45	50
Domestic premises, hotels and hospitals						

3.2 Ground-borne Noise Measurement Locations

3.2.1 Representative GBNSRs (both existing and planned NSRs) within 300m of the Project boundary and at the most critical locations (e.g. on top of alignment/close to alignment where appropriate) were selected and assessed in the approved SCL (TAW-HUH) and SCL (HHS) EIA Reports, Supporting Document for Application of VEP (Application No. VEP-370/2012) (June 2012) and the OGNMMP, according to the criteria set out in the Annex 13 of *Technical Memorandum on Environmental Impact Assessment Process* (EIAO-TM).

3.2.2 According to Section 9.5 of the approved EM&A Manuals for SCL (TAW-HUH) and SCL (HHS), a noise commissioning test should be conducted by the Environmental Team (ET) prior to the operation of the Project to confirm the compliance of the operational ground-borne railway noise levels with the noise criteria in **Table 3.1** above. The noise commissioning test should be performed at selected GBNSRs listed in Table 9.2 of the approved SCL (TAW-HUH) and SCL (HHS) EM&A Manuals. The GBNSRs selected in the EM&A Manual include DIH-1-1, DIH-11-1, MTW-6-2, HOM-1-1, HUH-1-3 and are listed in **Table 3.2** below.

3.2.3 Based on the Table 3.2 of the Final OGNMMP (**Appendix A** refers), the predicted ground-borne noise levels, with inclusion of 10dB(A) safety factor, at all representative GBNSRs are lower than the stipulated noise criteria by about 14 to 33dB(A) during daytime and evening time period, and about 9 to 24 dB(A) night-time period. It is therefore anticipated that there would be no adverse ground-borne railway noise impact to GBNSRs. The GBNSRs selected for performance test, except HUH-1-3, were predicted with relatively higher operational ground-borne railway noise levels. Further review on the validity of the selected GBNSRs has been conducted.

3.2.4 For DIH-1-1, it is located directly above the railway tunnels and away from nearby road traffic, and thus it is expected that the background noise at this GBNSR would be relatively lower. Given that the predicted noise level at GBNSR DIH-6-1 is slightly higher than DIH-1-1, performance test was also proposed to be conducted at both DIH-1-1 and DIH-6-1.

3.2.5 For the GBNSRs located in Diamond Hill area, although the planned GBNSR, DIH-P3-4, is predicted with the highest noise levels among the GBNSRs in the vicinity of DIH, it has not been selected for noise performance test because it is yet to be constructed during the commissioning period and thus DIH-11-1, nearest GBNSR to the DIH was selected for noise performance test.

3.2.6 GBNSR TKW-6-2 is predicted with the highest ground-borne noise level (i.e. 41dB(A)) among all representative GBNSRs during daytime and evening time period, it is also expected that the highest night-time noise level is also expected at this GBNSR where no sensitive use during night-time period. According to the maximum train frequency during night-time period (i.e. 6

trains per 30 minutes in each direction), the night-time noise level (i.e. 38dB(A)) is expected to be 3 dB(A) lower than that during daytime and evening time operation (i.e. 12 trains per 30 minutes in each direction). Performance test has therefore been proposed to be conducted at TKW-6-2, which could also be representing those GBNSRs along Ma Tau Chung Road, Ma Tau Wai Road and Chatham Road North to evaluate the ground-borne noise levels during both daytime and evening time, and night-time periods.

3.2.7 Near HOM, both the lowest sensitive floor of HOM-1-1 (G/F) and HOM-2-2 (2/F) are predicted with the same ground-borne noise level of 32dB(A) during night-time period (**Appendix A** refers), it is anticipated that these GBNSRs would be subject to same ground-borne noise level during night-time period although no sensitive use in HOM-1-1 (where opening hours between 0900 and 2300 hours as stated in https://www.lcsd.gov.hk/en/kst/openinghours.html refer). As staff of HOM-1-1 would be off work after 2400 hours and thus there would be no human activities that would affect the noise measurement results during the performance test period. Our on-site observations at HOM-2-2 also revealed that there were human activities between 2400 hours and 0400 hours. Therefore, performance test was proposed to be conducted at HOM-1-1.

3.2.8 In Hung Hom area, the predicted night-time ground-borne noise levels at HUH-1-1 to HUH-1-3 are of similar magnitude (i.e. 26 to 27dB(A)). Given that HUH-1-3 is the GBNSR closest to the alignment of SCL(TAW-HUH) and SCL (HHS), there would be cumulative railway ground-borne noise impact from the operation of SCL(TAW-HUH) and SCL(HHS) at HUH-1-3, HUH-1-3 was selected as the performance test location to evaluate the cumulative noise impact.

3.2.9 Access to the buildings was obtained from the property managements/owners/occupants for conducting site visits and noise measurement. Identifications of suitable locations within the building for noise measurement were also conducted and agreed with property managements/owners/occupants during the site visits prior to the commencement of performance test. The agreed ground-borne noise measurement locations were on either the lowest floor of the building with GBNSRs or lower floor if consent for entering the GBNSRs could not be obtained from the owners/occupants. Based on the measurement situations, a correction factor to account for floor-to-floor attenuation was applied accordingly to the measurement results for projection of the ground-borne noise level at the GBNSRs.

3.2.10 Details of the selected GBNSRs for the ground-borne railway noise performance test is summarised in **Table 3.2** and their locations are shown in **Figure Nos. C1103/C/SCL/ACM/M53/0023 - 026**.

Table 3.2 Selected GBNSRs for Performance test

Measurement Station ID. / NSR ID in EIA	Location	Floor with Measurement Equipment	Use	ASR	Criterion, dB(A)	
					$L_{eq,30min}$ (day / evening)	**$L_{eq,30min}$ (night)**
GBN Measurement Locations in the approved SCL (TAW-HUH) EM&A Manual						
NMS-OG-1 / DIH-1-1	Tsui Chuk Garden Block 5	G/F[(1)] (lowest sensitive floor on 1/F)	Residential	B	55	45
NMS-OG-2 / TKW-6-2[(2)]	Hong Kong Society for the Protection of Children	G/F (lowest sensitive floor)	Educational Institution	B	55	-[(3)]
NMS-OG-3 / HOM-1-1	Ko Shan Theatre	G/F (lowest sensitive floor)	Performing Arts Centre	B	55	-[(3)]
NMS-OG-4 / HUH-1-3	Wing Fung Building[(4)]	1/F (lowest sensitive floor)	Residential	B	55	45
GBN Measurement Location in the approved SCL (HHS) EM&A Manual						
NMS-OG-2 (HHS) / DIH-11-1	Lung Poon Court, Lung Wan House	1/F (lowest sensitive floor)	Residential	B	55	45

Measurement Station ID. / NSR ID in EIA	Location	Floor with Measurement Equipment	Use	ASR	Criterion, dB(A)	
					$L_{eq, 30min}$ (day / evening)	$L_{eq, 30min}$ (night)
Additional GBN Measurement Location						
DIH-6-1	WTS Fire Station and Quarters Block A	1/F (lowest sensitive floor)	Residential	B	55	45

Notes:
(1) Consent could not be obtained for accessing 1/F, which is the lowest sensitive floor. Measurement was therefore conducted at G/F of NMS-OG-1.
(2) Ma Tau Wai Station as named in the SCL (TAW-HUH) EIA Report has been recently renamed as To Kwa Wan Station (TKW). The NSR Nos. are therefore updated from MTW-XX-X to TKW-XX-X to match with existing naming of station.
(3) Performance arts centre and educational institutions are considered to be noise sensitive during daytime and evening only.
(4) Wing Fung Building is the same monitoring location under the approved EM&A Manuals for SCL(TAW-HUH), SCL(HHS) and SCL(MKK-HUH). Based on latest findings in OGNMMP (Last page of Appendix A refers), the ground-borne noise contribution from an about 28m tunnel section under SCL (HHS) (Figure No. C1103/C/SCL/ACM/M53/026 refers) is only 8dB(A). In view of insignificant noise contribution from HHS tunnel section, ground-borne noise measurement at Wing Fung Building was conducted for the train operation in SCL (TAW-HUH) tunnel section only.

3.3 Measurement Instrumentation and Procedures

3.3.1 According to the requirements of the Technical Memorandum (TM) issued under the NCO, sound level meters adopted for measurement comply with the International Electrotechnical Commission Publications 651: 1979 (Type 1) and 804: 1985 (Type 1) specifications and other noise measuring and analysis instrumentation are of a comparable professional quality. Immediately prior to and following each noise measurement the accuracy of the sound level meter was checked using an acoustic calibrator generating a known sound pressure level at a known frequency. Measurements were accepted as valid with the difference between the calibration levels obtained before and after each noise measurement was less than 1.0 dB.

3.3.2 The measurement instruments adopted for the ground-borne noise commissioning test met the above requirements and are listed in **Table 3.3**. The calibration records of the instruments are provided in **Appendix B**.

Table 3.3 Measurement Instrumentation

Instrument	Model No.
Integrating Sound Level Meter	Svantek SVAN 958(Serial No.:28422)
	Svantek SVAN 958A (Serial No.:59120)
	Svantek SVAN 958A (Serial No.:59121)
	Svantek SVAN 958(Serial No.:69082)
Acoustic Calibrator	Svantek SV35 (Serial No.:44797)
Vibration Calibrator	IMI Sensors 699A02 (Serial No.:989)

3.3.3 All ground-borne noise measurements were conducted indoor inside the buildings, with microphones and an accelerometer set up at each selected monitoring location. The microphones were placed inside the building/a room at around 1.2m above floor level at all selected GBNSR locations. The vibration levels collected from accelerometer were used to determine the train passby. Photographs showing measurement setup at each of selected GBNSR locations is provided in **Appendix C**.

3.4 Measurement Parameter

3.4.1 Noise levels (including L_{eq}) and vibration levels were measured and logged at 1 second interval for the necessary periods at each GBNSR location. The periods need to cover at least three passbys of uptrack trains, three passbys of downtrack trains (i.e. no less than 6 passbys in total)

and representative background noise level before/after each passby. Site observation was carried out during background and train passby noise measurement in order to detect whether the noise measurements were affected by other extraneous noise and to determine the representative of the measured noise levels.

3.4.2 Typically, train passby duration including head-tail period was determined when train noise was being perceived. However, if noise of train passby could not be perceived, it would be determined when there was an increase of vibration levels recorded by the accelerometer placed at the testing location. Vibration levels above background generally indicate train passby and its duration was checked against the train running schedule provided by MTR. Vibration levels were therefore extracted for identification of train passby time and duration when train noise could not be perceived.

3.5 Data Analysis and Evaluation of Ground-borne Railway Noise Impact

3.5.1 The collected noise data of train passbys and the evaluation of ground-borne noise impact ($L_{eq,30min}$) followed the steps as presented below.

i. Train passby data was extracted according to the recorded vibration levels and train running schedule provided by MTR. Noise level during a passby event was considered representative if the noise measurement was not affected by other extraneous noise.

ii. Background noise level was determined from averaging the noise level of over an representative period that was not affected by train GBN and extraneous noise.

iii. As the measured event noise levels would be used for further evaluation of $L_{Aeq,30min}$ to check against the relevant noise criteria, the measured event noise level should be corrected to account for the contribution from background. If the difference between the noise level during a passby event and the corresponding background noise level is equal to or greater than 3.0 dB(A), the measurements indicate that the event noise level is equal to or above the background noise level. In this case, the background corrected noise level could be determined by the following equation:

$$L_{eq,passby} = 10 \times log\left(10^{Leq,during\ passby/10} - 10^{Leq,background/10}\right)$$

Where $L_{eq,during\ passby}$ is the noise level during train passby, dB(A)
$L_{eq,background}$ is the background noise level, dB(A)
$L_{eq,passby}$ is the background corrected noise level, dB(A)

If the difference between the noise level during the passby event and the background noise level is less than 3.0 dB(A), the measurements indicate that the event noise level is below the background noise level and the accuracy of the above equation would be reduced and any background correction, if made, should only be regarded as approximate. In such case, as a conservative approach, no background correction would be applied for the measured noise level during the passby event.

iv. Sound Exposure Level (SEL) for uptrack and downtrack trains in 30 minutes was determined by the following equation:

$$SEL_{Up} = L_{eq,passby,Up} + 10 \times log\left(T_{Up}\right) + 10 \times log\left(N_{Up}\right)$$
$$SEL_{Down} = L_{eq,passby,Down} + 10 \times log\left(T_{Down}\right) + 10 \times log\left(N_{Down}\right)$$

Where $T_{up/Down}$ is the train passby duration, second
$N_{Up/Down}$ is number of train passby in 30 minutes

v. Ground-borne railway noise level ($L_{eq,30min}$) for compliance check was determined by the following equations:

$$L_{eq,30min} = 10 \times log\left(10^{SEL_{Up}/10} + 10^{SEL_{Down}/10}\right) - 10 \times log(1800)$$

vi. In case the measurement would not able to be conducted at the lowest noise sensitive floor, a floor-to-floor attenuation of 2 dB reduction per floor would be applied to the predicted ground-borne railway noise level ($L_{eq,30min}$).

3.6 Evaluation Results of Performance test

3.6.1 As discussed in **Section 3.5.1 (iii)**, correction for background noise would generally be adopted to account for the contribution of background noise. During the course of measurement, train noise could not be perceived at the measurement locations during train passby. As shown in the time history and noise measurement results recorded at the measurement locations (**Appendix D** refers), the measured noise levels during train passby were in general similar to the background noise levels. In such cases, the change of noise levels during train passby were likely due to fluctuation of background noise instead of the ground-borne railway noise. Since all measured noise levels during train passby were less than 3 dB(A) above the background noise levels, as a conservative approach, all the measured noise levels during train passby were not corrected for background noise in evaluating the ground-borne railway noise level (i.e. with inclusion of background noise) for noise criteria compliance check. It is anticipated that the actual operational ground-borne railway noise levels at the GBNSRs would be substantially lower than the evaluation results. Based on this conservative approach, the evaluated operational ground-borne railway noise levels, with the inclusion of background noise, at all the selected GBNSRs comply with the noise criteria in both daytime/evening and night-time periods.

3.6.2 The evaluation results during daytime/evening and night-time periods are summarised in **Table 3.4** and **Table 3.5** respectively. Measurement results and detailed calculations are provided in **Appendix D**.

Table 3.4 Ground-borne Railway Noise Calculation Results during Daytime/Evening Period (0700-2300 hrs)

Measurement Station ID. / NSR ID in EIA	Location	Train Frequency per 30 minutes	Ground-borne Railway Noise Level[(1)(2)], $L_{eq\ 30min}$, dB(A)	Noise Criterion, $L_{eq\ 30min}$, dB(A)	Compliance (Y/N)
GBN Measurement Locations in the approved SCL (TAW-HUH) EM&A Manual					
NMS-OG-1/ DIH-1-1	Tsui Chuk Garden Block 5	12 up and 12 down	<31 [(3)]	55	Y
NMS-OG-2/ TKW-6-2	Hong Kong Society for the Protection of Children		<15	55	Y
NMS-OG-3/ HOM-1-1	Ko Shan Theatre		<29	55	Y
NMS-OG-4/ HUH-1-3	Wing Fung Building		<45	55	Y
GBN Measurement Location in the approved SCL (HHS) EM&A Manual					
NMS-OG-2 (HHS) / DIH-11-1	Lung Poon Court, Lung Wan House	12 up and 12 down	<35	55	Y
Additional GBN Measurement Location					
- / DIH-6-1	WTS Fire Station and Quarters Block A	12 up and 12 down	<29	55	Y

Notes:

(1) Train passby data was extracted according to the recorded vibration levels and train running schedule provided by MTR. Noise level during a passby event was considered representative if the noise measurement was not affected by other extraneous noise. Background noise level was determined from averaging the noise levels of a representative period (approx. 1 minute) before or after the train passby that was not affected by train GBN and extraneous noise. Since all measured noise levels during train passby were less than 3dB(A) above the background noise levels, as a conservative approach, all the measured noise levels during train passby were not corrected for background noise in evaluating the $L_{eq,\ 30min}$. It is therefore anticipated that the actual operational ground-borne railway noise levels at the GBNSRs would be substantially lower than the evaluation

results.

(2) A worst case scenario with the adoption of maximum SEL measured for prediction has been considered. Given that all the ground-borne noise levels are lower than the stipulated noise criterion by more than 10dB(A) during daytime and evening period, it is anticipated that the ground-borne noise levels are still well within the stipulated noise criterion as the differences between the maximum SEL and the averaged SEL of corresponding train direction are in the range of 0.1 dB(A) to 1.6dB(A).

(3) The ground-borne noise level was measured on G/F while 1/F is the lowest sensitive floor. It is anticipated that the ground-borne noise railway level on 1/F would be lower than that on G/F due to floor-to-floor attenuation.

Table 3.5 Ground-borne Railway Noise Calculation Results during Night-time period (2300-0700 hrs)

Measurement Station ID. / NSR ID in EIA	Location	Train Frequency per 30 minutes	Ground-borne Railway Noise Level[(1)(2)], $L_{eq\ 30min}$, dB(A)	Noise Criterion, $L_{eq\ 30min}$, dB(A)	Compliance (Y/N)
GBN Measurement Locations in the approved SCL (TAW-HUH) EM&A Manual					
NMS-OG-1/ DIH-1-1	Tsui Chuk Garden Block 5	6 up and 6 down	<28 [(3)]	45	Y
NMS-OG-2/ TKW-6-2	Hong Kong Society for the Protection of Children		N.A. [(4)(5)]	N.A. [(4)]	Y
NMS-OG-3/ HOM-1-1	Ko Shan Theatre		N.A. [(4)(5)]	N.A. [(4)]	Y
NMS-OG-4/ HUH-1-3	Wing Fung Building		<42	45	Y
GBN Measurement Location in the approved SCL (HHS) EM&A Manual					
NMS-OG-2 (HHS) / DIH-11-1	Lung Poon Court, Lung Wan House	6 up and 6 down	<32	45	Y
Additional GBN Measurement Location					
- / DIH-6-1	WTS Fire Station and Quarters Block A	6 up and 6 down	<26	45	Y

Notes:

(1) Train passby data was extracted according to the recorded vibration levels and train running schedule provided by MTR. Noise level during a passby event was considered representative if the noise measurement was not affected by other extraneous noise. Background noise level was determined from averaging the noise levels of a representative period (approx. 1 minute) before or after the train passby that was not affected by train GBN and extraneous noise. Since all measured noise levels during train passby were less than 3dB(A) above the background noise levels, as a conservative approach, all the measured noise levels during train passby were not corrected for background noise in evaluating the $L_{eq,\ 30min}$. It is therefore anticipated that the actual operational ground-borne railway noise levels at the GBNSRs would be substantially lower than the evaluation results.

(2) A worst case scenario with the adoption of maximum SEL measured for prediction has been considered. Given that all the ground-borne noise levels are lower than the stipulated noise criterion by 3dB(A) or more during night-time period, it is anticipated that the ground-borne noise levels are still well within the stipulated noise criterion as the differences between the maximum SEL and the averaged SEL of corresponding train direction are in the range of 0.1 dB(A) to 1.6dB(A).

(3) The ground-borne noise level was measured on G/F while 1/F is the lowest sensitive floor. It is anticipated that the ground-borne noise railway level on 1/F would be lower than that on G/F due to floor-to-floor attenuation.

(4) N.A.- Not Applicable as there is no sensitive use at performance arts centre and educational institution during night-time period.

(5) Since the maximum train frequency during night-time operation is half of that during daytime/evening and other operation parameters remain the same, night-time ground-borne railway noise level is expected to be 3 dB(A) lower than that during daytime and evening time operation (i.e. Night-time ground-borne railway noise level is expected to be < 12dB(A) and <26 dB(A) at TKW-6-2 and HOM-1-1 respectively). As mentioned in Section 3.2.6, TKW-6-2 and HOM1-1 are the representative GBNSRs along Ma Tau Chung Road, Ma Tau Wai Road and Chatham Road North, therefore, night-time ground-borne railway noise levels at other GBNSRs along Ma Tau Chung Road, Ma Tau Wai Road and Chatham Road North also comply with the night-time ground-borne noise criterion (i.e. 45 dB(A)).

3.7 Cumulative Ground-borne Railway Noise Impact

3.7.1 Based on the performance test results in **Tables 3.4** and **3.5** above, the cumulative ground-borne railway noise levels at Wing Fung Building have been evaluated to check the compliance of noise criteria and the prediction results are presented in **Table 3.7**.

Table 3.6 Cumulative Ground-borne Railway Noise Calculation

Time Period	Location	Ground-borne Railway Noise Level, $L_{eq\ 30min}$, dB(A)				Predicted Cumulative Noise Level, dB(A)	NCO Noise Criteria, dB(A) (ANL)	Compliance (Y/N)
		SCL (TAW-HUH)	SCL (HHS) (1)	SCL (MKK-HUH) (2)	KTE (2)			
Daytime/ Evening (0700-2300 hrs)	Wing Fung Building	<45 (3)	8	20	<20	<55 (3)	55	Y
Night-time (2300-0700hrs)		<42 (3)	8	20	<20	<45 (3)	45	Y

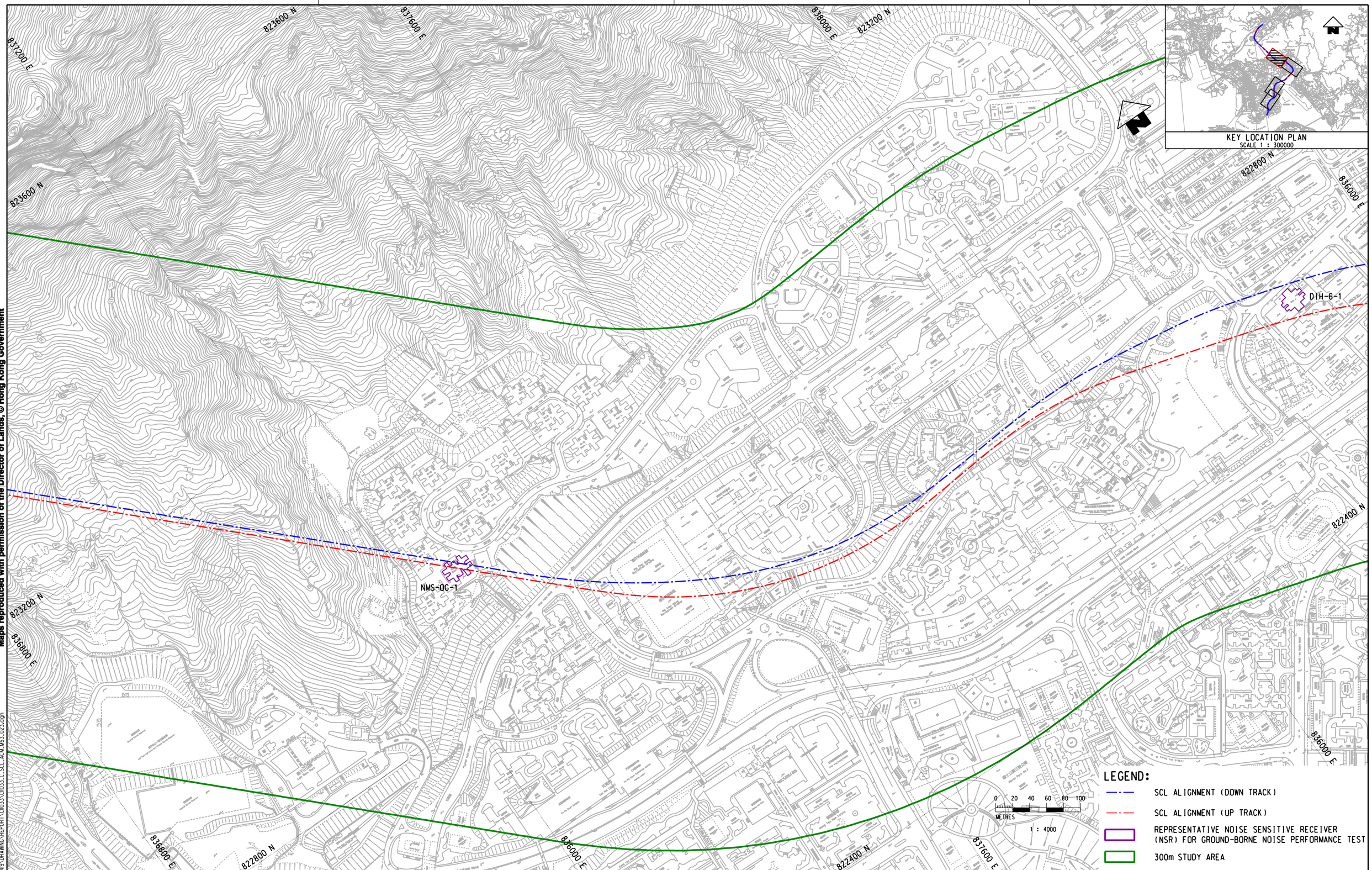
Note:
(1) Wing Fung Building is the same monitoring location under the approved EM&A Manuals for SCL(TAW-HUH), SCL(HHS) and SCL(MKK-HUH). Based on latest findings in OGNMMP (Last page of **Appendix A** refers), the ground-borne noise contribution from an about 28m tunnel section under SCL (HHS) (**Figure No. C1103/C/SCL/ACM/M53/026** refers) is only 8dB(A).
(2) Reference is made to the approved SCL(HHS) EIA report.
(3) Since the measured noise levels during train passby were less than 3dB(A) above the background noise levels, as a conservative approach, the measured noise levels during train passby were not corrected for background noise in evaluating the Leq, 30min. It is therefore anticipated that the actual operational ground-borne railway noise levels and the actual cumulative noise levels would be substantially lower than the evaluation results and comply with the NCO noise criteria.

4 CONCLUSION

4.1.1 Ground-borne noise performance test was conducted at 6 representative GBNSRs in July and December 2018.

4.1.2 The results show that ground-borne railway noise levels at all selected GBNSRs comply with the stipulated noise criteria in daytime/evening and night-time period. Based on the findings of the ground-borne railway noise performance test, there would be no adverse railway noise impact arising from the operation of the Project to GBNSRs.

Figure



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TITLE

C11033

SCL (TAW - HUH)

MEASUREMENT LOCATIONS FOR OPERATIONAL GROUND-BORNE RAILWAY NOISE PERFORMANCE TEST (SHEET 1 OF 4)

SCALE	FIGURE NO.	REV.
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838800 E 822800 N

839200 E

822400 N

839600 E

822800 N

838400 E

822000 N

839600 E

NMS-DG-2(HHS)

DTH

822400 N

821600 N

822000 N

838400 E

838800 E 821600 N

839200 E

KEY LOCATION PLAN
SCALE 1 : 300000

0 20 40 60 80 100
METRES
1 : 4000

LEGEND:

- SCL ALIGNMENT (DOWN TRACK)
- SCL ALIGNMENT (UP TRACK)
- REPRESENTATIVE NOISE SENSITIVE RECEIVER (NSR) FOR GROUND-BORNE NOISE PERFORMANCE TEST
- 300m STUDY AREA

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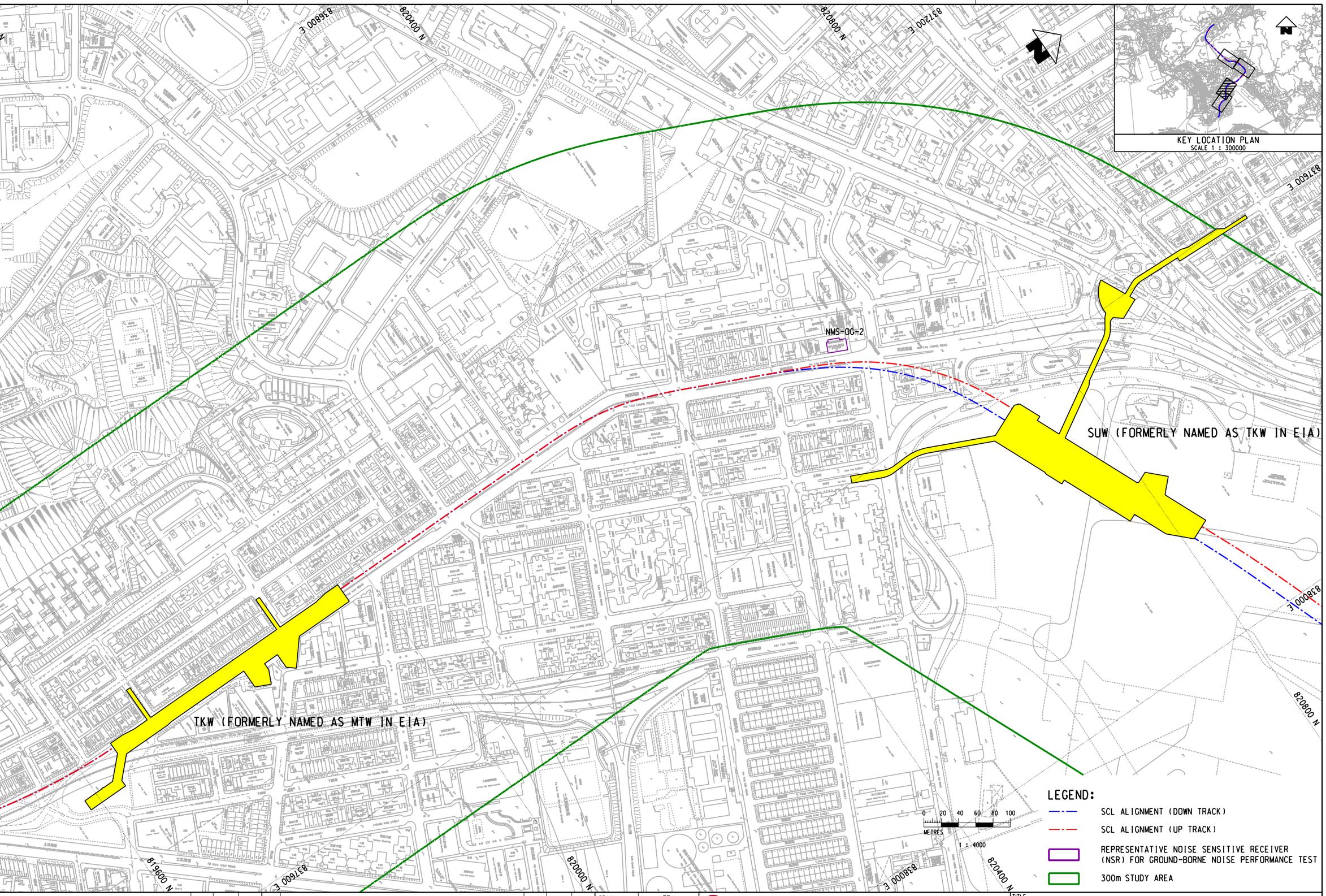
TITLE
C11033
SCL (TAW - HUH)
MEASUREMENT LOCATIONS FOR OPERATIONAL GROUND-BORNE RAILWAY NOISE PERFORMANCE TEST
(SHEET 2 OF 4)

SCALE 1 : 4000 (A3)

FIGURE NO. C11033/C/SCL/ACM/M53/024

REV. A



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DATE	04/JAN/2019

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C11033
SCL (TAW - HUH)
MEASUREMENT LOCATIONS FOR OPERATIONAL GROUND-BORNE RAILWAY NOISE PERFORMANCE TEST (SHEET 3 OF 4)

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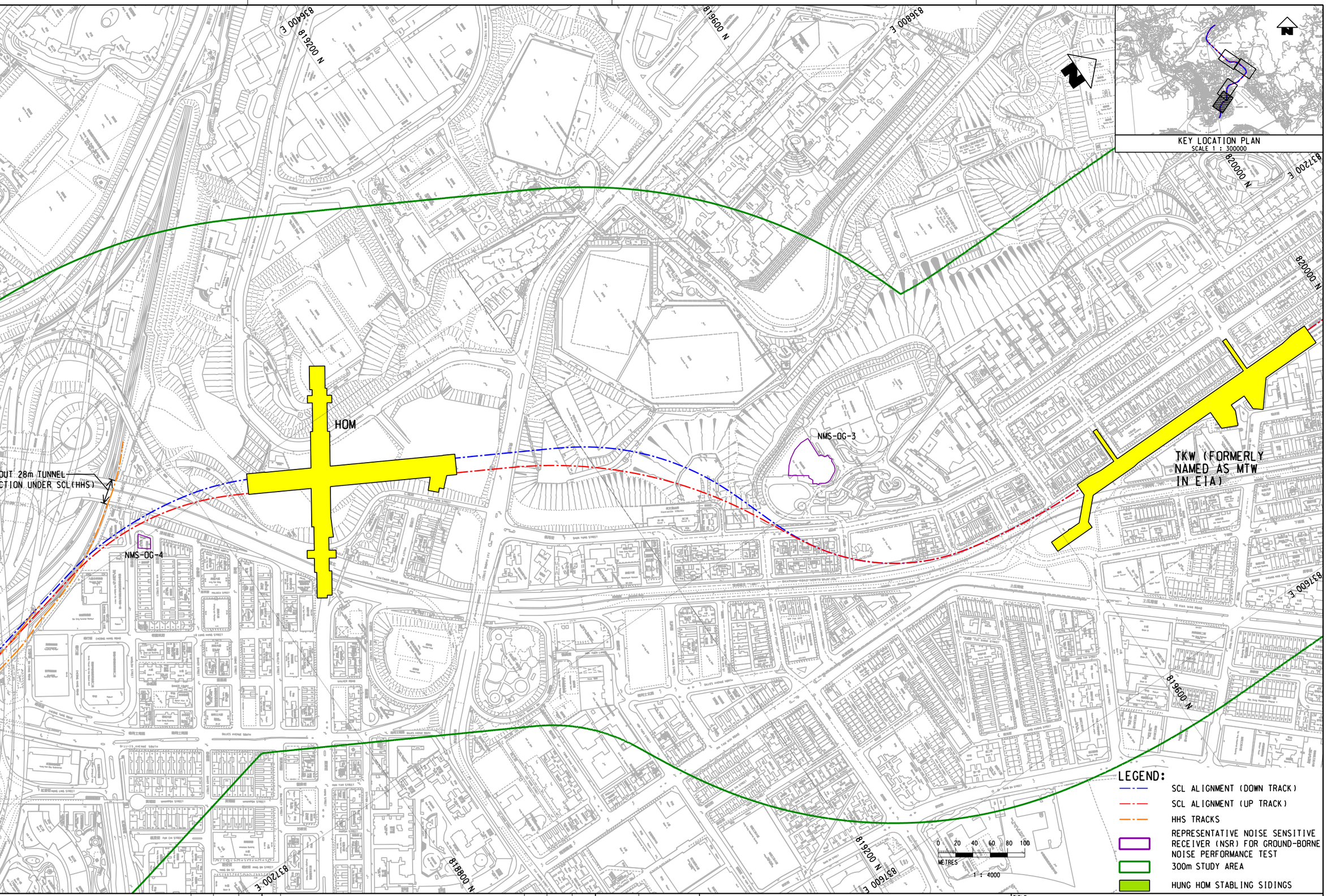

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TITLE

C11033
SCL (TAW - HUH)
MEASUREMENT LOCATIONS FOR OPERATIONAL GROUND-BORNE RAILWAY NOISE PERFORMANCE TEST (SHEET 4 OF 4)

SCALE	FIGURE NO.	REV.
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Appendix A

Excerpt of Final Operation Ground-borne Noise Mitigation Measures Plan (June 2017)

- Speed – no update and therefore follows those adopted in the approval of EIA Reports;
- Turnout Adjustment – updated information on the type of turnouts to be used and the adjustment of position corresponding to the type of turnouts; and
- Building information – updated information including building name, position and layout in Kai Tak and Diamond Hill areas.

3.3.2 Ground-borne noise assessment at the representative operational ground-borne noise sensitive receivers (OGBNSRs) (**Figures C11033/C/SCL/ACM/M53/013** to **018** refer) has been updated according to the LSR measurement results. Assessment methodology follows the prediction methodology recommended by the FTA Manual, which was adopted in the EIA Reports. The prediction results are summarised in **Table 3.2** and **Annex C**, with detailed sample calculation provided in **Annex D**. Cumulative operational ground-borne noise levels have also been updated with results indicate compliance with the stipulated noise limits (**Annex E** refers).

3.3.3 Results indicate that the updated operational ground-borne noise levels are all below the noise criteria. As such, no mitigation measures such as trackform upgrade is required for SCL(TAW-HUH) and SCL(HHS), and EIA conclusion remains unchanged.

Table 3.2 Ground-borne Noise Prediction Results

NSR ID	NSR Description	Lmax	Day and Evening Period (0700 - 2300 hours)			Night-time Period (2300 - 0700 hours)		
		Updated Results, L_{max}, dB(A)	Criteria, $L_{eq,30min}$, dB(A)	Updated Prediction, $L_{eq,30min}$, dB(A)	Comply with NCO (Y/N)	Criteria, $L_{eq,30min}$, dB(A)	Updated Prediction, $L_{eq,30min}$, dB(A)	Comply with NCO (Y/N)
SCL (TAW - HUH)								
DIH-1-1	Tsui Chuk Garden Block 5	45	55	34	Y	45	31	Y
DIH-2-1	Pak Yuen House	39	55	29	Y	45	26	Y
DIH-3-1	Wah Yuen House	42	55	32	Y	45	29	Y
DIH-3-2	Nga Yuen House	40	55	31	Y	45	28	Y
DIH-3-3	Kwai Yuen House	44	55	35	Y	45	32	Y
DIH-3-4	Chui Yuen House	42	55	33	Y	45	30	Y
DIH-4-1	Pang Ching Court	40	55	30	Y	45	27	Y
DIH-4-2	Carbo Anglo-Chinese Kindergarden	43	55	36	Y	-	-	Y
DIH-5-1	Rainbow Home	47	55	37	Y	45	34	Y
DIH-5-2	Residential premises	45	55	36	Y	45	33	Y
DIH-5-5	Our Lady's Kindergarden	43	55	36	Y	-	-	Y
DIH 6-1	WTS Fire Station and Quarters Block A	48	55	38	Y	45	35	Y
DIH-7-1	Tropicana Gardens Block 2	39	55	29	Y	45	26	Y
DIH-7-2	Tropicana Gardens Block 3	40	55	30	Y	45	27	Y
DIH-8-1	Redemption Lutheran Church	43	55	33	Y	45	30	Y

NSR ID	NSR Description	Lmax	Day and Evening Period (0700 - 2300 hours)			Night-time Period (2300 - 0700 hours)		
		Updated Results, L_{max}, dB(A)	Criteria, $L_{eq,30min}$, dB(A)	Updated Prediction, $L_{eq,30min}$, dB(A)	Comply with NCO (Y/N)	Criteria, $L_{eq,30min}$, dB(A)	Updated Prediction, $L_{eq,30min}$, dB(A)	Comply with NCO (Y/N)
DIH-9-1	Shek On Building	43	55	36	Y	-	-	Y
DIH-10-1	Hong Kong Sheung Keung Hui Nursing Home	39	55	30	Y	45	27	Y
DIH-11-1	Lung Wan House	35	55	29	Y	45	26	Y
DIH-12-1	Galaxia Tower B	23	55	<20	Y	45	<20	Y
DIH-12-2	Galaxia Tower E	21	55	<20	Y	45	<20	Y
DIH-13-1	Canossa Primary School	42	55	35	Y	-	-	Y
DIH-14-1	Rhythm Garden Block 2	41	55	33	Y	45	30	Y
DIH-14-2	Rhythm Garden Block 5	32	55	24	Y	45	21	Y
DIH-14-3	Rhythm Garden Block 8	13	55	<20	Y	45	<20	Y
DIH-14-4	Canossa Primary School (San Po Kong)	37	55	32	Y	-	-	Y
DIH-14-5	Rhythm Garden Block 1	41	55	33	Y	45	30	Y
DIH-14-6	Rhythm Garden Block 3	41	55	32	Y	45	29	Y
DIH-15-1	Kam Wan House	41	55	32	Y	45	29	Y
DIH-15-2	Pik Hoi House	41	55	33	Y	45	30	Y
DIH-16-1	Wong Tai Sin Temple	46	55	36	Y	45	33	Y
DIH-17-1	Chuk Yuen United Village	46	55	36	Y	45	33	Y
DIH-18-1	Upper Wong Tai Sin Estate Po Sin House	45	55	36	Y	45	33	Y
DIH-18-2	Upper Wong Tai Sin Estate Tat Sin House	45	55	35	Y	45	32	Y
DIH-19-1	Lung Cheung Gov. Secondary School	46	55	39	Y	-	-	Y
DIH-20-1	Baptist Rainbow Primary School	45	55	38	Y	-	-	Y
DIH-21-1	Tin Wang Court Wang King House	46	55	36	Y	45	33	Y
DIH-22-1	Price Memorial Catholic Primary School	45	55	38	Y	-	-	Y
DIH-23-1	Tin Ma Court Chun On House	42	55	32	Y	45	29	Y
DIH-24-1	Shing Wong Temple	46	55	37	Y	45	34	Y

NSR ID	NSR Description	Lmax	Day and Evening Period (0700 - 2300 hours)			Night-time Period (2300 - 0700 hours)		
		Updated Results, L_{max}, dB(A)	Criteria, $L_{eq,30min}$, dB(A)	Updated Prediction, $L_{eq,30min}$, dB(A)	Comply with NCO (Y/N)	Criteria, $L_{eq,30min}$, dB(A)	Updated Prediction, $L_{eq,30min}$, dB(A)	Comply with NCO (Y/N)
DIH-P1-1	Upper Wong Tai Sin Estate Phase 3	44	55	34	Y	45	31	Y
DIH-P3-1A	Planned receivers in the CDA site(2)	35	55	27	Y	45	24	Y
DIH-P3-2A	Planned receivers in the CDA site(2)	38	55	30	Y	45	27	Y
DIH-P3-4	Planned receivers in the CDA site(2)(3)	45	55	34	Y	-	-	Y
KAT-P1-1	Residential premises near Kai Tak Station	15	55	<20	Y	45	<20	Y
KAT-P1-2	One Kai Tak	8	55	<20	Y	45	<20	Y
KAT-P1-3	Residential premises near Kai Tak Station	21	55	<20	Y	45	<20	Y
KAT-P1-4	Residential premises near Kai Tak Station	16	55	<20	Y	45	<20	Y
KAT-P1-5	Mun Ching House, Kai Ching Estate	42	55	34	Y	45	31	Y
KAT-P1-6	Tower H3, De Novo	26	55	<20	Y	45	<20	Y
KAT-P1-7	Residential premises near Kai Tak Station	48	55	39	Y	45	36	Y
TKW-1-1	Parc 22	37	55	28	Y	45	25	Y
TKW-1-2	Sanford Mansion	37	55	28	Y	45	25	Y
TKW-2-1	Skytower Tower 1	28	55	<20	Y	45	<20	Y
TKW-2-2	Skytower Tower 2	28	55	<20	Y	45	<20	Y
TKW-2-3	Skytower Tower 7	24	55	<20	Y	45	<20	Y
TKW-3-1	Prince Ritz	13	55	<20	Y	45	<20	Y
TKW-3-2	Prosperity House	26	55	<20	Y	45	<20	Y
TKW-P1-1	Residential premises near To Kwa Wan Station	35	55	28	Y	45	25	Y
MTW-6-1	Fok On Building	42	55	34	Y	45	31	Y
MTW-6-2	HK Society for the Protection of Children	47	55	41	Y	-	-	Y
MTW-6-3	Chung Nam Mansion	42	55	33	Y	45	30	Y
MTW-6-4	Pok Oi Lau	46	55	38	Y	45	35	Y
MTW-7-1	Geranium House	46	55	37	Y	45	34	Y
MTW-8-1	Horae Palace	43	55	35	Y	45	32	Y
MTW-9-1	Majestic Park	40	55	32	Y	45	29	Y
MTW-10-1	18 Farm Road	43	55	35	Y	45	32	Y

NSR ID	NSR Description	Lmax	Day and Evening Period (0700 - 2300 hours)			Night-time Period (2300 - 0700 hours)		
		Updated Results, L_{max}, dB(A)	Criteria, $L_{eq,30min}$, dB(A)	Updated Prediction, $L_{eq,30min}$, dB(A)	Comply with NCO (Y/N)	Criteria, $L_{eq,30min}$, dB(A)	Updated Prediction, $L_{eq,30min}$, dB(A)	Comply with NCO (Y/N)
MTW-11-1	Farm Road Government Primary School	44	55	38	Y	-	-	Y
MTW-12-1	Yuet Fai Mansion	47	55	38	Y	45	35	Y
MTW-12-2	Delight Court	41	55	32	Y	45	29	Y
MTW-12-3	Lucky Mansion	35	55	27	Y	45	24	Y
MTW-12-4	352-354 Ma Tau Wai Road	34	55	27	Y	45	24	Y
MTW-12-5	Seng Cheong Building	39	55	32	Y	45	29	Y
MTW-12-6	Great Wall Building	41	55	33	Y	45	30	Y
MTW-12-7	197-199 Ma Tau Wai Road	45	55	37	Y	45	34	Y
MTW-12-8	Pak Tai Mansion	47	55	39	Y	45	36	Y
MTW-12-9	Residential premises along Hung Kwong Street	43	55	35	Y	45	32	Y
MTW-12-10	Lucky Building	35	55	28	Y	45	25	Y
MTW-12-11	Jing Ming Building	34	55	26	Y	45	23	Y
MTW-12-12	One Elegance	43	55	35	Y	45	32	Y
MTW-13-1	Cheung Chuk Shan Memorial School	43	55	37	Y	-	-	Y
MTW-14-1	PLK Lam Man Chan English Primary School	37	55	32	Y	-	-	Y
MTW-15-1	Hung Hom Lutheran Primary School	40	55	36	Y	-	-	Y
MTW-16-1	SKH Good Shepherd Primary School	38	55	34	Y	-	-	Y
MTW-17-1	Loyal Mansion	38	55	30	Y	45	27	Y
MTW-18-1	Residential premises along Chi Kiang St	32	55	25	Y	45	22	Y
MTW-18-2	No. 2 Kowloon City Road	33	55	26	Y	45	23	Y
MTW-19-1	Holy Trinity Church	38	55	30	Y	45	27	Y
HOM-1-1	Ko Shan Theartre	43	55	35	Y	45	32	Y
HOM-2-1	Faerie Court	41	55	34	Y	45	31	Y
HOM-2-2	Lee Wing Building	43	55	35	Y	45	32	Y
HOM-2-3	Wing Lam Mansion	43	55	36	Y	45	33	Y
HOM-2-4	Tak Lee Court	42	55	34	Y	45	31	Y
HOM-2-5	Chat Ma Mansion	42	55	34	Y	45	31	Y

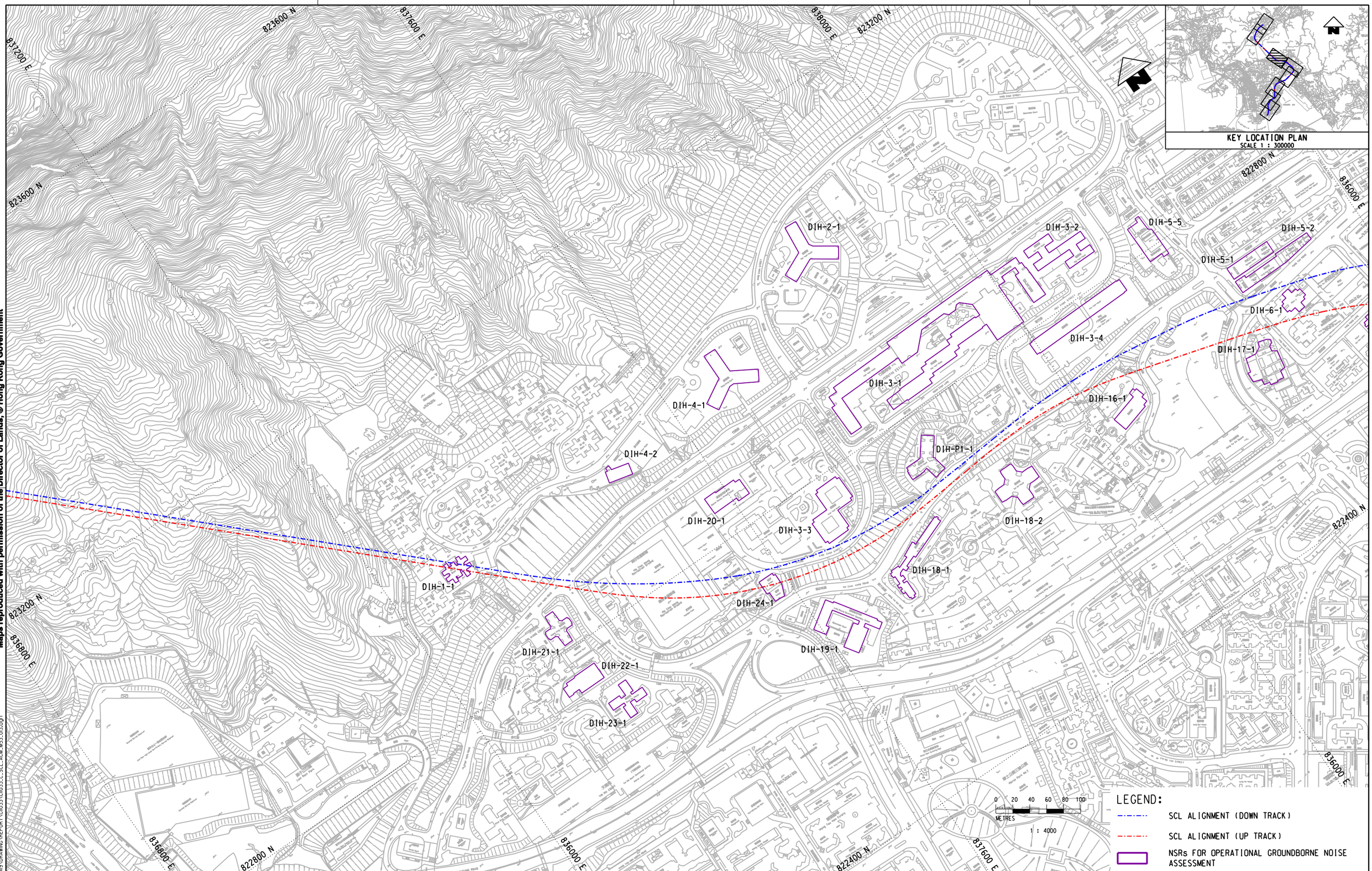
NSR ID	NSR Description	Lmax	Day and Evening Period (0700 - 2300 hours)			Night-time Period (2300 - 0700 hours)		
		Updated Results, L_{max}, dB(A)	Criteria, $L_{eq,30min}$, dB(A)	Updated Prediction, $L_{eq,30min}$, dB(A)	Comply with NCO (Y/N)	Criteria, $L_{eq,30min}$, dB(A)	Updated Prediction, $L_{eq,30min}$, dB(A)	Comply with NCO (Y/N)
HOM-2-6	Chatham Mansion	45	55	37	Y	45	34	Y
HOM-3-1	Fook Sing Mansion	39	55	31	Y	45	28	Y
HOM-3-2	Marigold Mansion, Block A	39	55	31	Y	45	28	Y
HOM-4-1	Yee Fu Building	36	55	28	Y	45	25	Y
HOM-5-1	271 Chatham Road North	28	55	22	Y	45	<20	Y
HOM-P2	HKPU Student Halls of Residence	35	55	28	Y	45	25	Y
HOM-P3-1	Residential Building, HOM Station Development	37	55	30	Y	45	27	Y
HUH-1-1	Cartas Branchi College of Careers	34	55	30	Y	-	-	Y
HUH-1-2	Lok Ka House	37	55	30	Y	45	27	Y
HUH-1-3	Wing Fung Building	37	55	29	Y	45	26	
SCL (HHS)								
HUH-1-3	Wing Fung Building	16	55	<20	Y	45	<20	Y

Notes:
(1) The operational groundborne noise results are taken from either those presented in SCL(TAW-HUH) EIA Report or SCL(HHS) EIA Report KAT-P1-5 or Supporting Document for Application of VEP (Application No. VEP-370/2012) (June 2012) where applicable.
(2) Information based on the Environmental Review Report (ERR) for Update of Fixed Plant Noise Sources at Diamond Hill Station (DIH) and Hin Keng Station (HIK), and Minor Update of HIK Footprint (August 2016) for supporting the Application of Variation of Environmental Permit (Application No.: VEP-506/2016).
(3) There would be no night-time operation at DIH-P3-4 according to the information in ERR.

4 CONCLUSION

4.1.1 The measurement of LSR values were conducted at the recommended testing locations as stated in the agreed T&RMP. The assumptions adopted in the EIA Reports have been further reviewed and the ground-borne noise prediction for SCL(TAW-HUH) and SCL(HHS) have been updated based on all measured LSR results in the Final OGNMMP and the latest available information.

4.1.2 The updated ground-borne noise levels are all below the noise criteria, and thus the conclusion in the EIA Reports remains unchanged, and no mitigation measures are required



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DESIGNED	LCLL
CHECKED	LCLL
APPROVED	IMW
DATE	23/MAY/2017

MTR

SHATIN TO CENTRAL LINK

ORIGINATOR

AECOM

CADD REF. C11033_C_SCL_ACM_M53_013.dgn

TITLE

C11033

SCL (TAW - HUH)

LOCATIONS OF NOISE SENSITIVE RECEIVERS (GROUNDBORNE) (SHEET 1 OF 6)

SCALE	FIGURE NO.	REV.
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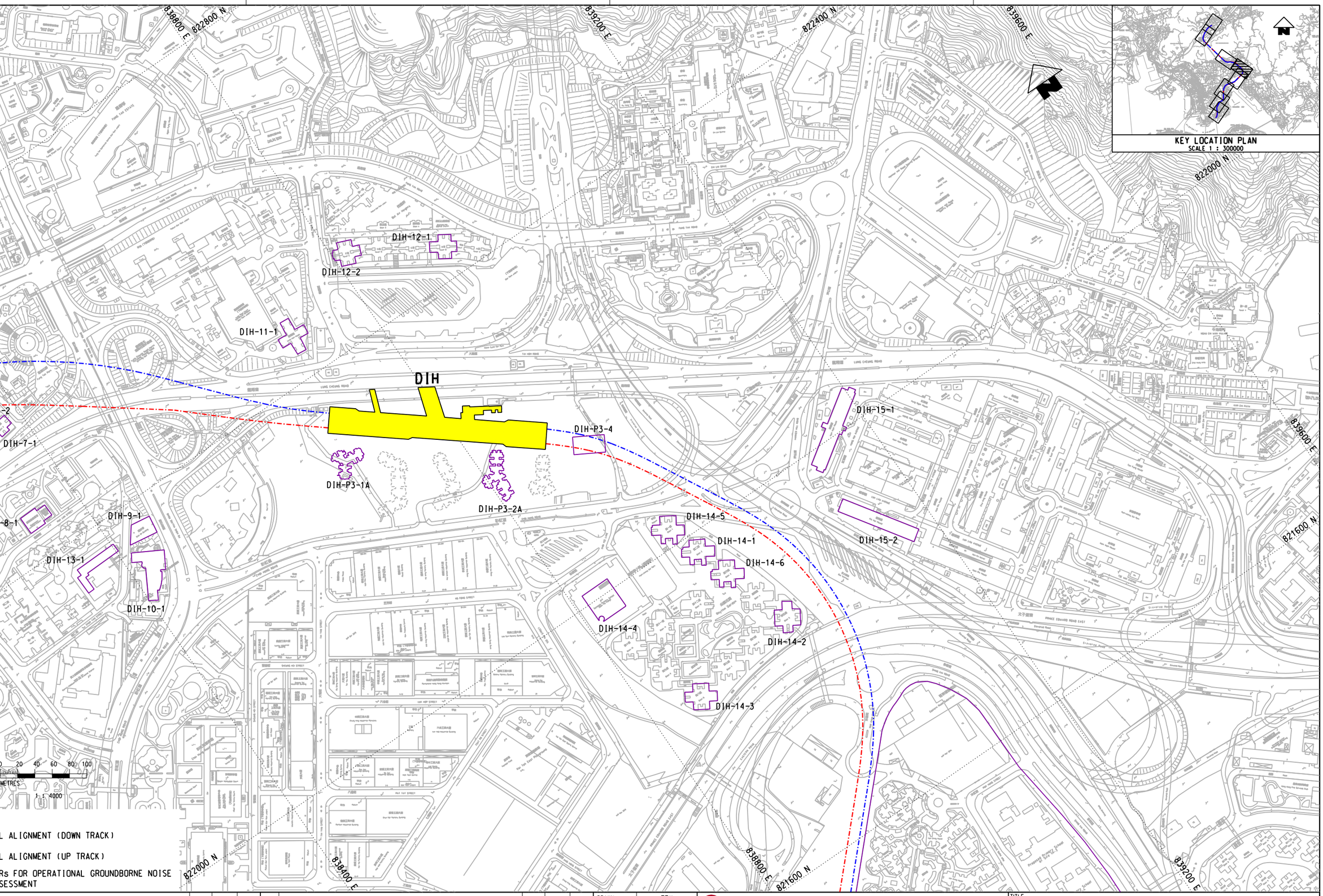

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DRAWN	ZFX
DESIGNED	LCLL
CHECKED	LCLL
APPROVED	IMW
DATE	23/MAY/2017

MTR

SHATIN TO CENTRAL LINK

ORIGINATOR

AECOM

CADD REF. C11033_C_SCL_ACM_M53_014.dgn

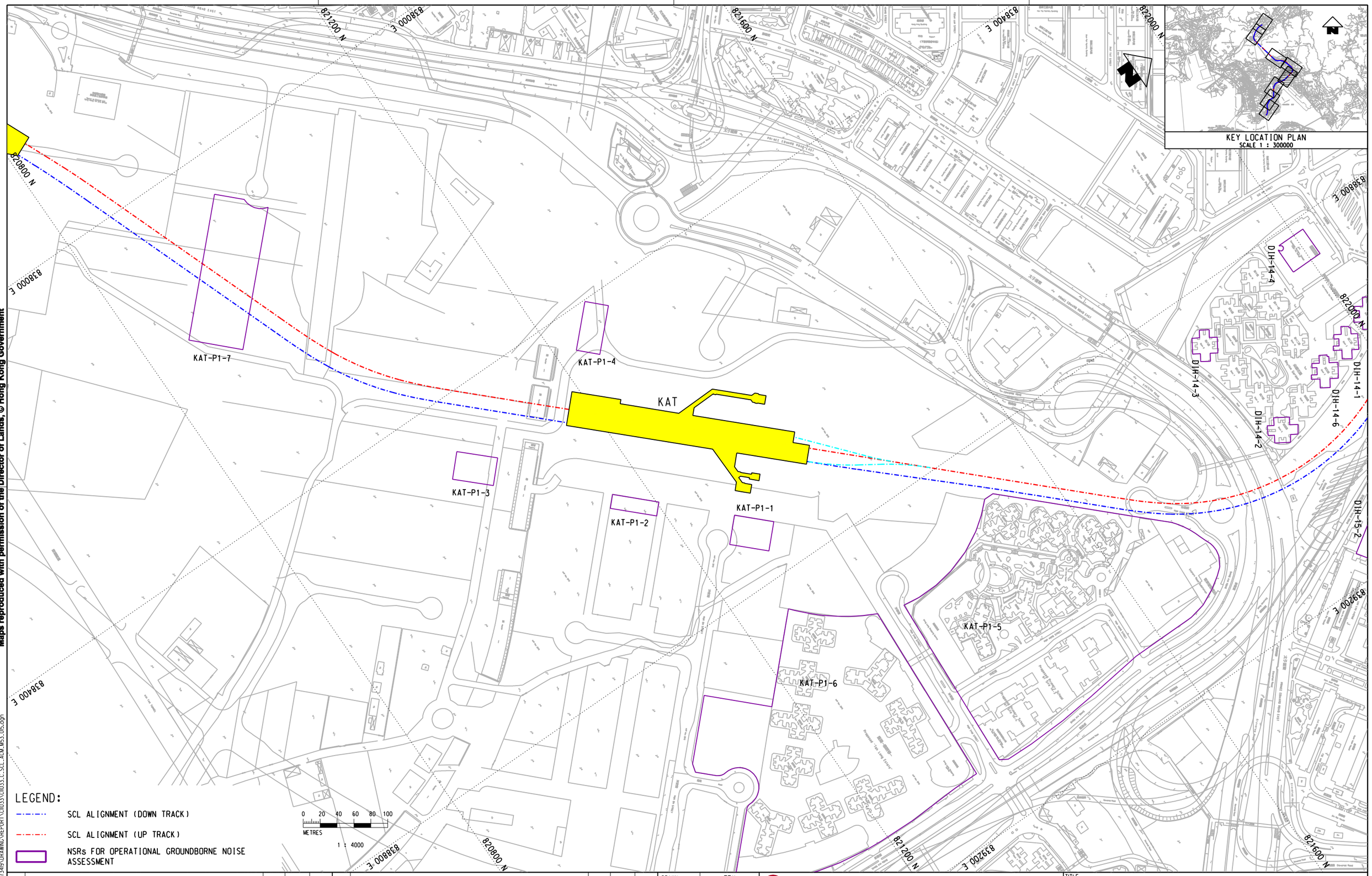
TITLE

C11033
SCL (TAW - HUH)
LOCATIONS OF NOISE SENSITIVE RECEIVERS (GROUNDBORNE)
(SHEET 2 OF 6)

SCALE 1 : 4000 (A3)

FIGURE NO. C11033/C/SCL/ACM/M53/014

REV. A



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DRAWN	ZFX
DESIGNED	LCLL
CHECKED	LCLL
APPROVED	IMW
DATE	23/MAY/2017

MTR

SHATIN TO CENTRAL LINK

ORIGINATOR

AECOM

CADD REF. C11033_C_SCL_ACM_M53_015.dgn

TITLE

C11033
SCL (TAW - HUH)
LOCATIONS OF NOISE SENSITIVE RECEIVERS (GROUNDBORNE)
(SHEET 3 OF 6)

SCALE	FIGURE NO.	REV.
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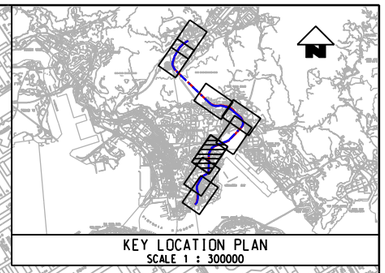

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820400 N
820800 N
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838000 E
MTW-7-1
MTW-9-1
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MTW-8-1
MTW-10-1
MTW-12-1
MTW-12-7
MTW-12-6
MTW-12-12
MTW-12-2
MTW-12-11
MTW-12-3
MTW-13-1
MTW-12-9
MTW-12-4
MTW-14-1
MTW-16-1
MTW-15-1
MTW-12-10
MTW
MTW-12-5
MTW-17-1
MTW-18-2
MTW-18-1
HOM-2-1
HOM-2-6
MTW-6-2
MTW-19-1
MTW-6-4
MTW-6-1
MTW-6-3
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TKW-3-2
TKW-3-1
TKW
TKW-P1-1
0 20 40 60 80 100
METRES
1 : 4000

LEGEND:
- SCL ALIGNMENT (DOWN TRACK)
- SCL ALIGNMENT (UP TRACK)
- NSRs FOR OPERATIONAL GROUNDBORNE NOISE ASSESSMENT

REV	DESCRIPTION	BY	DATE	APPROVED
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DRAWN	ZFX
DESIGNED	LCLL
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APPROVED	IMW
DATE	23/MAY/2017

MTR

SHATIN TO CENTRAL LINK

ORIGINATOR

AECOM

CADD REF. C11033_C_SCL_ACM_M53_016.dgn

TITLE
C11033
SCL (TAW - HUH)
LOCATIONS OF NOISE SENSITIVE RECEIVERS (GROUNDBORNE)
(SHEET 4 OF 6)

SCALE 1 : 4000 (A3)

FIGURE NO. C11033/C/SCL/ACM/M53/016

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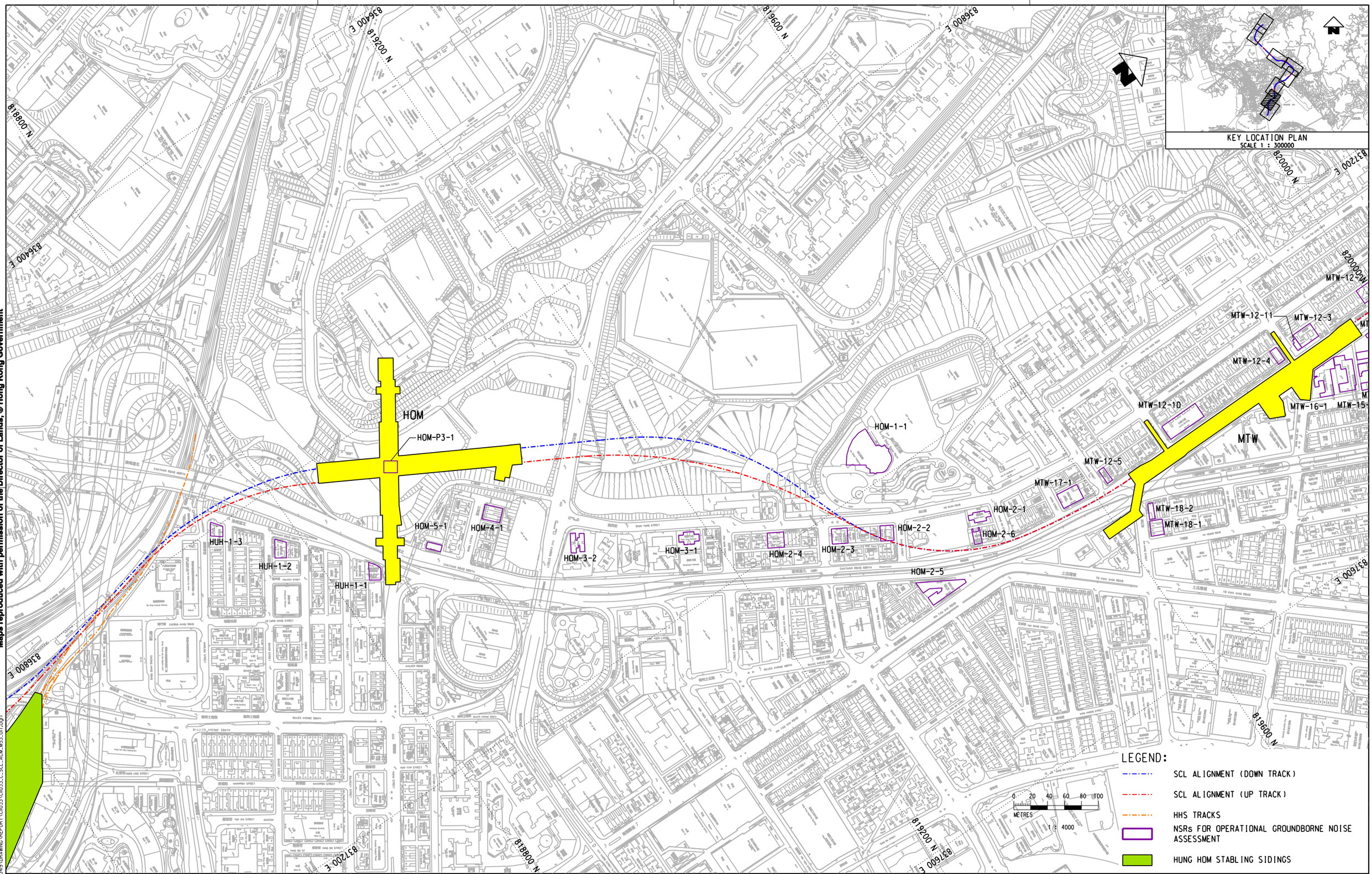

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APPROVED	IMW
DATE	23/MAY/2017

MTR

SHATIN TO CENTRAL LINK

ORIGINATOR

AECOM

CADD REF. C11033_C_SCL_ACM_M53_017.dgn

TITLE

C11033
SCL (TAW - HUH)
LOCATIONS OF NOISE SENSITIVE RECEIVERS (GROUNDBORNE)
(SHEET 5 OF 6)

SCALE	FIGURE NO.	REV.
1 : 4000 (A3)	C11033/C/SCL/ACM/M53/017	A

Annex C - Operational Groundborne Noise Assessment Results

Project: SCL (TAW-HUH) SCL (HHS)

Item	NSR	Location	Floor	Horizontal Distance		Vertical Distance		Reference LSR[1]		TCF[2]	TOC[3]		Track Type[4]		CCF	BCF	L_{max} [5]	Speed[6]	Passby Duration	SEL[7] 1UP&DN	Train Freqency	Predicted $L_{eq\ 30min}$ (dB(A))	NCO Criteria (Nighttime)	Criteria Achieved?
				Up Track (m)	Down Track (m)	Up Track (m)	Down Track (m)	Up	Down		Up	Down	Up	Down				kph	(sec)	(dB(A))	no./30m/dir	SCL (HHS)		
102	HUH-1-3	Wing Fung Building	1	45	-	0	-	KAT-P1-5	-	C	0	0	0	0	N	N	16	25	27	33	6	<20	45	Yes

Notes:

[1] Reference LSR are measurement result taken at representative NSR.

[2] TCF types : B - Bored tunnel, C - Cut and cover tunnel, S - Station

[3] TOC types : 0 - No turnouts, 1 - turnout, 2 - inclined turnout

[4] Track Type 0 = Direct Fixation, 1 = Atl 1 Baseplate, Type 2 = Egg Type Baseplate, Type 3 = 12.5Hz FST.

[5] L_{max} has incorporated a +0.5dB(A) correction to passby L_{eq} based on previous study.

[5] FDL based on 60kph data and adjusted by the correction factor of $20\text{xlog}(V/V_{ref})$, in line with FTA manual.

[6] Calculation based on 8-car train with 23.75m legth for each car.

[7] Nighttime train frequency is presented. For HHS, 6 trains per 30 minutes is assumed at the tunnel section under Chatham Road North for tuning around.

Appendix B

Calibration Certificates of Monitoring Equipment

Sound & Vibration Analyzer SVAN958 (Serial No. 28422)
(for measurement conducted in July and December 2018)

MAXLAB

CALIBRATION CERTIFICATE

Certificate Information

Date of Issue	7-May-2018	**Certificate Number**	MLCN180788S

Customer Information

Company Name	Wilson Accoustics Limited
Address	Unit 601, Block A, Shatin Industrial Centre, Yuen Shun Circuit, Shatin, N. T., Hong Kong

Equipment-under-Test (EUT)

Description	Sound & Vibration Analyser
Manufacturer	Svantek
Model Number	SVAN 958
Serial Number	28422
Equipment Number	--

Calibration Particular

Date of Calibration	7-May-2018		
Calibration Equipment	4231(MLTE008) / PA160059 / 20-May-2018		
Calibration Procedure	MLCG00, MLCG15		
Calibration Conditions	Laboratory	Temperature	23 °C ± 5 °C
		Relative Humidity	55% ± 25%
	EUT	Stabilizing Time	Over 3 hours
		Warm-up Time	10 minutes
		Power Supply	Internal battery
Calibration Results	Calibration data were detailed in the continuation pages.		

Approved By & Date

K.O. Lo 7-May-2018

Statements

* Calibration equipment used for this calibration are traceable to national / international standards.
* The results on this Calibration Certificate only relate to the values measured at the time of the calibration and the uncertainties quoted will not include allowance for the EUT long term drift, variation with environmental changes, vibration and shock during transportation, overloading, mishandling, misuse, and the capacity of any other laboratory to repeat the measurement.
* MaxLab Calibration Centre Limited shall not be liable for any loss or damage resulting from the use of the EUT.
* The copy of this Certificate is owned by MaxLab Calibration Centre Limited. No part of this Certificate may be reproduced without the prior written approval of MaxLab Calibration Centre Limited.

萬儀校正中心有限公司
MaxLab Calibration Centre Limited
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Unit B2, 9/F., Boldwin Industrial Bldg., 16-18 Wah Sing Street, Kwai Chung, N.T., Hong Kong Tel: (852) 2116 1380 Fax: (852) 2264 6480 Email: info@maxlab.com.hk

MAXLAB

Certificate No. MLCN180788S

Calibration Data

Channel / Mode	Filter / Detector	Range	EUT Reading	Standard Reading	EUT Error	Calibration Uncertainty
CH4 / Sound	A / FAST (1 kHz Input)	105 dB	93.9 dB	94.0 dB	-0.1 dB	0.2 dB
		130 dB	94.0 dB	94.0 dB	0.0 dB	0.2 dB
			114.0 dB	114.0 dB	0.0 dB	0.2 dB
	C / FAST (1 kHz Input)	105 dB	93.9 dB	94.0 dB	-0.1 dB	0.2 dB
		130 dB	94.0 dB	94.0 dB	0.0 dB	0.2 dB
			114.0 dB	114.0 dB	0.0 dB	0.2 dB
	LIN / FAST (1 kHz Input)	105 dB	93.9 dB	94.0 dB	-0.1 dB	0.2 dB
		130 dB	94.0 dB	94.0 dB	0.0 dB	0.2 dB
			114.0 dB	114.0 dB	0.0 dB	0.2 dB
	A / SLOW (1 kHz Input)	105 dB	93.9 dB	94.0 dB	-0.1 dB	0.2 dB
		130 dB	114.0 dB	114.0 dB	0.0 dB	0.2 dB
	C / SLOW (1 kHz Input)	105 dB	93.9 dB	94.0 dB	-0.1 dB	0.2 dB
		130 dB	114.0 dB	114.0 dB	0.0 dB	0.2 dB
	LIN / SLOW (1 kHz Input)	105 dB	93.9 dB	94.0 dB	-0.1 dB	0.2 dB
		130 dB	114.0 dB	114.0 dB	0.0 dB	0.2 dB
	A / IMPULSE (1 kHz Input)	105 dB	93.9 dB	94.0 dB	-0.1 dB	0.2 dB
		130 dB	114.0 dB	114.0 dB	0.0 dB	0.2 dB
	C / IMPULSE (1 kHz Input)	105 dB	93.9 dB	94.0 dB	-0.1 dB	0.2 dB
		130 dB	114.0 dB	114.0 dB	0.0 dB	0.2 dB
	LIN / IMPULSE (1 kHz Input)	105 dB	93.9 dB	94.0 dB	-0.1 dB	0.2 dB
		130 dB	114.0 dB	114.0 dB	0.0 dB	0.2 dB

- END -

Calibrated By : Dan
Date : 7-May-2018

Checked By : K.O. Lo
Date : 7-May-2018

萬儀校正中心有限公司
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Sound & Vibration Analyzer SVAN958A (Serial No. 59120)
(for measurement conducted in July 2018)

SVANTEK ISO9001 certified

FACTORY CALIBRATION DATA OF THE SVAN 958 *No. 59120*

SOUND LEVEL METER

1. CALIBRATION (electrical)

LEVEL METER; Filter: LIN; Input signal =114.0dB, f_{sin}=1kHz

	Range 105dB		Range 130dB	
	Indication [dB]	Error [dB]	Indication [dB]	Error [dB]
Channel 1	113.99	-0.01	114.02	0.02
Channel 2	113.98	-0.02	114.03	0.03
Channel 3	113.98	-0.02	114.03	0.03
Channel 4	113.98	-0.02	114.02	0.02

2. CALIBRATION* (acoustical)

LEVEL METER; Range: 130 dB; Reference frequency: 1000Hz;

Filter	LIN		A		C	
	Indication [dB]	Error [dB]	Indication [dB]	Error [dB]	Indication [dB]	Error [dB]
Channel 1	114.0	0.0	114.0	0.0	114.0	0.0
Channel 2	114.0	0.0	114.0	0.0	114.0	0.0
Channel 3	114.0	0.0	114.0	0.0	114.0	0.0
Channel 4	114.0	0.0	114.0	0.0	114.0	0.0

Calibration measured with the microphone SVANTEK type SV22 No. 4013604. Calibration factor: -0.4dB

3. LINEARITY TEST* (electrical)

LEVEL METER; Range: 105 dB; Filter: A; f_{sin}= 1000 Hz

	Input [dB]	24.0	30.0	40.0	60.0	80.0	100.0	114.0
Channel 1	Error [dB]	0.24	0.11	0.04	-0.0i	0.00	0.01	0.01
Channel 2	Error [dB]	0.28	0.10	0.04	-0.01	0.00	0.01	0.01
Channel 3	Error [dB]	0.20	0.10	0.04	-0.01	0.00	0.01	0.01
Channel 4	Error [dB]	0.21	0.09	0.04	-0.01	0.00	0.01	0.01

LEVEL METER; Range: 130 dB; Filter: A; f_{sin}= 1000 Hz

	Input [dB]	45.0	50.0	60.0	80.0	100.0	120.0	135.0
Channel 1	Error [dB]	0.09	0.07	0.03	0.00	0.01	0.00	0.01
Channel 2	Error [dB]	0.10	0.06	0.03	0.00	0.01	0.00	0.01
Channel 3	Error [dB]	0.03	0.05	0.02	0.01	0.01	0.01	0.02
Channel 4	Error [dB]	0.00	0.04	0.02	0.00	0.01	0.00	0.01

1/3 OCTAVE (1kHz); Range: 130 dB; Filter: A; f_{sin}= 1000 Hz

	Input [dB]	35.0	40.0	60.0	80.0	100.0	120.0	135.0
Channel 1	Error [dB]	0.39	0.15	0.03	0.01	0.01	0.00	0.01
Channel 2	Error [dB]	0.37	0.14	0.03	0.01	0.01	-0.00	0.02
Channel 3	Error [dB]	0.23	0.05	0.03	0.00	0.01	0.00	0.01
Channel 4	Error [dB]	0.23	0.03	0.02	0.01	0.01	0.01	0.02

4. TONEBURST RESPONSE* (electrical)

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

Range: **105dB**; Equivalent input steady level = 112dB

Result	Detector	Ch.	Duration [ms]	1000	500	200	100	50	20	10	5	2	1	0.5	0.25
MAX	Fast	1	Indication [dB]	112.0	111.9	111.0	109.4	107.2	103.7	100.9	97.9	94.0	91.0	87.9	84.9
			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
		2	Indication [dB]	112.0	111.9	111.0	109.4	107.2	103.7	100.8	97.9	94.0	90.9	87.9	84.9
			Error [dB]	0.0	0.0	0.0	0.0	-0.0	0.0	-0.1	0.0	-0.0	-0.0	-0.1	-0.1
		3	Indication [dB]	112.0	111.9	111.0	109.4	107.1	103.7	100.8	97.9	93.9	90.9	87.9	84.8
			Error [dB]	0.0	0.0	0.0	0.0	-0.0	0.0	-0.1	0.0	-0.0	-0.0	-0.1	-0.1
		4	Indication [dB]	112.0	111.9	111.0	109.4	107.2	103.7	100.9	97.9	94.0	91.0	87.9	84.9
			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	1	Indication [dB]	109.9	108.0	104.6	101.8	98.9	95.0	92.0	89.0	85.0	-	-	-
			Error [dB]	-0.1	0.1	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-	-	-
		2	Indication [dB]	109.9	107.9	104.6	101.8	98.9	95.0	92.0	89.0	85.0	-	-	-
			Error [dB]	-0.1	0.1	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-	-	-
		3	Indication [dB]	109.9	107.9	104.5	101.7	98.8	94.9	91.9	88.9	84.9	-	-	-
			Error [dB]	-0.1	0.1	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-	-	-
		4	Indication [dB]	109.9	108.0	104.6	101.8	98.9	95.0	92.0	89.0	85.0	-	-	-
			Error [dB]	-0.1	0.1	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-	-	-
SEL	-	1	Indication [dB]	111.8	109.0	105.0	102.0	99.0	95.0	92.0	89.0	85.0	82.0	78.9	75.9
			Error [dB]	-0.2	-0.0	0.0	0.0	-0.0	0.0	0.0	-0.0	-0.0	-0.0	-0.1	-0.1
		2	Indication [dB]	111.8	109.0	105.0	102.0	99.0	95.0	92.0	89.0	85.0	81.9	78.9	75.9
			Error [dB]	-0.2	-0.0	0.0	0.0	-0.0	0.0	0.0	-0.0	-0.0	-0.0	-0.1	-0.1
		3	Indication [dB]	111.8	108.9	105.0	102.0	98.9	95.0	92.0	88.9	84.9	81.9	78.9	75.8
			Error [dB]	-0.2	-0.0	0.0	0.0	-0.0	0.0	0.0	-0.0	-0.0	-0.0	-0.1	-0.1
		4	Indication [dB]	111.8	109.0	105.0	102.0	99.0	95.0	92.0	89.0	85.0	82.0	78.9	75.9
			Error [dB]	-0.2	-0.0	0.0	0.0	-0.0	0.0	0.0	-0.0	-0.0	-0.0	-0.1	-0.1

Range: **105dB**; Equivalent input steady level = 52dB

Result	Detector	Ch.	Duration [ms]	1000	500	200	100	50	20	10	5
MAX	Fast	1	Indication [dB]	52.0	51.9	51.0	49.4	47.2	43.7	40.8	37.9
			Error [dB]	-0.0	0.0	0.0	-0.0	-0.0	-0.0	-0.1	0.0
		2	Indication [dB]	52.0	51.9	51.0	49.4	47.1	43.7	40.8	37.9
			Error [dB]	-0.0	0.0	0.0	0.0	-0.0	-0.0	-0.1	0.0
		3	Indication [dB]	51.9	51.9	51.0	49.3	47.1	43.6	40.8	37.9
			Error [dB]	0.0	0.0	0.0	0.0	-0.0	0.0	-0.1	0.0
		4	Indication [dB]	52.0	51.9	51.0	49.4	47.2	43.7	40.8	37.9
			Error [dB]	0.0	0.0	0.0	-0.0	-0.0	0.0	-0.1	-0.0
	Slow	1	Indication [dB]	49.9	47.9	44.6	41.8	38.9	35.0	32.0	29.0
			Error [dB]	-0.1	0.0	-0.0	-0.0	-0.0	-0.0	-0.0	0.0
		2	Indication [dB]	49.9	47.9	44.6	41.8	38.9	34.9	31.9	29.1
			Error [dB]	-0.1	0.0	-0.0	-0.0	-0.0	-0.0	-0.0	0.1
		3	Indication [dB]	49.9	47.9	44.5	41.7	38.8	34.9	31.9	29.0
			Error [dB]	-0.1	0.1	-0.0	-0.0	-0.0	-0.0	0.0	0.1
		4	Indication [dB]	49.9	47.9	44.6	41.8	38.9	35.0	32.1	29.0
			Error [dB]	-0.1	0.0	-0.0	-0.0	-0.0	0.0	0.1	0.0
SEL	-	1	Indication [dB]	51.8	49.0	45.0	42.0	39.0	35.1	32.1	29.2
			Error [dB]	-0.2	-0.0	0.0	0.0	0.0	0.1	0.1	0.2
		2	Indication [dB]	51.8	49.0	45.0	42.0	39.0	35.0	32.0	29.2
			Error [dB]	-0.2	-0.0	0.0	0.0	0.0	0.1	0.1	0.2
		3	Indication [dB]	51.8	48.9	45.0	41.9	38.9	35.0	32.0	29.1
			Error [dB]	-0.2	-0.0	0.0	0.0	0.0	0.1	0.1	0.1
		4	Indication [dB]	51.8	49.0	45.0	42.0	39.0	35.1	32.1	29.1
			Error [dB]	-0.2	0.0	0.0	-0.0	0.0	0.1	0.1	0.1

Range: **105dB**; Equivalent input steady level = 34dB

Result	Detector	Ch.	Duration [ms]	1000	500
MAX	Fast	1	Indication [dB]	34.1	34.0
			Error [dB]	0.0	0.0
		2	Indication [dB]	34.1	33.9
			Error [dB]	0.0	-0.0
		3	Indication [dB]	34.0	33.9
			Error [dB]	0.0	0.0
		4	Indication [dB]	34.0	33.9
			Error [dB]	-0.0	-0.1
	Slow	1	Indication [dB]	32.0	30.1
			Error [dB]	-0.1	0.1
		2	Indication [dB]	32.0	30.0
			Error [dB]	-0.1	0.1
		3	Indication [dB]	31.9	29.9
			Error [dB]	-0.1	0.1
		4	Indication [dB]	31.9	30.0
			Error [dB]	-0.1	0.0
SEL	-	1	Indication [dB]	33.9	31.2
			Error [dB]	-0.1	0.1
		2	Indication [dB]	33.9	31.1
			Error [dB]	-0.1	0.1
		3	Indication [dB]	33.8	31.1
			Error [dB]	-0.2	0.1
		4	Indication [dB]	33.8	31.1
			Error [dB]	-0.2	0.0

Range: **130dB**; Equivalent input steady level = 134dB

Result	Detector	Ch.	Duration [ms]	1000	500	200	100	50	20	10	5	2	1	0.5	0.25
MAX	Fast	1	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
		2	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
		3	Indication [dB]	134.0	133.9	133.0	131.4	129.1	125.7	122.8	119.9	115.9	112.9	109.9	106.8
			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
		4	Indication [dB]	134.0	133.9	133.0	131.4	129.2	125.7	122.9	119.9	116.0	113.0	109.9	106.9
			Error [dB]	-0.0	0.0	0.0	0.0	129.2	-0.0	-0.1	0.0	-0.0	-0.1	-0.1	-0.1
	Slow	1	Indication [dB]	131.9	129.9	126.6	123.8	120.9	117.0	114.0	111.0	107.0	-	-	-
			Error [dB]	-0.1	0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-	-	-
		2	Indication [dB]	131.9	129.9	126.6	123.8	120.9	117.0	114.0	111.0	107.0	-	-	-
			Error [dB]	-0.1	0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-	-	-
		3	Indication [dB]	131.9	129.9	126.5	123.8	120.8	116.9	113.9	110.9	106.9	-	-	-
			Error [dB]	-0.1	0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-	-	-
		4	Indication [dB]	131.9	129.9	126.6	123.8	120.9	117.0	114.0	111.0	107.0	-	-	-
			Error [dB]	-0.1	0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-	-	-
SEL	-	1	Indication [dB]	133.8	131.0	127.0	124.0	121.0	117.0	114.0	111.0	107.0	104.0	100.9	97.9
			Error [dB]	-0.2	-0.0	0.0	0.0	-0.0	0.0	-0.0	-0.0	-0.0	-0.0	-0.1	-0.1
		2	Indication [dB]	133.8	131.0	127.0	124.0	121.0	117.0	114.0	111.0	107.0	103.9	100.9	97.9
			Error [dB]	-0.2	-0.0	0.0	0.0	-0.0	0.0	-0.0	-0.0	-0.0	-0.1	-0.1	-0.1
		3	Indication [dB]	133.8	130.9	127.0	124.0	121.0	117.0	114.0	110.9	107.0	103.9	100.9	97.8
			Error [dB]	-0.2	-0.0	0.0	0.0	-0.0	0.0	0.0	-0.0	-0.0	-0.1	-0.1	-0.1
		4	Indication [dB]	133.8	131.0	127.0	124.0	121.0	117.0	114.0	111.0	107.0	104.0	100.9	97.9
			Error [dB]	-0.2	-0.0	0.0	0.0	-0.0	0.0	-0.0	-0.0	-0.0	-0.1	-0.1	-0.1

Range: **130dB**, Equivalent input steady level = 74dB

Result	Detector	Ch.	Duration [ms]	1000	500	200	100	50	20	10	5
MAX	Fast	1	Indication [dB]	74.0	73.9	73.0	71.4	69.2	65.7	62.8	59.9
			Error [dB]	0.0	0.0	0.0	-0.0	-0.0	-0.0	-0.1	-0.0
		2	Indication [dB]	74.0	73.9	73.0	71.4	69.2	65.7	62.8	59.9
			Error [dB]	0.0	0.0	73.0	0.0	-0.0	-0.0	-0.0	0.0
		3	Indication [dB]	73.9	73.9	73.0	71.3	69.1	65.6	62.8	59.9
			Error [dB]	-0.0	0.0	0.0	-0.0	-0.0	-0.0	-0.0	-0.0
		4	Indication [dB]	74.0	73.9	73.0	71.4	69.2	65.7	62.8	59.9
			Error [dB]	0.0	0.0	0.0	0.0	-0.0	-0.0	-0.1	0.0
	Slow	1	Indication [dB]	71.9	69.9	66.6	63.8	60.9	57.0	54.0	51.0
			Error [dB]	-0.1	0.1	-0.0	-0.0	-0.0	-0.0	-0.0	0.0
		2	Indication [dB]	71.9	69.9	66.5	63.8	60.9	56.9	54.0	51.0
			Error [dB]	-0.1	0.1	-0.0	-0.0	-0.0	-0.0	0.0	0.0
		3	Indication [dB]	71.9	69.9	66.5	63.7	60.8	56.9	54.0	51.0
			Error [dB]	-0.1	0.0	-0.0	-0.0	-0.0	-0.0	0.0	0.1
		4	Indication [dB]	71.9	69.9	66.6	63.8	60.9	57.0	54.0	51.0
			Error [dB]	-0.1	0.1	-0.0	-0.0	-0.0	-0.0	-0.0	0.1
SEL	-	1	Indication [dB]	73.8	71.0	67.0	64.0	61.0	57.0	54.1	51.1
			Error [dB]	-0.2	0.0	0.0	0.0	0.0	0.0	0.1	0.1
		2	Indication [dB]	73.8	71.0	67.0	64.0	61.0	57.0	54.0	51.1
			Error [dB]	-0.2	0.0	0.0	0.0	0.0	0.0	0.1	0.1
		3	Indication [dB]	73.8	70.9	67.0	63.9	61.0	57.0	54.0	51.0
			Error [dB]	-0.2	-0.0	0.0	-0.0	0.0	0.0	0.0	0.0
		4	Indication [dB]	73.8	71.0	67.0	64.0	61.0	57.0	54.0	51.1
			Error [dB]	-0.2	-0.0	0.0	0.0	-0.0	0.0	0.0	0.1

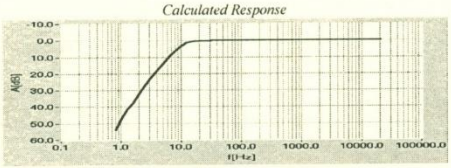
Range: **130dB**, Equivalent input steady level = 54dB

Result	Detector	Ch.	Duration [ms]	1000	500
MAX	Fast	1	Indication [dB]	54.1	53.9
			Error [dB]	0.0	-0.0
		2	Indication [dB]	54.0	53.9
			Error [dB]	-0.0	-0.0
		3	Indication [dB]	54.0	53.9
			Error [dB]	0.1	0.1
		4	Indication [dB]	54.0	54.0
			Error [dB]	0.0	0.1
	Slow	1	Indication [dB]	52.0	50.0
			Error [dB]	-0.1	0.1
		2	Indication [dB]	51.9	50.0
			Error [dB]	-0.1	0.1
		3	Indication [dB]	51.9	49.9
			Error [dB]	-0.0	0.1
		4	Indication [dB]	51.9	50.0
			Error [dB]	-0.1	0.1
SEL	-	1	Indication [dB]	53.9	51.1
			Error [dB]	-0.1	0.1
		2	Indication [dB]	53.9	51.1
			Error [dB]	-0.2	0.1
		3	Indication [dB]	53.8	51.0
			Error [dB]	-0.1	0.1
		4	Indication [dB]	53.9	51.1
			Error [dB]	-0.1	0.1

6. FREQUENCY RESPONSE (electrical)

LEVEL METER; Filter: Z; Range: 130 dB; Input signal =135 dB;

Calculated Response



Measured Response with Preamplifier SV12 (f-frequency, An-attenuation in channel n)

f [Hz]	A1[dB]	A2[dB]	A3[dB]	A4[dB]	f [Hz]	A1[dB]	A2[dB]	A3[dB]	A4[dB]
10	3.2	3.2	3.2	3.2	250	0.0	0.0	-0.0	0.0
12.5	1.4	1.4	1.4	1.4	500	0.0	0.0	-0.0	0.0
16	0.5	0.5	0.5	0.5	1000	0.0	0.0	-0.0	0.0
20	0.1	0.1	0.1	0.1	2000	0.0	0.0	0.0	0.0
25	0.0	0.0	0.0	0.0	4000	0.0	0.0	0.0	0.0
31.5	-0.0	-0.0	-0.0	-0.0	8000	0.0	0.0	0.0	0.0
63	-0.0	-0.0	-0.0	-0.0	16000	0.0	0.0	0.0	-0.0
125	0.0	0.0	-0.0	0.0	20000	-0.0	0.0	0.0	-0.1

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

7. INTERNAL NOISE LEVEL* (electrical)

LEVEL METER; Range: 105 dB, Back-light – off; Calibration factor: 0dB

	Filter	Z	A	C
Channel 1	Level [dB]	14.7	13.3	12.6
Channel 2	Level [dB]	17.4	13.0	12.3
Channel 3	Level [dB]	17.8	11.7	11.1
Channel 4	Level [dB]	14.9	11.8	12.4

* measured with preamplifier SVANTEK type SV12 No. 1771.

VIBRATION LEVEL METER

1. CALIBRATION (electrical)

LEVEL METER; Filter: HP10; Input signal =140.0dB (10.0 m/s^2), f_{sin}=79,6Hz

	Range 145dB		Range 170dB	
	Indication [dB]	Error [dB]	Indication [dB]	Error [dB]
Channel 1	139.98	-0.02	140.03	0.03
Channel 2	139.99	-0.01	140.04	0.04
Channel 3	139.98	-0.02	140.04	0.04
Channel 4	139.98	-0.02	140.03	0.03

2. CALIBRATION (vibrational)

LEVEL METER; Range: 145dB; Input signal: 120dB;

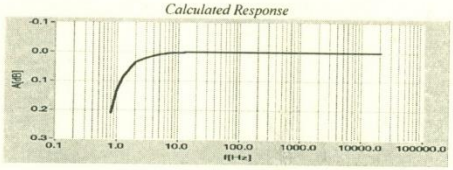
Filter	HP1		HP10		Wd		Wm		Wh	
	Indication [dB]	Error [dB]	Indication [dB]	Error [dB]	Indication [dB]	Error [dB]	Indication [dB]	Error [dB]	Indication [dB]	Error [dB]
Channel 1	119.8	-0.2	119.8	-0.2	105.9	-0.2	102.2	0.1	110.7	0.1
Channel 2	119.8	-0.2	119.8	-0.2	105.9	-0.2	102.2	0.1	110.7	0.1
Channel 3	119.8	-0.2	119.8	-0.2	105.9	-0.2	102.1	0.1	110.7	0.1
Channel 4	119.8	-0.2	119.8	-0.2	105.9	-0.2	102.2	0.1	110.7	0.1

Calibration measured with the accelerometer DYTRAN type 3185D No. 2975. Calibration factor: -0.3dB

3. FREQUENCY RESPONSE (electrical)

1/3 OCTAVE; Filter: HP; Range: 170 dB; input=175 dB;

Calculated Response



Measured Response (f-frequency, An-attenuation in channel n)

f [Hz]	A1[dB]	A2[dB]	A3[dB]	A4[dB]	f [Hz]	A1[dB]	A2 [dB]	A3[dB]	A4[dB]	f [Hz]	A1[dB]	A2[dB]	A3[dB]	A4[dB]
0.8	0.21	0.21	0.20	0.21	5	0.01	0.01	0.01	0.02	500	0.00	0.00	0.00	0.00
1	0.12	0.12	0.12	0.12	6.3	0.01	0.01	0.01	0.01	1000	0.00	0.00	0.00	0.00
1.25	0.09	0.09	0.09	0.09	8	0.01	0.01	0.01	0.01	2000	0.00	0.00	0.00	0.00
1.6	0.04	0.04	0.04	0.05	16	0.00	0.00	0.00	0.00	4000	0.01	0.02	0.02	0.01
2	0.04	0.04	0.03	0.04	31.5	-0.01	0.00	-0.01	0.00	8000	0.04	0.04	0.05	0.02
2.5	0.02	0.02	0.02	0.03	63	0.00	0.00	0.00	0.00	16000	0.02	0.02	0.04	-0.04
3.15	0.03	0.03	0.03	0.03	125	0.00	0.00	0.00	0.00	20000	-0.01	0.00	0.02	-0.07
4	0.03	0.03	0.03	0.03	250	0.00	0.00	-0.01	0.00					

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

4. INTERNAL NOISE LEVEL (electrical)

LEVEL METER func.; Range: 145 dB; Back-light – off

	Filter	HP1	HP10	Wd	Wm	Wh
Channel 1	**Indication** [dB]	54.4	52.1	42.2	39.0	36.5
Channel 2	**Indication** [dB]	55.0	52.5	42.5	39.0	36.5
Channel 3	**Indication** [dB]	53.2	50.2	42.7	38.8	36.8
Channel 4	**Indication** [dB]	54.9	52.7	42.9	39.4	37.1

ENVIRONMENTAL CONDITIONS

Temperature	Relative humidity	Ambient pressure
22 °C	31 %	1004 hPa

TEST EQUIPMENT

Item	Manufacturer	Model	Serial no.	Description
1.	SVANTEK	SVAN 401	100	Signal generator
2.	SVANTEK	SVAN 912A	15900	Sound &Vibration Analyser
3.	KEITHLEY	2000	0910165	Digital multimeter
4.	SVANTEK	SV30A	24563	Acoustic calibrator
5.	SVANTEK	ST02	-	Microphone equivalent electrical impedance (18pF)
6.	DYTRAN	3233A	747	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. Tracebility of the calibration is guarantied by the above mentioned ISO9001 procedures.

3. 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.

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

Calibration specialist: Pawel Bednarczyk .....

Test date: 2016-09-20

Sound & Vibration Analyzer SVAN958A (Serial No. 59120)
(for measurement conducted in December 2018)

MAXLAB

CALIBRATION CERTIFICATE

Certificate Information

Date of Issue	7-Nov-2018	**Certificate Number**	MLCN182746S

Customer Information

Company Name	Wilson Accoustics Limited
Address	Unit 601, Block A, Shatin Industrial Centre, Yuen Shun Circuit, Shatin, N. T., Hong Kong

Equipment-under-Test (EUT)

Description	Sound & Vibration Analyser
Manufacturer	Svantek
Model Number	SVAN 958A
Serial Number	59120
Equipment Number	--

Calibration Particular

Date of Calibration	7-Nov-2018		
Calibration Equipment	4231(MLTE008) / AV180068 / 13-May-2020		
Calibration Procedure	MLCG00, MLCG15		
Calibration Conditions	Laboratory	Temperature	23 °C ± 5 °C
		Relative Humidity	55% ± 25%
	EUT	Stabilizing Time	Over 3 hours
		Warm-up Time	10 minutes
		Power Supply	Internal battery
Calibration Results	Calibration data were detailed in the continuation pages.		

Approved By & Date

K.O. Lo 7-Nov-2018

Statements

* Calibration equipment used for this calibration are traceable to national / international standards.
* The results on this Calibration Certificate only relate to the values measured at the time of the calibration and the uncertainties quoted will not include allowance for the EUT long term drift, variation with environmental changes, vibration and shock during transportation, overloading, mishandling, misuse, and the capacity of any other laboratory to repeat the measurement.
* MaxLab Calibration Centre Limited shall not be liable for any loss or damage resulting from the use of the EUT.
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Page 1 of 2

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Certificate No. MLCN182746S

Calibration Data

Channel / Mode	Filter / Detector	Range	EUT Reading	Standard Reading	EUT Error	Calibration Uncertainty
CH4 / Sound	A / FAST (1 kHz Input)	105 dB	94.0 dB	94.0 dB	0.0 dB	0.2 dB
		130 dB	94.0 dB	94.0 dB	0.0 dB	0.2 dB
			114.0 dB	114.0 dB	0.0 dB	0.2 dB
	C / FAST (1 kHz Input)	105 dB	94.0 dB	94.0 dB	0.0 dB	0.2 dB
		130 dB	94.0 dB	94.0 dB	0.0 dB	0.2 dB
			114.0 dB	114.0 dB	0.0 dB	0.2 dB
	LIN / FAST (1 kHz Input)	105 dB	94.0 dB	94.0 dB	0.0 dB	0.2 dB
		130 dB	94.0 dB	94.0 dB	0.0 dB	0.2 dB
			114.0 dB	114.0 dB	0.0 dB	0.2 dB
	A / SLOW (1 kHz Input)	105 dB	94.0 dB	94.0 dB	0.0 dB	0.2 dB
		130 dB	114.0 dB	114.0 dB	0.0 dB	0.2 dB
	C / SLOW (1 kHz Input)	105 dB	94.0 dB	94.0 dB	0.0 dB	0.2 dB
		130 dB	114.0 dB	114.0 dB	0.0 dB	0.2 dB
	LIN / SLOW (1 kHz Input)	105 dB	94.0 dB	94.0 dB	0.0 dB	0.2 dB
		130 dB	114.0 dB	114.0 dB	0.0 dB	0.2 dB
	A / IMPULSE (1 kHz Input)	105 dB	94.0 dB	94.0 dB	0.0 dB	0.2 dB
		130 dB	114.0 dB	114.0 dB	0.0 dB	0.2 dB
	C / IMPULSE (1 kHz Input)	105 dB	94.0 dB	94.0 dB	0.0 dB	0.2 dB
		130 dB	114.0 dB	114.0 dB	0.0 dB	0.2 dB
	LIN / IMPULSE (1 kHz Input)	105 dB	94.0 dB	94.0 dB	0.0 dB	0.2 dB
		130 dB	114.0 dB	114.0 dB	0.0 dB	0.2 dB

- END -

Calibrated By : Dan
Date : 7-Nov-2018

Checked By : K.O. Lo
Date : 7-Nov-2018

萬儀校正中心有限公司
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香港新界葵涌華星街 16-18 號保盈工業大廈 9 樓 B2 室
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Sound & Vibration Analyzer SVAN958A (Serial No. 59121)
(for measurement conducted in July 2018)

SVANTEK

ISO9001 certified

FACTORY CALIBRATION DATA OF THE SVAN 958 *No. 59121*

SOUND LEVEL METER

1. CALIBRATION (electrical)

LEVEL METER; Filter: LIN; Input signal =114.0dB, f_{sin}=1kHz

	Range 105dB		Range 130dB	
	Indication [dB]	Error [dB]	Indication [dB]	Error [dB]
Channel 1	113.98	-0.02	114.02	0.02
Channel 2	113.97	-0.03	114.02	0.02
Channel 3	113.97	-0.03	114.02	0.02
Channel 4	113.97	-0.03	114.02	0.02

2. CALIBRATION* (acoustical)

LEVEL METER; Range: 130 dB; Reference frequency: 1000Hz;

Filter	LIN		A		C	
	Indication [dB]	Error [dB]	Indication [dB]	Error [dB]	Indication [dB]	Error [dB]
Channel 1	114.0	0.0	114.0	0.0	114.0	0.0
Channel 2	114.0	0.0	114.0	0.0	114.0	0.0
Channel 3	114.0	0.0	114.0	0.0	114.0	0.0
Channel 4	114.0	0.0	114.0	0.0	114.0	0.0

Calibration measured with the microphone SVANTEK type SV22 No. 4013604. Calibration factor: -0.4dB

3. LINEARITY TEST* (electrical)

LEVEL METER; Range: 105 dB; Filter: A; f_{sin}= 1000 Hz

	Input [dB]	24.0	30.0	40.0	60.0	80.0	100.0	114.0
Channel 1	Error [dB]	0.32	0.13	0.04	-0.01	0.00	0.01	0.01
Channel 2	Error [dB]	0.29	0.11	0.04	-0.01	0.00	0.01	0.01
Channel 3	Error [dB]	0.25	0.09	0.04	-0.01	0.00	0.01	0.01
Channel 4	Error [dB]	0.35	0.11	0.03	-0.01	-0.00	0.01	0.01

LEVEL METER; Range: 130 dB; Filter: A; f_{sin}= 1000 Hz

	Input [dB]	45.0	50.0	60.0	80.0	100.0	120.0	135.0
Channel 1	Error [dB]	0.07	0.09	0.04	0.01	0.01	0.00	0.01
Channel 2	Error [dB]	0.09	0.10	0.04	0.01	0.01	0.00	0.01
Channel 3	Error [dB]	0.00	0.01	0.00	0.01	0.01	0.00	0.01
Channel 4	Error [dB]	-0.02	0.00	0.01	0.01	0.01	0.00	0.01

1/3 OCTAVE (1kHz); Range: 130 dB; Filter: A; f_{sin}= 1000 Hz

	Input [dB]	35.0	40.0	60.0	80.0	100.0	120.0	135.0
Channel 1	Error [dB]	0.32	0.11	0.03	0.00	0.00	-0.01	0.00
Channel 2	Error [dB]	0.34	0.11	0.03	0.00	0.01	0.00	0.01
Channel 3	Error [dB]	0.30	0.07	0.03	0.00	0.01	0.00	0.01
Channel 4	Error [dB]	0.28	0.08	0.04	0.00	0.01	-0.01	-0.00

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4. TONEBURST RESPONSE* (electrical)

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

Range: **105dB**, Equivalent input steady level = 112dB

Result	Detector	Ch.	Duration [ms]	1000	500	200	100	50	20	10	5	2	1	0.5	0.25
MAX	Fast	1	Indication [dB]	111.9	111.9	111.0	109.3	107.1	103.6	100.8	97.9	93.9	90.9	87.8	84.8
			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
		2	Indication [dB]	111.9	111.8	110.9	109.3	107.1	103.6	100.8	97.8	93.9	90.9	87.8	84.8
			Error [dB]	0.0	0.0	0.0	0.0	-0.0	-0.0	-0.1	0.0	-0.0	-0.0	-0.1	-0.1
		3	Indication [dB]	112.0	111.9	111.0	109.4	107.2	103.7	100.8	97.9	94.0	90.9	87.9	84.9
			Error [dB]	0.0	0.0	0.0	0.0	-0.0	-0.0	-0.1	0.0	-0.0	-0.0	-0.1	-0.1
		4	Indication [dB]	111.9	111.9	111.0	109.3	107.1	103.6	100.8	97.9	93.9	90.9	87.8	84.8
			Error [dB]	-0.0	0.0	0.0	0.0	-0.0	-0.0	-0.1	0.0	-0.0	-0.0	-0.1	-0.1
	Slow	1	Indication [dB]	109.9	107.9	104.5	101.7	98.8	94.9	91.9	88.9	84.9	-	-	-
			Error [dB]	0.0	0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-	-	-
		2	Indication [dB]	109.9	107.9	104.5	101.7	98.8	94.9	91.9	88.9	84.9	-	-	-
			Error [dB]	0.0	0.1	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-	-	-
		3	Indication [dB]	110.0	107.9	104.6	101.8	98.9	95.0	92.0	89.0	85.0	-	-	-
			Error [dB]	0.0	0.1	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-	-	-
		4	Indication [dB]	109.9	107.9	104.5	101.7	98.8	94.9	91.9	88.9	84.9	-	-	-
			Error [dB]	0.0	0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-	-	-
SEL	-	1	Indication [dB]	111.9	108.9	104.9	101.9	98.9	94.9	91.9	88.9	84.9	81.9	78.8	75.8
			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
		2	Indication [dB]	111.9	108.9	104.9	101.9	98.9	94.9	91.9	88.9	84.9	81.9	78.8	75.8
			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
		3	Indication [dB]	112.0	109.0	105.0	102.0	99.0	95.0	92.0	89.0	85.0	81.9	78.9	75.9
			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
		4	Indication [dB]	111.9	108.9	105.0	101.9	98.9	94.9	91.9	88.9	84.9	81.9	78.8	75.8
			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: **105dB**; Equivalent input steady level = 52dB

Result	Detector	Ch.	Duration [ms]	1000	500	200	100	50	20	10	5
MAX	Fast	1	Indication [dB]	51.9	51.8	50.9	49.3	47.1	43.6	40.8	37.9
			Error [dB]	0.0	0.0	0.0	-0.0	-0.0	-0.0	-0.1	0.0
		2	Indication [dB]	51.9	51.8	50.9	49.3	47.1	43.6	40.7	37.8
			Error [dB]	0.0	0.0	0.0	0.0	-0.0	0.0	-0.1	0.0
		3	Indication [dB]	52.0	51.9	51.0	49.4	47.1	43.7	40.8	37.9
			Error [dB]	0.0	0.0	0.0	0.0	-0.0	0.0	-0.1	0.0
		4	Indication [dB]	51.9	51.8	50.9	49.3	47.1	43.6	40.8	37.9
			Error [dB]	0.0	0.0	0.0	-0.0	-0.0	-0.0	-0.1	0.0
	Slow	1	Indication [dB]	49.9	47.9	44.5	41.7	38.8	34.9	31.9	28.9
			Error [dB]	0.0	0.1	-0.0	-0.0	-0.0	0.0	-0.0	0.0
		2	Indication [dB]	49.9	47.9	44.5	41.7	38.8	34.9	31.9	28.9
			Error [dB]	0.0	0.1	-0.0	-0.0	-0.0	0.0	-0.0	-0.0
		3	Indication [dB]	50.0	47.9	44.6	41.8	38.8	35.0	31.9	29.0
			Error [dB]	0.0	0.1	-0.0	-0.0	-0.0	0.0	-0.0	0.0
		4	Indication [dB]	49.9	47.9	44.5	41.7	38.8	34.9	31.9	29.2
			Error [dB]	0.0	0.0	-0.0	-0.0	-0.0	0.0	-0.0	0.3
SEL	-	1	Indication [dB]	51.9	48.9	44.9	41.9	38.9	35.0	32.0	29.1
			Error [dB]	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.2
		2	Indication [dB]	51.9	48.9	44.9	41.9	38.9	35.0	32.0	29.0
			Error [dB]	0.0	-0.0	0.0	0.0	0.0	0.1	0.1	0.1
		3	Indication [dB]	52.0	49.0	45.0	42.0	39.0	35.0	32.0	29.1
			Error [dB]	0.0	-0.0	0.0	0.0	0.0	0.1	0.1	0.2
		4	Indication [dB]	51.9	48.9	44.9	41.9	38.9	35.0	32.0	29.1
			Error [dB]	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.2

Range: **105dB**, Equivalent input steady level = 34dB

Result	Detector	Ch.	Duration [ms]	1000	500
MAX	Fast	1	Indication [dB]	34.0	33.9
			Error [dB]	0.0	-0.0
		2	Indication [dB]	34.0	33.9
			Error [dB]	-0.0	0.0
		3	Indication [dB]	34.0	33.9
			Error [dB]	0.0	0.0
		4	Indication [dB]	34.0	33.9
			Error [dB]	0.0	0.0
	Slow	1	Indication [dB]	32.0	30.0
			Error [dB]	0.0	0.1
		2	Indication [dB]	32.0	30.0
			Error [dB]	0.0	0.1
		3	Indication [dB]	32.0	29.9
			Error [dB]	0.0	0.1
		4	Indication [dB]	31.9	30.1
			Error [dB]	0.0	0.3
SEL	-	1	Indication [dB]	34.0	31.1
			Error [dB]	0.0	0.1
		2	Indication [dB]	34.0	31.1
			Error [dB]	0.0	0.1
		3	Indication [dB]	34.0	31.1
			Error [dB]	0.0	0.1
		4	Indication [dB]	34.0	31.0
			Error [dB]	0.0	0.1

Range: **130dB**, Equivalent input steady level = 134dB

Result	Detector	Ch.	Duration [ms]	1000	500	200	100	50	20	10	5	2	1	0.5	0.25
MAX	Fast	1	Indication [dB]	133.9	133.8	132.9	131.3	129.1	125.6	122.8	119.8	115.9	112.9	109.8	106.8
			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
		2	Indication [dB]	133.9	133.8	132.9	131.3	129.1	125.6	122.8	119.8	115.9	112.9	109.8	106.8
			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
		3	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
		4	Indication [dB]	133.9	133.9	133.0	131.3	129.1	125.6	122.8	119.9	115.9	112.9	109.8	106.8
			Error [dB]	0.0	0.0	0.0	0.0	129.1	-0.0	-0.0	0.0	-0.0	-0.0	-0.1	-0.1
	Slow	1	Indication [dB]	131.9	129.9	126.5	123.7	120.8	116.9	113.9	110.9	106.9	-	-	-
			Error [dB]	0.0	0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-	-	-
		2	Indication [dB]	131.9	129.9	126.5	123.7	120.8	116.9	113.9	110.9	106.9	-	-	-
			Error [dB]	0.0	0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-	-	-
		3	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	-	-	-
		4	Indication [dB]	131.9	129.9	126.5	123.7	120.8	116.9	113.9	110.9	106.9	-	-	-
			Error [dB]	0.0	0.1	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-	-	-
SEL	-	1	Indication [dB]	133.9	130.9	126.9	123.9	120.9	116.9	113.9	110.9	106.9	103.9	100.8	97.8
			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
		2	Indication [dB]	133.9	130.9	126.9	123.9	120.9	116.9	113.9	110.9	106.9	103.9	100.8	97.8
			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
		3	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
		4	Indication [dB]	133.9	130.9	127.0	123.9	120.9	116.9	113.9	110.9	106.9	103.9	100.8	97.8
			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: **130dB**; Equivalent input steady level = 74dB

Result	Detector	Ch.	Duration [ms]	1000	500	200	100	50	20	10	5
MAX	Fast	1	Indication [dB]	73.9	73.8	72.9	71.3	69.1	65.6	62.8	59.8
			Error [dB]	-0.0	0.0	0.0	0.0	-0.0	-0.0	-0.1	0.0
		2	Indication [dB]	73.9	73.8	72.9	71.3	69.1	65.6	62.8	59.8
			Error [dB]	-0.0	0.0	72.9	0.0	-0.0	-0.0	-0.0	0.0
		3	Indication [dB]	74.0	73.9	73.0	71.4	69.1	65.7	62.8	59.9
			Error [dB]	0.0	0.0	0.0	0.0	-0.0	-0.0	-0.0	0.0
		4	Indication [dB]	73.9	73.9	72.9	71.3	69.1	65.6	62.8	59.8
			Error [dB]	0.0	0.0	0.0	0.0	-0.0	-0.0	-0.1	0.0
	Slow	1	Indication [dB]	71.9	69.9	66.5	63.7	60.8	56.9	54.0	50.9
			Error [dB]	0.0	0.0	-0.0	-0.0	-0.0	-0.0	0.0	-0.0
		2	Indication [dB]	71.9	69.9	66.5	63.7	60.8	56.9	53.9	51.0
			Error [dB]	0.0	0.0	-0.0	-0.0	-0.0	-0.0	-0.0	0.1
		3	Indication [dB]	72.0	69.9	66.5	63.8	60.9	56.9	54.0	50.9
			Error [dB]	0.0	0.1	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0
		4	Indication [dB]	71.9	69.9	66.5	63.7	60.8	56.9	53.9	50.9
			Error [dB]	0.0	0.1	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0
SEL	-	1	Indication [dB]	73.9	70.9	66.9	63.9	60.9	56.9	54.0	51.0
			Error [dB]	-0.0	-0.0	0.0	0.0	-0.0	0.0	0.0	0.1
		2	Indication [dB]	73.9	70.9	66.9	63.9	60.9	56.9	54.0	51.0
			Error [dB]	0.0	-0.0	0.0	-0.0	-0.0	0.0	0.0	0.1
		3	Indication [dB]	74.0	71.0	67.0	64.0	61.0	57.0	54.0	51.0
			Error [dB]	0.0	-0.0	0.0	0.0	0.0	0.0	0.0	0.1
		4	Indication [dB]	73.9	70.9	66.9	63.9	60.9	56.9	54.0	51.0
			Error [dB]	0.0	-0.0	0.0	0.0	0.0	0.0	0.0	0.1

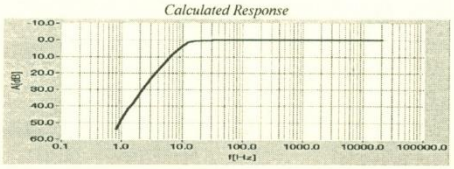
Range: **130dB**; Equivalent input steady level = 54dB

Result	Detector	Ch.	Duration [ms]	1000	500
MAX	Fast	1	Indication [dB]	54.0	53.9
			Error [dB]	0.0	0.1
		2	Indication [dB]	54.0	53.8
			Error [dB]	0.1	-0.0
		3	Indication [dB]	54.0	53.9
			Error [dB]	0.0	-0.0
		4	Indication [dB]	53.9	53.9
			Error [dB]	-0.0	0.0
	Slow	1	Indication [dB]	52.0	49.9
			Error [dB]	0.0	0.1
		2	Indication [dB]	52.0	49.9
			Error [dB]	0.0	0.1
		3	Indication [dB]	52.0	50.0
			Error [dB]	0.0	0.1
		4	Indication [dB]	51.9	50.0
			Error [dB]	-0.0	0.1
SEL	-	1	Indication [dB]	54.0	51.0
			Error [dB]	0.0	0.1
		2	Indication [dB]	54.0	51.0
			Error [dB]	0.0	0.0
		3	Indication [dB]	54.0	51.0
			Error [dB]	0.0	0.0
		4	Indication [dB]	54.0	51.0
			Error [dB]	-0.0	0.0

6. FREQUENCY RESPONSE (electrical)

LEVEL METER; Filter: Z; Range: 130 dB; Input signal =135 dB;

Calculated Response



Measured Response with Preamplifier SV12 (f-frequency, An-attenuation in channel n)

f [Hz]	A1[dB]	A2[dB]	A3[dB]	A4[dB]	f [Hz]	A1[dB]	A2[dB]	A3[dB]	A4[dB]
10	3.2	3.2	3.2	3.2	250	0.0	-0.0	-0.0	0.0
12.5	1.4	1.4	1.4	1.4	500	0.0	-0.0	0.0	0.0
16	0.5	0.5	0.5	0.5	1000	0.0	0.0	0.0	0.0
20	0.1	0.1	0.1	0.1	2000	0.0	0.0	0.0	0.0
25	0.0	0.0	0.0	0.0	4000	0.0	0.0	0.0	0.0
31.5	-0.0	-0.0	-0.0	-0.0	8000	0.0	0.0	0.0	0.0
63	-0.0	-0.0	-0.0	-0.0	16000	0.0	0.0	0.0	0.0
125	0.0	-0.0	-0.0	-0.0	20000	0.0	0.0	0.1	0.0

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

7. INTERNAL NOISE LEVEL* (electrical)

LEVEL METER; Range: 105 dB; Back-light – off; Calibration factor: 0dB

	Filter	Z	A	C
Channel 1	Level [dB]	14.2	11.6	11.8
Channel 2	Level [dB]	13.2	10.7	10.8
Channel 3	Level [dB]	13.9	11.2	11.8
Channel 4	Level [dB]	14.0	11.4	11.3

* measured with preamplifier SVANTEK type SV12 No. 1771.

VIBRATION LEVEL METER

1. CALIBRATION (electrical)

LEVEL METER; Filter: HP10; Input signal =140.0dB (10.0 m/s^2), f_{sin}=79,6Hz

	Range 145dB		Range 170dB	
	Indication [dB]	Error [dB]	Indication [dB]	Error [dB]
Channel 1	139.99	-0.01	140.03	0.03
Channel 2	139.98	-0.02	140.02	0.02
Channel 3	139.98	-0.02	140.03	0.03
Channel 4	139.98	-0.02	140.02	0.02

2. CALIBRATION (vibrational)

LEVEL METER; Range: 145dB; Input signal: 120dB;

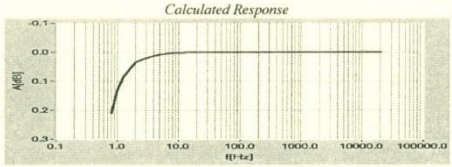
Filter	HP1		HP10		Wd		Wm		Wh	
	Indication [dB]	Error [dB]	Indication [dB]	Error [dB]	Indication [dB]	Error [dB]	Indication [dB]	Error [dB]	Indication [dB]	Error [dB]
Channel 1	119.8	-0.2	119.8	-0.2	106.0	-0.2	102.2	0.1	110.7	0.1
Channel 2	119.8	-0.2	119.8	-0.2	105.9	-0.2	102.1	0.1	110.7	0.1
Channel 3	119.8	-0.2	119.8	-0.2	105.9	-0.2	102.1	0.1	110.6	0.1
Channel 4	119.8	-0.2	119.8	-0.2	105.9	-0.2	102.1	0.1	110.7	0.1

Calibration measured with the accelerometer DYTRAN type 3185D No. 2975. Calibration factor: -0.3dB

3. FREQUENCY RESPONSE (electrical)

1/3 OCTAVE; Filter: HP; Range: 170 dB; input=175 dB;

Calculated Response



Measured Response (f-frequency, An-attenuation in channel n)

f [Hz]	A1[dB]	A2[dB]	A3[dB]	A4[dB]	f [Hz]	A1[dB]	A2 [dB]	A3[dB]	A4[dB]	f [Hz]	A1[dB]	A2[dB]	A3[dB]	A4[dB]
0.8	0.18	0.19	0.18	0.18	5	0.01	0.01	0.01	0.01	500	-0.01	-0.01	-0.01	-0.01
1	0.13	0.13	0.13	0.13	6.3	-0.00	-0.00	-0.00	-0.00	1000	-0.01	-0.00	-0.01	-0.00
1.25	0.08	0.08	0.07	0.08	8	-0.00	-0.00	-0.00	-0.00	2000	-0.01	-0.00	-0.01	-0.00
1.6	0.06	0.07	0.06	0.06	16	-0.01	-0.00	-0.01	-0.00	4000	-0.00	0.01	-0.00	0.01
2	0.04	0.05	0.04	0.05	31.5	-0.01	-0.01	-0.01	-0.01	8000	0.03	0.04	0.03	0.03
2.5	0.01	0.02	0.01	0.02	63	-0.01	-0.00	-0.01	-0.00	16000	0.01	0.02	0.03	0.02
3.15	-0.00	-0.00	-0.00	-0.00	125	-0.01	-0.01	-0.01	-0.01	20000	0.01	0.02	0.04	0.03
4	-0.00	0.01	-0.00	0.01	250	-0.01	-0.01	-0.01	-0.01					

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

4. INTERNAL NOISE LEVEL (electrical)

LEVEL METER func.; Range: 145 dB; Back-light – off

	Filter	HP1	HP10	Wd	Wm	Wh
Channel 1	**Indication** [dB]	53.7	51.0	42.4	39.4	36.2
Channel 2	**Indication** [dB]	54.8	52.5	42.5	38.5	36.3
Channel 3	**Indication** [dB]	53.0	50.3	42.7	39.4	36.9
Channel 4	**Indication** [dB]	54.8	52.6	42.7	39.1	36.7

ENVIRONMENTAL CONDITIONS

Temperature	Relative humidity	Ambient pressure
22 °C	31 %	1004 hPa

TEST EQUIPMENT

Item	Manufacturer	Model	Serial no.	Description
1.	SVANTEK	SVAN 401	100	Signal generator
2.	SVANTEK	SVAN 912A	15900	Sound &Vibration Analyser
3.	KEITHLEY	2000	0910165	Digital multimeter
4.	SVANTEK	SV30A	24563	Acoustic calibrator
5.	SVANTEK	ST02	-	Microphone equivalent electrical impedance (18pF)
6.	DYTRAN	3233A	747	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. Tracebility of the calibration is guarantied by the above mentioned ISO9001 procedures.

3. 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.

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

Calibration specialist: Paweł Bednarczyk ..... Test date: 2016-09-20

Sound & Vibration Analyzer SVAN958A (Serial No. 69082)
(for measurement conducted in December 2018)

SVANTEK ISO9001 certified

FACTORY CALIBRATION DATA OF THE SVAN 958 *No. 69082*

SOUND LEVEL METER

1. CALIBRATION (electrical)

LEVEL METER; Filter: LIN; Input signal =114.0dB, f_{sin}=1kHz

	Range 105dB		Range 130dB	
	Indication [dB]	Error [dB]	Indication [dB]	Error [dB]
Channel 1	113.98	-0.02	114.03	0.03
Channel 2	113.98	-0.02	114.02	0.02
Channel 3	113.98	-0.02	114.02	0.02
Channel 4	113.98	-0.02	114.02	0.02

2. CALIBRATION* (acoustical)

LEVEL METER; Range: 130 dB; Reference frequency: 1000Hz;

Filter	LIN		A		C	
	Indication [dB]	Error [dB]	Indication [dB]	Error [dB]	Indication [dB]	Error [dB]
Channel 1	113.8	-0.2	113.8	-0.2	113.8	-0.2
Channel 2	113.8	-0.2	113.8	-0.2	113.8	-0.2
Channel 3	113.8	-0.2	113.8	-0.2	113.8	-0.2
Channel 4	113.8	-0.2	113.8	-0.2	113.8	-0.2

Calibration measured with the microphone SVANTEK type SV 22 No. 4010479. Calibration factor: 0.6dB

3. LINEARITY TEST* (electrical)

LEVEL METER; Range: 105 dB; Filter: A; f_{sin}= 1000 Hz

	Input [dB]	24.0	30.0	40.0	60.0	80.0	100.0	114.0
Channel 1	Error [dB]	0.19	0.10	0.05	0.00	0.00	0.00	0.00
Channel 2	Error [dB]	0.21	0.11	0.04	-0.01	0.00	0.00	0.00
Channel 3	Error [dB]	0.14	0.08	0.03	0.00	0.00	0.01	0.01
Channel 4	Error [dB]	0.11	0.07	0.03	0.00	0.00	0.00	0.01

LEVEL METER; Range: 130 dB; Filter: A; f_{sin}= 1000 Hz

	Input [dB]	45.0	50.0	60.0	80.0	100.0	120.0	135.0
Channel 1	Error [dB]	0.11	0.15	0.06	0.00	0.00	0.00	0.01
Channel 2	Error [dB]	0.13	0.14	0.05	0.00	0.00	-0.01	0.01
Channel 3	Error [dB]	0.07	0.07	0.04	-0.00	0.01	-0.00	0.02
Channel 4	Error [dB]	0.08	0.07	0.03	-0.00	-0.00	-0.01	0.01

1/3 OCTAVE (1kHz); Range: 130 dB; Filter: A; f_{sin}= 1000 Hz

	Input [dB]	35.0	40.0	60.0	80.0	100.0	120.0	135.0
Channel 1	Error [dB]	0.44	0.11	0.07	0.00	0.00	-0.01	0.01
Channel 2	Error [dB]	0.42	0.12	0.07	-0.00	-0.00	-0.00	0.01
Channel 3	Error [dB]	0.34	0.11	0.04	-0.00	-0.00	-0.01	0.01
Channel 4	Error [dB]	0.35	0.12	0.04	0.00	0.01	0.00	0.01

4. TONEBURST RESPONSE* (electrical)

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

Range: **105dB**; Equivalent input steady level = 112dB

Result	Detector	Ch.	Duration [ms]	1000	500	200	100	50	20	10	5	2	1	0.5	0.25
MAX	Fast	1	Indication [dB]	112.0	111.9	111.0	109.4	107.2	103.7	100.8	97.9	94.0	91.0	87.9	84.9
			Error [dB]	-0.0	0.0	0.0	0.0	-0.0	-0.0	-0.1	0.0	-0.0	-0.0	-0.1	-0.1
		2	Indication [dB]	112.0	111.9	111.0	109.4	107.2	103.7	100.8	97.9	94.0	91.0	87.9	84.9
			Error [dB]	-0.0	0.0	0.0	0.0	-0.0	-0.0	-0.1	0.0	-0.0	-0.0	-0.1	-0.1
		3	Indication [dB]	112.0	111.9	111.0	109.4	107.2	103.7	100.9	97.9	94.0	91.0	87.9	84.9
			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
		4	Indication [dB]	112.0	111.9	111.0	109.4	107.2	103.7	100.8	97.9	94.0	90.9	87.9	84.9
			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	1	Indication [dB]	109.9	107.9	104.6	101.8	98.9	95.0	92.0	89.0	85.0	-	-	-
			Error [dB]	-0.1	0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-	-	-
		2	Indication [dB]	109.9	107.9	104.6	101.8	98.9	95.0	92.0	89.0	85.0	-	-	-
			Error [dB]	-0.1	0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-	-	-
		3	Indication [dB]	109.9	108.0	104.6	101.8	98.9	95.0	92.0	89.0	85.0	-	-	-
			Error [dB]	-0.1	0.1	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-	-	-
		4	Indication [dB]	109.9	107.9	104.6	101.8	98.9	95.0	92.0	89.0	85.0	-	-	-
			Error [dB]	-0.1	0.1	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-	-	-
SEL	-	1	Indication [dB]	111.8	109.0	105.0	102.0	99.0	95.0	92.0	89.0	85.0	82.0	78.9	75.9
			Error [dB]	-0.2	-0.0	0.0	0.0	-0.0	0.0	-0.0	-0.0	-0.0	-0.0	-0.1	-0.1
		2	Indication [dB]	111.8	109.0	105.0	102.0	99.0	95.0	92.0	89.0	85.0	82.0	78.9	75.9
			Error [dB]	-0.2	-0.0	0.0	0.0	-0.0	0.0	-0.0	-0.0	-0.0	-0.0	-0.1	-0.1
		3	Indication [dB]	111.8	109.0	105.0	102.0	99.0	95.0	92.0	89.0	85.0	82.0	78.9	75.9
			Error [dB]	-0.2	-0.0	0.0	0.0	-0.0	0.0	0.0	-0.0	-0.0	-0.0	-0.1	-0.1
		4	Indication [dB]	111.8	109.0	105.0	102.0	99.0	95.0	92.0	89.0	85.0	81.9	78.9	75.9
			Error [dB]	-0.2	-0.0	0.0	0.0	-0.0	0.0	-0.0	-0.0	-0.0	-0.0	-0.1	-0.1

Range: **105dB**; Equivalent input steady level = 52dB

Result	Detector	Ch.	Duration [ms]	1000	500	200	100	50	20	10	5
MAX	Fast	1	Indication [dB]	52.0	51.9	51.0	49.4	47.2	43.7	40.9	37.9
			Error [dB]	0.0	0.0	0.0	-0.0	-0.0	-0.0	-0.0	0.0
		2	Indication [dB]	52.0	51.9	51.0	49.4	47.2	43.7	40.8	37.9
			Error [dB]	0.0	0.0	0.0	-0.0	-0.0	-0.0	-0.0	0.0
		3	Indication [dB]	52.0	51.9	51.0	49.4	47.2	43.7	40.9	38.0
			Error [dB]	0.0	0.0	0.0	-0.0	-0.0	0.0	-0.0	0.0
		4	Indication [dB]	52.0	51.9	51.0	49.4	47.1	43.7	40.8	37.9
			Error [dB]	0.0	0.0	0.0	0.0	-0.0	-0.0	-0.0	0.0
	Slow	1	Indication [dB]	49.8	47.9	44.6	41.8	38.9	35.0	32.0	29.0
			Error [dB]	-0.2	0.0	-0.0	-0.0	-0.0	-0.0	-0.0	0.0
		2	Indication [dB]	49.8	47.9	44.6	41.8	38.9	35.0	32.0	29.0
			Error [dB]	-0.2	0.0	-0.0	-0.0	-0.0	-0.0	0.0	0.0
		3	Indication [dB]	49.9	48.0	44.6	41.8	38.9	35.0	32.0	29.0
			Error [dB]	-0.1	0.1	-0.0	-0.0	-0.0	-0.0	0.0	0.0
		4	Indication [dB]	49.8	47.9	44.6	41.8	38.9	34.9	32.0	29.0
			Error [dB]	-0.2	0.1	-0.0	-0.0	-0.0	-0.0	0.0	0.0
SEL	-	1	Indication [dB]	51.7	49.0	45.0	42.0	39.0	35.0	32.1	29.1
			Error [dB]	-0.3	-0.0	0.0	0.0	0.0	0.0	0.1	0.1
		2	Indication [dB]	51.7	49.0	45.0	42.0	39.0	35.0	32.0	29.1
			Error [dB]	-0.3	-0.0	0.0	-0.0	0.0	0.0	0.1	0.1
		3	Indication [dB]	51.7	49.0	45.0	42.0	39.0	35.1	32.1	29.1
			Error [dB]	-0.3	0.0	0.0	0.0	0.0	0.1	0.1	0.1
		4	Indication [dB]	51.7	49.0	45.0	42.0	39.0	35.0	32.0	29.1
			Error [dB]	-0.3	-0.0	0.0	0.0	0.0	0.0	0.1	0.1

Range: **105dB**; Equivalent input steady level = 34dB

Result	Detector	Ch.	Duration [ms]	1000	500
MAX	Fast	1	Indication [dB]	34.1	34.0
			Error [dB]	0.0	0.1
		2	Indication [dB]	34.0	34.0
			Error [dB]	0.0	0.0
		3	Indication [dB]	34.0	34.0
			Error [dB]	-0.0	0.0
		4	Indication [dB]	34.0	33.9
			Error [dB]	0.0	0.1
	Slow	1	Indication [dB]	31.9	30.1
			Error [dB]	-0.1	0.1
		2	Indication [dB]	31.9	30.0
			Error [dB]	-0.1	0.1
		3	Indication [dB]	31.9	30.1
			Error [dB]	-0.1	0.1
		4	Indication [dB]	31.8	30.0
			Error [dB]	-0.1	0.1
SEL	-	1	Indication [dB]	33.8	31.1
			Error [dB]	-0.2	0.1
		2	Indication [dB]	33.8	31.1
			Error [dB]	-0.2	0.1
		3	Indication [dB]	33.8	31.1
			Error [dB]	-0.2	0.0
		4	Indication [dB]	33.8	31.1
			Error [dB]	-0.2	0.1

Range: **130dB**; Equivalent input steady level = 134dB

Result	Detector	Ch.	Duration [ms]	1000	500	200	100	50	20	10	5	2	1	0.5	0.25
MAX	Fast	1	Indication [dB]	134.0	133.9	133.0	131.4	129.2	125.7	122.8	119.9	116.0	113.0	109.9	106.9
			Error [dB]	0.0	0.0	0.0	0.0	-0.0	-0.0	-0.1	0.0	-0.0	-0.0	-0.1	-0.1
		2	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
		3	Indication [dB]	134.0	133.9	133.1	131.4	129.2	125.7	122.9	119.9	116.0	113.0	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
		4	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	129.2	-0.0	-0.1	0.0	-0.0	-0.1	-0.1	-0.1
	Slow	1	Indication [dB]	131.8	129.9	126.6	123.8	120.9	117.0	114.0	111.0	107.0	-	-	-
			Error [dB]	-0.2	0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-	-	-
		2	Indication [dB]	131.8	129.9	126.6	123.8	120.9	117.0	114.0	111.0	107.0	-	-	-
			Error [dB]	-0.2	0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-	-	-
		3	Indication [dB]	131.9	130.0	126.6	123.8	120.9	117.0	114.0	111.0	107.0	-	-	-
			Error [dB]	-0.2	0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-	-	-
		4	Indication [dB]	131.8	129.9	126.6	123.8	120.9	117.0	114.0	111.0	107.0	-	-	-
			Error [dB]	-0.2	0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-	-	-
SEL	-	1	Indication [dB]	133.7	131.0	127.0	124.0	121.0	117.0	114.0	111.0	107.0	104.0	100.9	97.9
			Error [dB]	-0.3	-0.0	0.0	0.0	-0.0	0.0	-0.0	-0.0	-0.0	-0.0	-0.1	-0.1
		2	Indication [dB]	133.7	131.0	127.0	124.0	121.0	117.0	114.0	111.0	107.0	103.9	100.9	97.9
			Error [dB]	-0.3	-0.0	0.0	-0.0	-0.0	0.0	-0.0	-0.0	-0.0	-0.1	-0.1	-0.1
		3	Indication [dB]	133.8	131.0	127.0	124.0	121.0	117.0	114.0	111.0	107.0	104.0	100.9	97.9
			Error [dB]	-0.3	-0.0	0.0	0.0	-0.0	0.0	-0.0	-0.0	-0.0	-0.0	-0.1	-0.1
		4	Indication [dB]	133.7	131.0	127.0	124.0	121.0	117.0	114.0	111.0	107.0	103.9	100.9	97.9
			Error [dB]	-0.3	-0.0	0.0	-0.0	-0.0	0.0	-0.0	-0.0	-0.0	-0.1	-0.1	-0.1

Range: **130dB**; Equivalent input steady level = 74dB

Result	Detector	Ch.	Duration [ms]	1000	500	200	100	50	20	10	5
MAX	Fast	1	Indication [dB]	74.0	73.9	73.0	71.4	69.2	65.7	62.9	59.9
			Error [dB]	0.0	0.0	0.0	0.0	-0.0	-0.0	-0.0	0.0
		2	Indication [dB]	74.0	73.9	73.0	71.4	69.2	65.7	62.9	59.9
			Error [dB]	0.0	0.0	73.0	0.0	-0.0	-0.0	-0.0	-0.0
		3	Indication [dB]	74.0	73.9	73.0	71.4	69.2	65.7	62.9	60.0
			Error [dB]	-0.0	0.0	0.0	-0.0	-0.0	-0.0	-0.0	0.0
		4	Indication [dB]	74.0	73.9	73.0	71.4	69.2	65.7	62.8	59.9
			Error [dB]	-0.0	0.0	0.0	0.0	-0.0	-0.0	-0.1	0.0
	Slow	1	Indication [dB]	71.9	70.0	66.6	63.8	60.9	57.0	54.0	51.0
			Error [dB]	-0.1	0.1	-0.0	-0.0	-0.0	-0.0	0.0	-0.0
		2	Indication [dB]	71.8	69.9	66.6	63.8	60.9	57.0	54.0	51.0
			Error [dB]	-0.2	0.0	-0.0	-0.0	-0.0	-0.0	0.0	-0.0
		3	Indication [dB]	71.9	70.0	66.6	63.8	60.9	57.0	54.0	51.0
			Error [dB]	-0.2	0.0	-0.0	-0.0	-0.0	-0.0	-0.0	0.0
		4	Indication [dB]	71.8	69.9	66.6	63.8	60.9	56.9	54.0	51.0
			Error [dB]	-0.1	0.0	-0.0	-0.0	-0.0	-0.0	0.0	0.0
SEL	-	1	Indication [dB]	73.8	71.0	67.0	64.0	61.0	57.0	54.0	51.1
			Error [dB]	-0.2	-0.0	0.0	0.0	0.0	0.0	0.0	0.1
		2	Indication [dB]	73.7	71.0	67.0	64.0	61.0	57.0	54.1	51.0
			Error [dB]	-0.3	-0.0	0.0	0.0	-0.0	0.0	0.1	0.0
		3	Indication [dB]	73.8	71.0	67.0	64.0	61.0	57.0	54.1	51.1
			Error [dB]	-0.3	-0.0	0.0	0.0	-0.0	0.0	0.0	0.1
		4	Indication [dB]	73.7	71.0	67.0	64.0	61.0	57.0	54.0	51.1
			Error [dB]	-0.3	-0.0	0.0	0.0	0.0	0.0	0.0	0.1

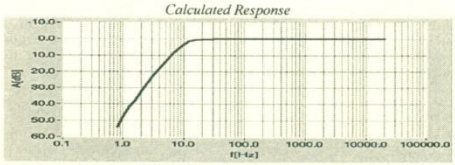
Range: **130dB**; Equivalent input steady level = 54dB

Result	Detector	Ch.	Duration [ms]	1000	500
MAX	Fast	1	Indication [dB]	54.1	54.0
			Error [dB]	0.0	0.0
		2	Indication [dB]	54.1	54.0
			Error [dB]	0.0	0.0
		3	Indication [dB]	54.1	54.0
			Error [dB]	0.0	0.1
		4	Indication [dB]	54.0	53.9
			Error [dB]	0.0	0.0
	Slow	1	Indication [dB]	52.0	50.1
			Error [dB]	-0.1	0.1
		2	Indication [dB]	51.9	50.0
			Error [dB]	-0.1	0.1
		3	Indication [dB]	51.9	50.0
			Error [dB]	-0.1	0.1
		4	Indication [dB]	51.9	50.0
			Error [dB]	-0.1	0.1
SEL	-	1	Indication [dB]	53.9	51.1
			Error [dB]	-0.2	0.1
		2	Indication [dB]	53.8	51.1
			Error [dB]	-0.2	0.1
		3	Indication [dB]	53.8	51.1
			Error [dB]	-0.2	0.1
		4	Indication [dB]	53.8	51.0
			Error [dB]	-0.2	0.0

6. FREQUENCY RESPONSE (electrical)

LEVEL METER; Filter: Z; Range: 130 dB; Input signal =135 dB;

Calculated Response



Measured Response with Preamplifier SV12 (f-frequency, An-attenuation in channel n)

f [Hz]	A1[dB]	A2[dB]	A3[dB]	A4[dB]	f [Hz]	A1[dB]	A2[dB]	A3[dB]	A4[dB]
10	3.2	3.2	3.2	3.2	250	-0.0	0.0	0.0	-0.0
12.5	1.4	1.4	1.4	1.4	500	-0.0	0.0	0.0	0.0
16	0.5	0.5	0.5	0.5	1000	0.0	0.0	0.0	0.0
20	0.1	0.1	0.1	0.1	2000	0.0	0.0	0.0	0.0
25	-0.0	0.0	0.0	-0.0	4000	0.0	0.0	0.0	0.0
31.5	-0.0	-0.0	-0.0	-0.0	8000	0.0	0.0	0.0	0.0
63	-0.0	-0.0	-0.0	-0.0	16000	0.0	0.0	0.0	-0.0
125	-0.0	0.0	0.0	-0.0	20000	0.0	0.0	0.0	-0.0

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

7. INTERNAL NOISE LEVEL* (electrical)

LEVEL METER; Range: 105 dB; Back-light – off; Calibration factor: 0dB

	Filter	Z	A	C
Channel 1	Level [dB]	14.4	11.2	12.0
Channel 2	Level [dB]	15.0	10.9	11.1
Channel 3	Level [dB]	13.9	10.6	11.2
Channel 4	Level [dB]	13.3	10.2	11.3

* measured with preamplifier SVANTEK type SV 12L No. 17701.

VIBRATION LEVEL METER

1. CALIBRATION (electrical)

LEVEL METER; Filter: HP10; Input signal =140.0dB (10.0 m/s^2), f_{set}=79,6Hz

	Range 145dB		Range 170dB	
	Indication [dB]	Error [dB]	Indication [dB]	Error [dB]
Channel 1	139.98	-0.02	140.04	0.04
Channel 2	139.98	-0.02	140.03	0.03
Channel 3	139.98	-0.02	140.03	0.03
Channel 4	139.98	-0.02	140.03	0.03

2. CALIBRATION (vibrational)

LEVEL METER; Range: 145dB; Input signal: 120dB;

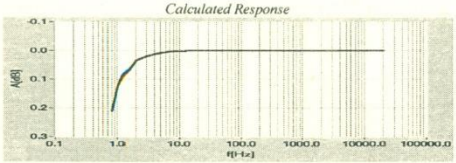
Filter	HP1		HP10		Wd		Wm		Wh	
	Indication [dB]	Error [dB]	Indication [dB]	Error [dB]	Indication [dB]	Error [dB]	Indication [dB]	Error [dB]	Indication [dB]	Error [dB]
Channel 1	120.0	0.0	120.0	0.0	106.1	0.0	102.0	-0.0	110.5	-0.0
Channel 2	120.0	0.0	120.0	0.0	106.1	0.0	102.0	-0.0	110.5	-0.0
Channel 3	120.0	0.0	120.0	0.0	106.1	0.0	102.0	-0.0	110.5	-0.0
Channel 4	120.0	0.0	120.0	0.0	106.2	0.0	102.0	-0.0	110.5	-0.0

Calibration measured with the accelerometer SVANTEK type SV80 No. H0413. Calibration factor: -0.56dB

3. FREQUENCY RESPONSE (electrical)

1/3 OCTAVE; Filter: HP; Range: 170 dB; input=175 dB;

Calculated Response



Measured Response (f-frequency, An-attenuation in channel n)

f [Hz]	A1[dB]	A2[dB]	A3[dB]	A4[dB]	f [Hz]	A1[dB]	A2 [dB]	A3[dB]	A4[dB]	f [Hz]	A1[dB]	A2[dB]	A3[dB]	A4[dB]
0.8	0.19	0.19	0.19	0.19	5	0.02	0.01	0.01	0.01	500	-0.01	-0.01	-0.01	-0.01
1	0.10	0.10	0.10	0.10	6.3	0.00	-0.00	-0.00	-0.00	1000	0.00	-0.00	-0.00	-0.01
1.25	0.08	0.08	0.08	0.08	8	-0.01	-0.01	-0.01	-0.01	2000	0.00	-0.00	-0.00	-0.00
1.6	0.06	0.06	0.06	0.06	16	-0.02	-0.02	-0.02	-0.02	4000	0.01	0.01	-0.00	-0.00
2	0.02	0.02	0.02	0.02	31.5	0.00	-0.00	-0.00	-0.00	8000	0.03	0.04	0.02	0.02
2.5	0.01	0.01	0.01	0.01	63	-0.01	-0.01	-0.01	-0.01	16000	0.02	0.02	-0.01	-0.02
3.15	-0.01	-0.01	-0.01	-0.01	125	-0.01	-0.01	-0.01	-0.01	20000	0.02	0.01	0.01	-0.01
4	0.02	0.02	0.02	0.02	250	-0.01	-0.01	-0.01	-0.01					

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

4. INTERNAL NOISE LEVEL (electrical)

LEVEL METER func.; Range: 145 dB; Back-light – off

	Filter	HP1	HP10	Wd	Wm	Wh
Channel 1	Indication [dB]	54.8	52.0	42.6	38.8	36.2
Channel 2	Indication [dB]	55.0	52.4	42.6	39.0	36.8
Channel 3	Indication [dB]	55.5	53.3	42.8	39.1	36.1
Channel 4	Indication [dB]	54.8	52.4	42.4	39.0	36.2

ENVIRONMENTAL CONDITIONS

Temperature	Relative humidity	Ambient pressure
26 °C	47 %	1000 hPa

TEST EQUIPMENT

Item	Manufacturer	Model	Serial no.	Description
1.	SVANTEK	SVAN 401	127	Signal generator
2.	SVANTEK	SVAN 912A	4369	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	1376	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. Traceability of the calibration is guaranteed by the above mentioned ISO9001 procedures.

3. 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.

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

Calibration specialist: Krzysztof Kubeł ..... Test date: 2018-08-13

Acoustic Calibrator Svantek SV35 (Serial No. 44797)
(for measurements conducted in July 2018)

MAXLAB

CALIBRATION CERTIFICATE

Certificate Information

Date of Issue	26-Sep-2017	**Certificate Number**	MLCN172047S

Customer Information

Company Name	Acoustics Innovation Limited
Address	Unit 601, Block A, Shatin Industrial Centre, Yuen Shun Circuit, Shatin, N. T.

Equipment-under-Test (EUT)

Description	Acoustic Calibrator
Manufacturer	Svantek
Model Number	SV 35
Serial Number	44797
Equipment Number	--

Calibration Particular

Date of Calibration	26-Sep-2017		
Calibration Equipment	4231(MLTE008) / PA160059 / 20-May-18 1357(MLTE190) / MLEC17/05/02 / 25-May-18		
Calibration Procedure	MLCG00, MLCG15		
Calibration Conditions	Laboratory	Temperature	23 °C ± 5 °C
		Relative Humidity	55% ± 25%
	EUT	Stabilizing Time	Over 3 hours
		Warm-up Time	Not applicable
		Power Supply	Internal battery
Calibration Results	Calibration data were detailed in the continuation pages. All calibration results were within EUT specification.		

Approved By & Date

K.O. Lo 26-Sep-2017

Statements

* Calibration equipment used for this calibration are traceable to national / international standards.
* The results on this Calibration Certificate only relate to the values measured at the time of the calibration and the uncertainties quoted will not include allowance for the EUT long term drift, variation with environmental changes, vibration and shock during transportation, overloading, mishandling, misuse, and the capacity of any other laboratory to repeat the measurement.
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Page 1 of 2

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Unit B2, 9/F., Boldwin Industrial Bldg., 16-18 Wah Sing Street, Kwai Chung, N.T., Hong Kong Tel: (852) 2116 1380 Fax: (852) 2264 6480 Email: info@maxlab.com.hk

MAXLAB

Certificate No. MLCN172047S

Calibration Data

EUT Setting	Standard Reading	EUT Error	Calibration Uncertainty	EUT Specification
94 dB	93.7 dB	0.3 dB	0.15 dB	± 0.3 dB
114 dB	113.8 dB	0.2 dB	0.15 dB	± 0.3 dB

- END -

Calibrated By : Dan
Date : 26-Sep-17

Checked By : K.O. Lo
Date : 26-Sep-17

萬儀校正中心有限公司
MaxLab Calibration Centre Limited
香港新界葵涌華星街 16-18 號保盈工業大廈 9 樓 B2 室
Unit B2, 9/F., Boldwin Industrial Bldg., 16-18 Wah Sing Street, Kwai Chung, N.T., Hong Kong Tel: (852) 2116 1380 Fax: (852) 2264 6480 Email: info@maxlab.com.hk

Acoustic Calibrator Svantek SV35 (Serial No. 44797)
(for measurements conducted in December 2018)

MAXLAB

CALIBRATION CERTIFICATE

Certificate Information

Date of Issue	7-Nov-2018	**Certificate Number**	MLCN182745S

Customer Information

Company Name	Wilson Accoustics Limited
Address	Unit 601, Block A, Shatin Industrial Centre, Yuen Shun Circuit, Shatin, N. T., Hong Kong

Equipment-under-Test (EUT)

Description	Acoustic Calibrator
Manufacturer	Svantek
Model Number	SV 35
Serial Number	44797
Equipment Number	--

Calibration Particular

Date of Calibration	7-Nov-2018		
Calibration Equipment	4231(MLTE008) / AV180068 / 13-May-20 1357(MLTE190) / MLEC18/05/02 / 25-May-19		
Calibration Procedure	MLCG00, MLCG15		
Calibration Conditions	Laboratory	Temperature	23 °C ± 5 °C
		Relative Humidity	55% ± 25%
	EUT	Stabilizing Time	Over 3 hours
		Warm-up Time	Not applicable
		Power Supply	Internal battery
Calibration Results	Calibration data were detailed in the continuation pages. All calibration results were within EUT specification.		

Approved By & Date

K.O. Lo 7-Nov-2018

Statements

* Calibration equipment used for this calibration are traceable to national / international standards.
* The results on this Calibration Certificate only relate to the values measured at the time of the calibration and the uncertainties quoted will not include allowance for the EUT long term drift, variation with environmental changes, vibration and shock during transportation, overloading, mishandling, misuse, and the capacity of any other laboratory to repeat the measurement.
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MAXLAB

Certificate No. MLCN182745S

Calibration Data

EUT Setting	Standard Reading	EUT Error	Calibration Uncertainty	EUT Specification
94 dB	93.7 dB	0.3 dB	0.15 dB	± 0.3 dB
114 dB	113.8 dB	0.2 dB	0.15 dB	± 0.3 dB

- END -

Calibrated By : Dan
Date : 7-Nov-18

Checked By : K.O. Lo
Date : 7-Nov-18

萬儀校正中心有限公司
MaxLab Calibration Centre Limited
香港新界葵涌華星街 16-18 號保盈工業大廈 9 樓 B2 室
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Vibration Calibrator IMI Sensors 699A02 (Serial No.:989)
(for measurements conducted in July 2018)

深圳市计量质量检测研究院
Shenzhen Academy of Metrology & Quality Inspection
国家高新技术计量站
National Hi-tech Metrology Station

ilac-MRA CNAS 中国认可 国际互认 校准 CALIBRATION CNAS L0579

校 准 报 告
CALIBRATION REPORT

报告编号：173604733

客户名称 Name of Customer ： 威信声学顾问有限公司

客户地址 Address of Customer ： 香港新界沙田工业中心A座601

计量器具名称 Name of Instrument： 振动校准器

器具用途 Use of Instrument ： --------

型号/规格 Type/Specification ： 699A02

出厂编号 Serial № ： 989

资产编号 Asset № ： --------

制造单位 Manufacturer ： IMI

校准依据 Calibrated in Accordance to ： JJG 1062-2010 便携式振动校准器

(校准专用章) Stamp

批准人 Authorized by ： 张国庆(副所长)

签名 Signature ：

核验员 Checked by ：

校准员 Calibrated by ：

校准日期 Operation Date ： 2017 年 Year 10 月 Month 27 日 Day

建议复校日期 Suggested Recal.Date： 2018 年 Year 10 月 Month 26 日 Day

校准机构备案号：[2012]粤量校F002号
地址：深圳市南山区龙珠大道中段计量质检大楼
电话：0086-755-26941696 0086-755-26941546
传真：0086-755-26941615 0086-755-26941547
邮编：518055 网址：www.smq.com.cn
电子邮件：kfzx@smq.com.cn

Register No.: [2012]粤量校F002号
Add:Metrology and Quality Inspection Building,Central Section of Longzhu Road, Nanshan District,Shenzhen
Tel:0086-755-26941696 0086-755-26941546
Fax:0086-755-26941615 0086-755-26941547
Post Code:518055 http://www.smq.com.cn
E-mail:kfzx@smq.com.cn

SMQ0009-1

深圳市计量质量检测研究院
Shenzhen Academy of Metrology & Quality Inspection
国家高新技术计量站
National Hi-tech Metrology Station

校准报告
CALIBRATION REPORT

报告编号：173604733
Report №

校准用主要计量标准装置信息
Main Standard Devices Used

名称 Equipment Name	测量范围 Measuring Range	不确定度/准确度等级/最大允许误差 Uncertainty/Accuracy Class/ Maximum Permissible Error	计量标准考核证书号 Certificate №	有效期至 Due Date
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校准用主要标准器信息
Main Standards of Measurement Used

名称 Equipment Name	测量范围 Measuring Range	不确定度/准确度等级/最大允许误差 Uncertainty/Accuracy Class/ Maximum Permissible Error	设备编号 Equipment №	证书号 Certificate №	有效期至 Due Date
振动仪标准传感器	0.2 Hz ～ 4000 Hz (±1%)	Urel = 0.5 %, k = 2	SB0424/02	LSzd2017-0638	2018-05-14

附加说明
Appended Directions

委托日期：2017 年 10 月 23 日
Application Date

校准地点：本院声学振动实验室
Operation Location

环境条件：温度 25 ℃ 相对湿度 50 %
Operation Environment

符合性及限制使用说明：所校准项目（或量值）合格
Statement of Compliance and Limitation

校准报告
CALIBRATION REPORT

校准结果
Results of Calibration

1 外观检查： 正常

Appearance Check: Pass

2 振动幅值：

Amplitude

2.1 加速度：见表1

Acceleration: See Table 1

表1 Table 1

加速度标称值 Nominal SPL	加速度实测值 Measured SPL	误差 Error	最大允许误差 M.P.E.
(m/s^2)	(m/s^2)	(%)	(%)
9.8	9.75	+0.5	±3.0

2.2 等效速度：见表2

Equivalent Velocity: See Table 2

表2 Table 2

速度标称值 Nominal SPL	速度实测值 Measured SPL	误差 Error	最大允许误差 M.P.E.
(mm/s)	(mm/s)	(%)	(%)

校准报告
CALIBRATION REPORT

校准结果
Results of Calibration

9.8	9.75	+0.5	±3.0

2.3 等效位移：见表3

Equivalent Displacement: See Table 3

表3 Table 3

位移标称值 Nominal SPL (um)	位移实测值 Measured SPL (um)	误差 Error (%)	最大允许误差 M.P.E. (%)
9.8	9.75	+0.5	±3.0

3 频率：见表4

Frequency: see Table 4

表4 Table 4

频率标称值 Nominal Freq. (Hz)	频率实测值 Measured Freq. (Hz)	误差 Error (%)	最大允许误差 M.P.E. (%)
159.2	159.2	0.0	±1.0

4 加速度波形失真度：见表5

校准报告
CALIBRATION REPORT

校准结果
Results of Calibration

ACC.Distortion：See Table 5

表5　Table 5

标称频率 Nominal Freq.	标称幅值 Nominal Amplitude	失真度 Distortion	允许范围 Limit
(Hz)	(m/s^2)	(%)	(%)
159.2	9.8	0.62	≤5.0

附注(Note)：

1）等效速度和等效位移由参考频率加速度换算得出。

2）加速度测量结果相对扩展不确定度：U_{rel} = 1.4 %，k = 2

（依据JJF1059.1-2012测量不确定度评定及表示）

Related Expanded Uncertainty of Acceleration: U_{rel} = 1.4 %, k = 2

(By JJF1059.1-2012 Evaluation and Expression of Uncertainty in Measurement)

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Vibration Calibrator IMI Sensors 699A02 (Serial No.:989)
(for measurements conducted in December 2018)

深圳市计量质量检测研究院
Shenzhen Academy of Metrology & Quality Inspection
国家高新技术计量站
National Hi-tech Metrology Station

中国认可 国际互认 校准 CALIBRATION CNAS L0579

校 准 报 告
CALIBRATION REPORT

报告编号：183605548

客户名称 Name of Customer	：	威信声学顾问有限公司
客户地址 Address of Customer	：	香港新界沙田工业中心A座601
计量器具名称 Name of Instrument	：	振动校准器
器具用途 Use of Instrument	：	环境监测
型号/规格 Type/Specification	：	699A02
出厂编号 Serial №	：	989
资产编号 Asset №	：	--------
制造单位 Manufacturer	：	IMI
校准依据 Calibrated in Accordance to	：	JJG 1062-2010 便携式振动校准器

（校准专用章）
Stamp

校准日期 Operation Date ：2018 年 Year 11 月 Month 07 日 Day

建议复校日期 Suggested Recal.Date：2019 年 Year 11 月 Month 06 日 Day

批准人 Authorized by ： 张国庆(副所长)

签名 Signature ：

核验员 Checked by ：

校准员 Calibrated by ：

校准机构备案号：[2012]粤量校F002号
地址：深圳市南山区龙珠大道中段计量质检大楼
电话：0086-755-26941696 0086-755-26941546
传真：0086-755-26941615 0086-755-26941547
邮编：518055 网址：www.smq.com.cn
电子邮件：kfzx@smq.com.cn

Register No.: [2012]粤量校F002号
Add:Metrology and Quality Inspection Building,Central Section of Longzhu Road, Nanshan District,Shenzhen
Tel:0086-755-26941696 0086-755-26941546
Fax:0086-755-26941615 0086-755-26941547
Post Code:518055 http://www.smq.com.cn
E-mail:kfzx@smq.com.cn

校准报告
CALIBRATION REPORT

校准用主要计量标准装置信息
Main Standard Devices Used

名称 Equipment Name	测量范围 Measuring Range	不确定度/准确度等级/最大允许误差 Uncertainty/Accuracy Class/Maximum Permissible Error	计量标准考核证书号 Certificate №	有效期至 Due Date
————	————	————	————	————

校准用主要标准器信息
Main Standards of Measurement Used

名称 Equipment Name	测量范围 Measuring Range	不确定度/准确度等级/最大允许误差 Uncertainty/Accuracy Class/Maximum Permissible Error	设备编号 Equipment №	证书号 Certificate №	有效期至 Due Date
振动仪标准传感器	0.2 Hz ～ 4000 Hz (±1%)	Urel = 0.5 %, k = 2	SB0424/02	LSzd2018-0705	2019-05-24

附加说明
Appended Directions

委托日期： 2018 年 11 月 01 日
Application Date

校准地点： 本院声学振动实验室
Operation Location

环境条件： 温度 25 ℃ 相对湿度 50 %
Operation Environment

符合性及限制使用说明： 所校准项目（或量值）合格
Statement of Compliance and Limitation

校准报告
CALIBRATION REPORT

校准结果
Results of Calibration

1 外观检查： 正常

Appearance Check: Pass

2 振动幅值：

Amplitude

2.1 加速度：见表1

Acceleration: See Table 1

表1 Table 1

加速度标称值 Nominal SPL	加速度实测值 Measured SPL	误差 Error	最大允许误差 M.P.E.
(m/s^2)	(m/s^2)	(%)	(%)
9.8	9.74	+0.6	±3.0

2.2 等效速度：见表2

Equivalent Velocity: See Table 2

表2 Table 2

速度标称值 Nominal SPL	速度实测值 Measured SPL	误差 Error	最大允许误差 M.P.E.
(mm/s)	(mm/s)	(%)	(%)

校准报告
CALIBRATION REPORT

校准结果
Results of Calibration

9.8	9.68	+1.2	±3.0

2.3 等效位移：见表3

Equivalent Displacement: See Table 3

表3 Table 3

位移标称值 Nominal SPL (um)	位移实测值 Measured SPL (um)	误差 Error (%)	最大允许误差 M.P.E. (%)
9.8	9.62	+1.9	±3.0

3 频率：见表4

Frequency: see Table 4

表4 Table 4

频率标称值 Nominal Freq. (Hz)	频率实测值 Measured Freq. (Hz)	误差 Error (%)	最大允许误差 M.P.E. (%)
159.2	160.0	-0.5	±1.0

校准报告
CALIBRATION REPORT

校准结果
Results of Calibration

4 加速度波形失真度：见表5

ACC.Distortion: See Table 5

表5 Table 5

标称频率 Nominal Freq.	标称幅值 Nominal Amplitude	失真度 Distortion	允许范围 Limit
(Hz)	(m/s^2)	(%)	(%)
159.2	9.8	0.63	≤5.0

附注(Note)：

1）等效速度和等效位移由参考频率加速度换算得出。

2）加速度测量结果相对扩展不确定度：U_{rel} = 1.4 %，k = 2

(依据JJF1059.1-2012测量不确定度评定及表示)

Related Expanded Uncertainty of Acceleration: U_{rel} = 1.4 %, k = 2

(By JJF1059.1-2012 Evaluation and Expression of Uncertainty in Measurement)

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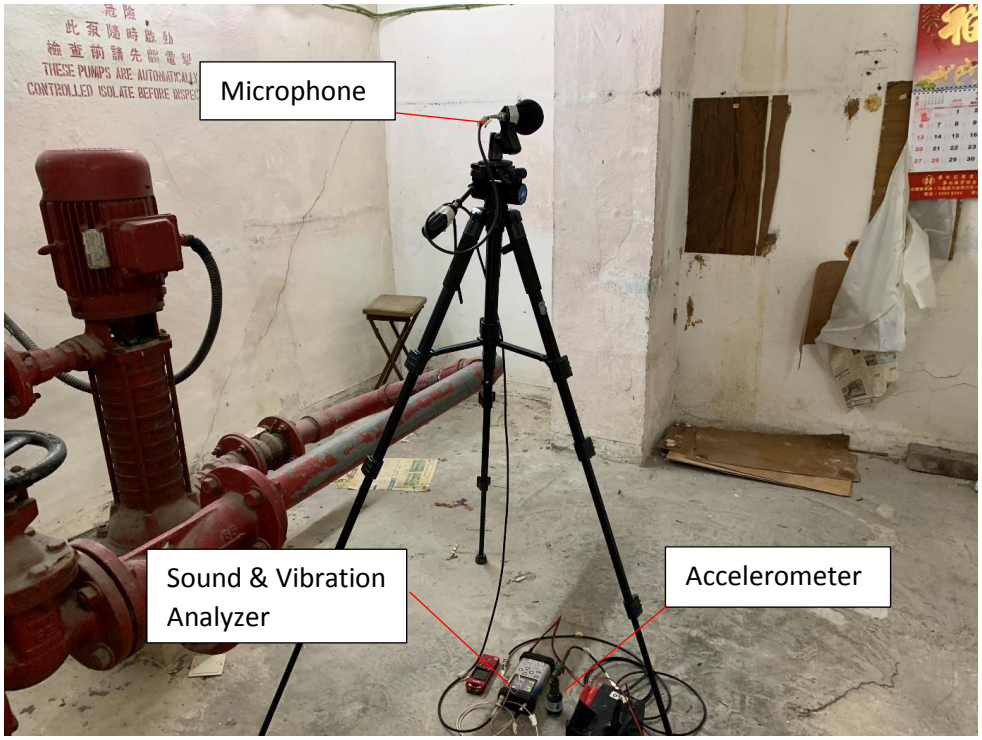
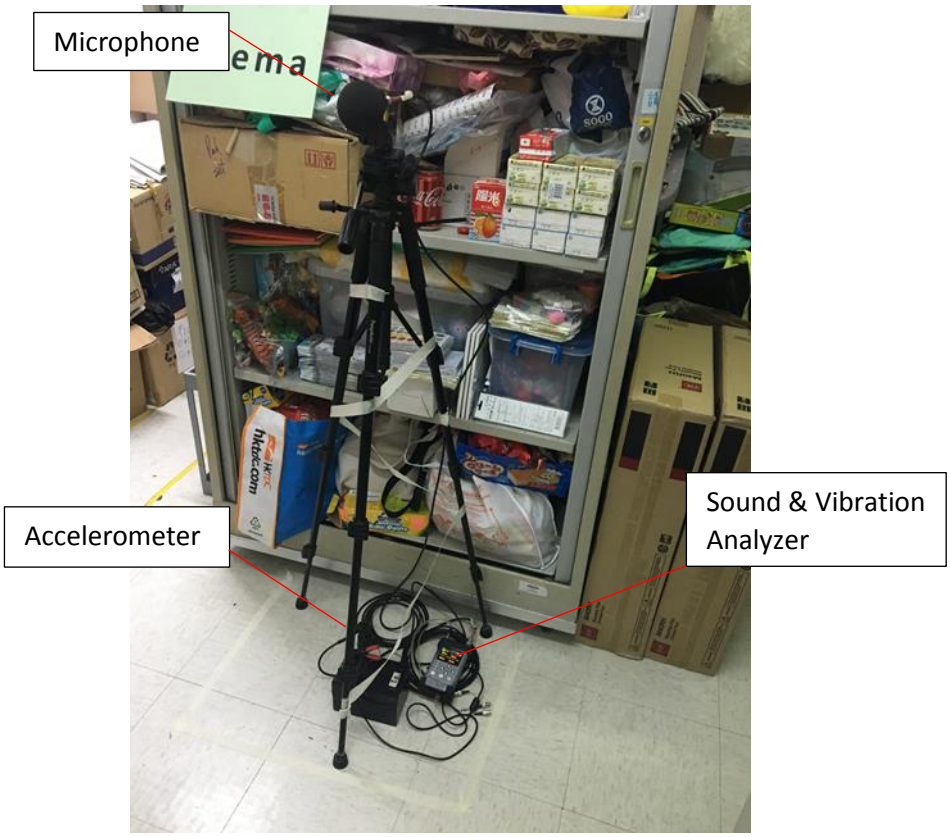
Appendix C

Ground-borne Noise Measurement – Photographs of Measurement Setup

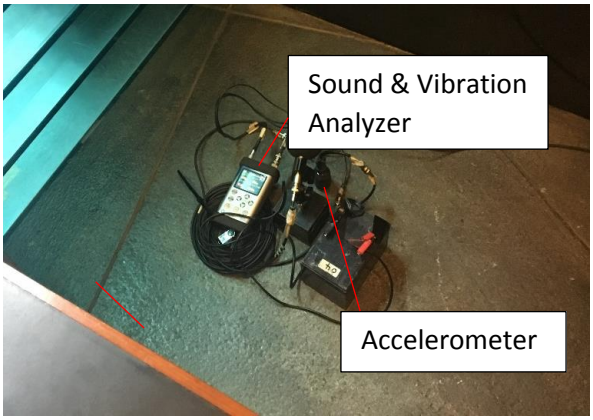
Appendix C Ground-borne Railway Noise Measurement - Photographs of Measurement Setup



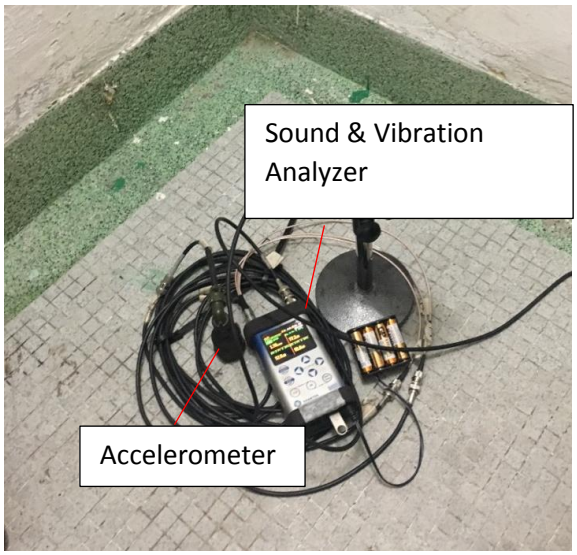
DIH-1-1 Tsui Chuk Garden Block 5



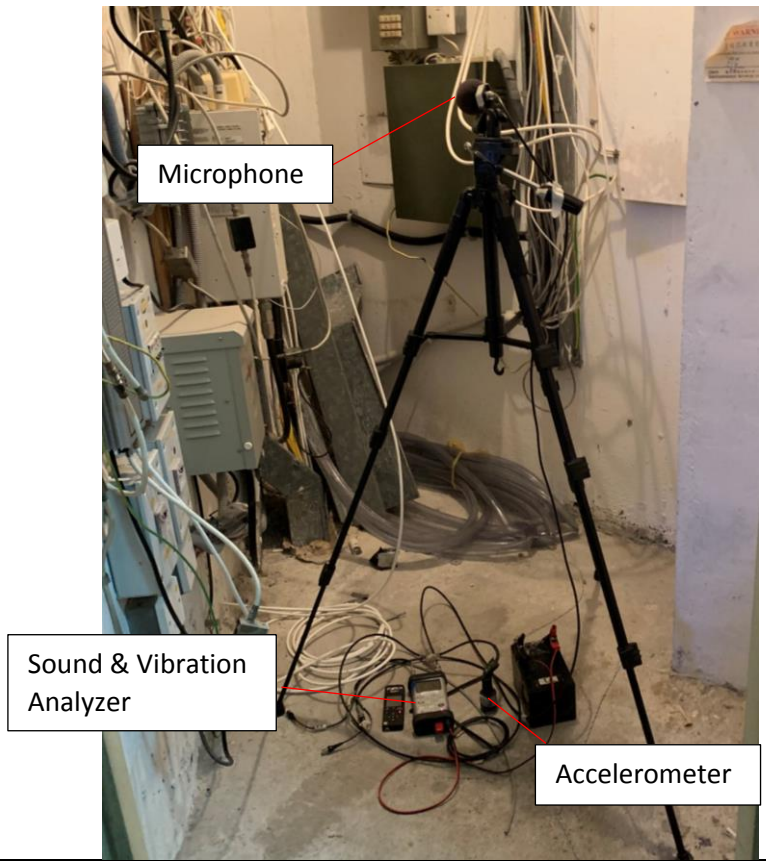
TKW-6-2 Hong Kong Society for the Protection of Children



HOM-1-1 Ko Shan Theatre



HUH-1-3 Wing Fung Building



DIH-11-1 Lung Poon Court, Lung Wan House

DIH-6-1 WTS Fire Station and Quarters Block A

Appendix D

Ground-borne Railway Noise Measurement Results and Detailed Calculation

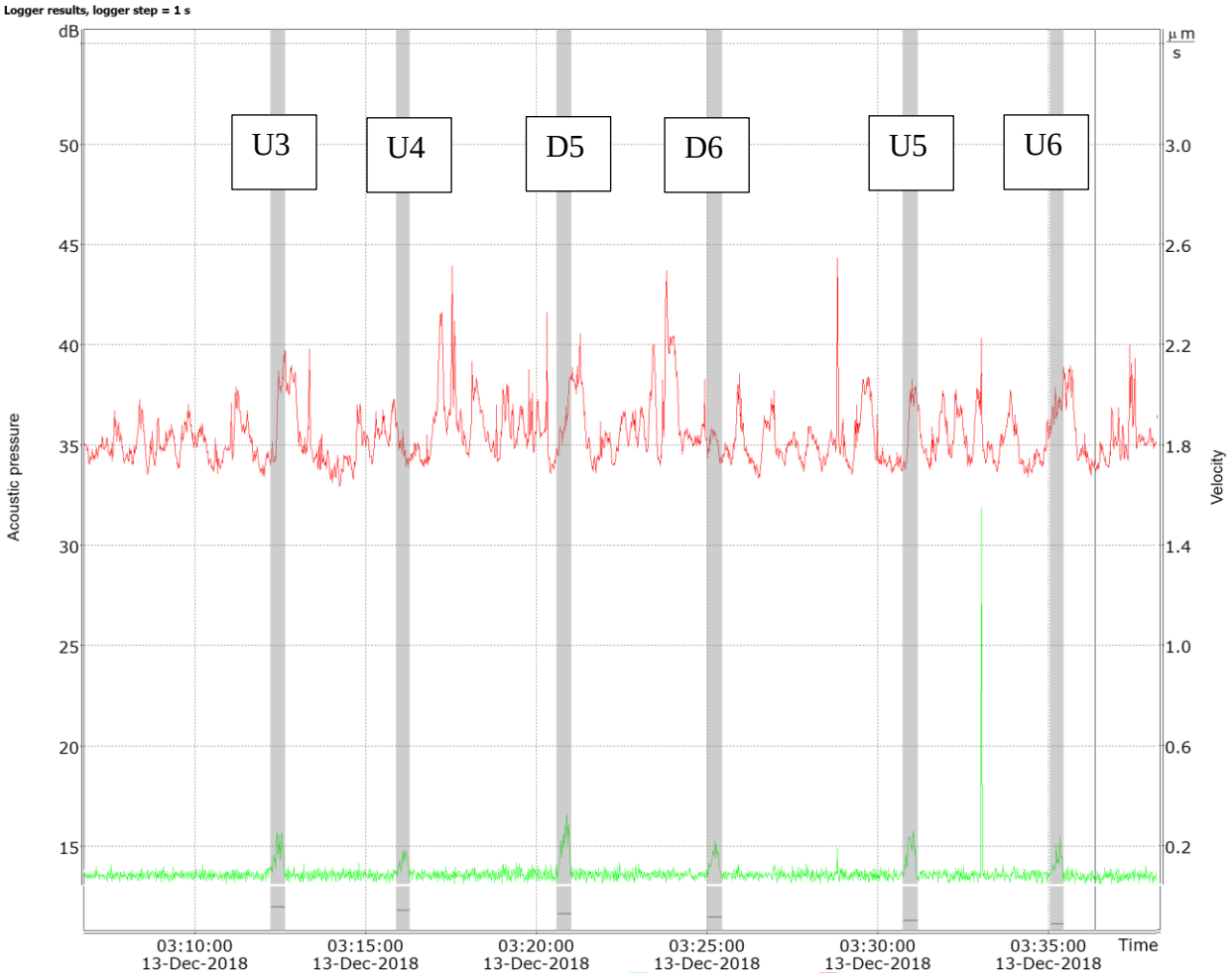
Noise and Vibration Time History of Train Passby

Measurement Location: DIH-1-1, Basement Floor

Legend:

——: Vibration level at 50Hz, µm/s

——: Overall noise level, dB(A)



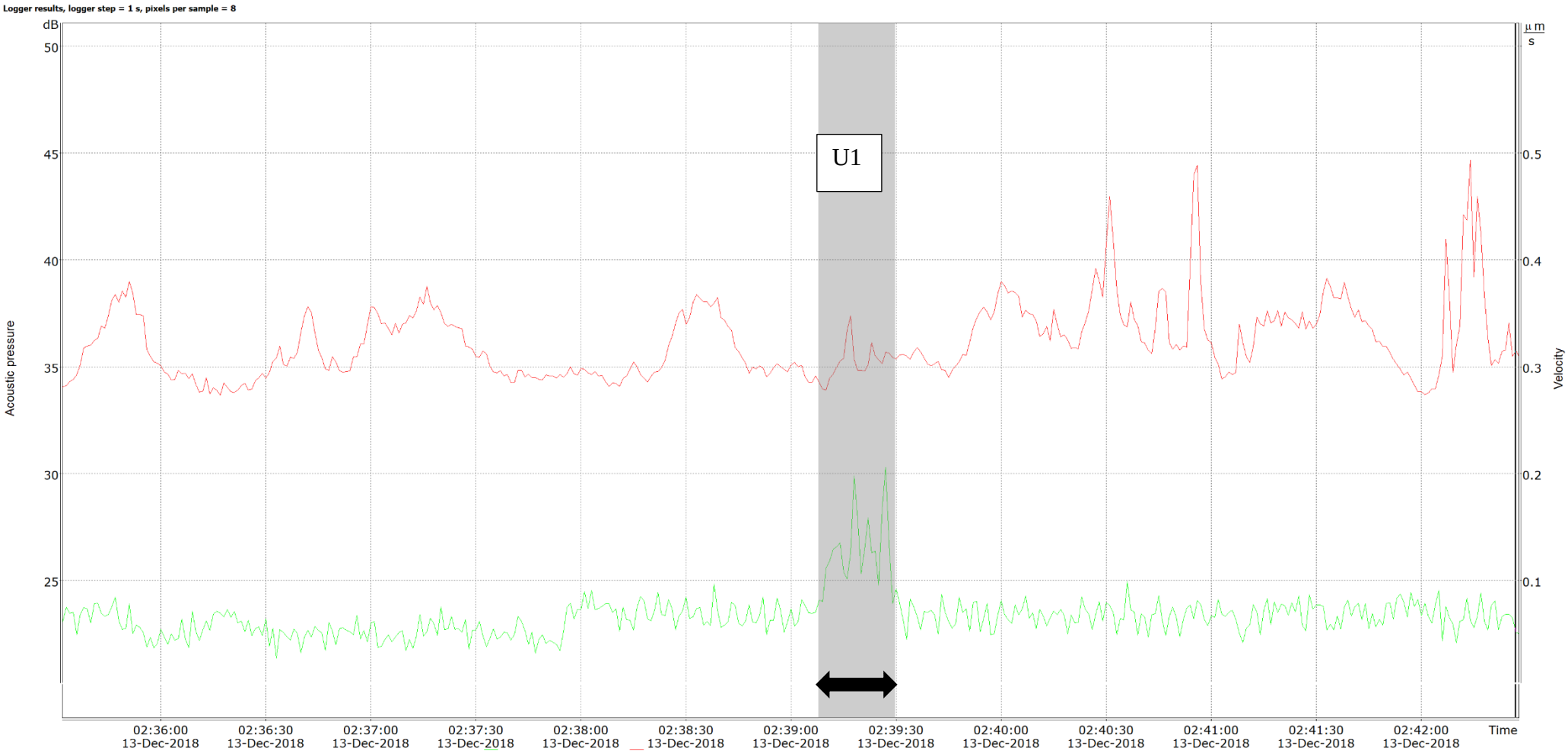
Legend:

———: Vibration level at 50Hz, µm/s

———: Overall noise level, dB(A)

Typical Train Passby

Measurement Location: DIH-1-1, Basement Floor

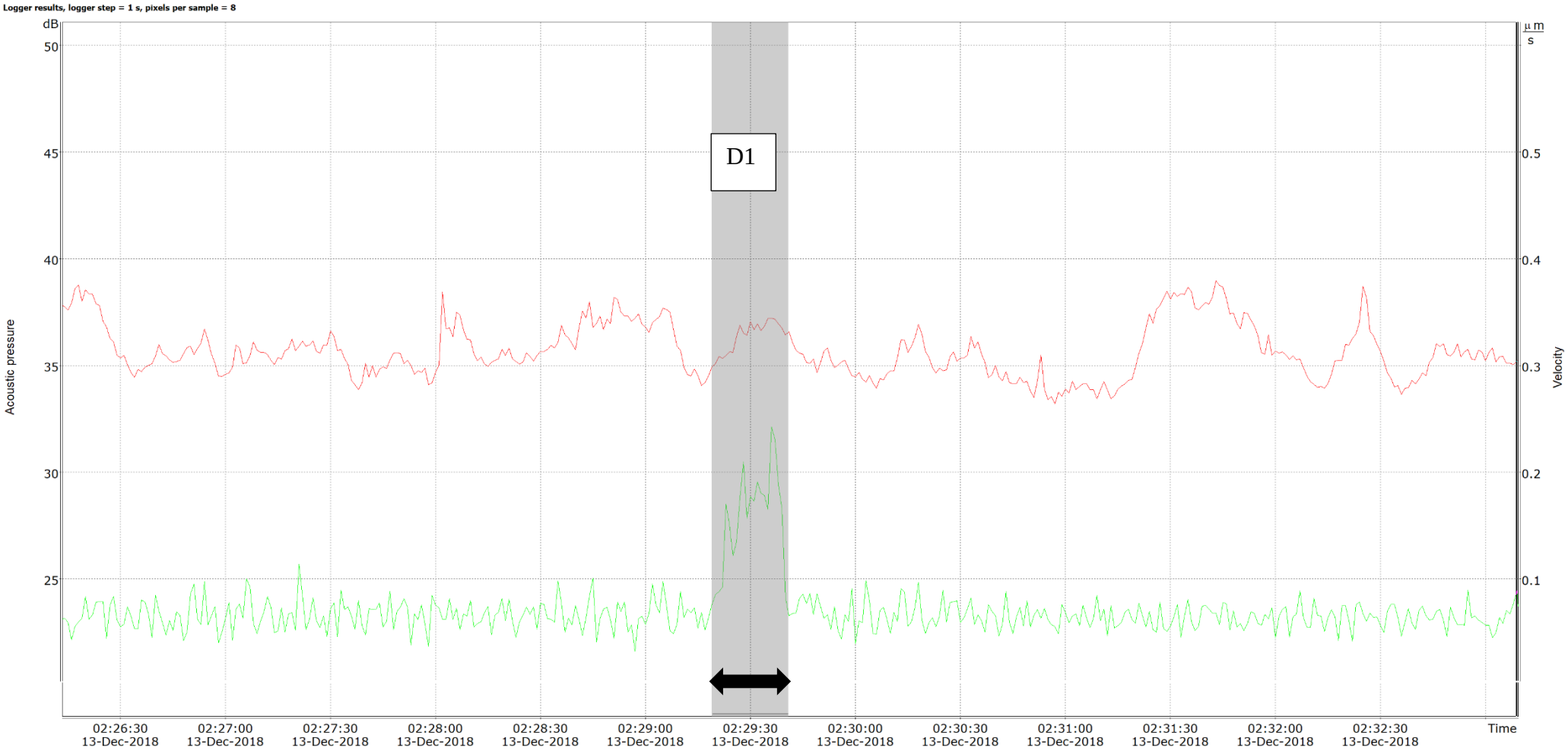


Legend:

——: Vibration level at 50Hz, µm/s

——: Overall noise level, dB(A)

⟷ : Train Passby



Legend:

: Vibration level at 50Hz, µm/s

: Overall noise level, dB(A)

:Train Passby

Appendix D Ground-borne Noise Measurement Results and Detailed Calculation (Without Background Correction)

Measurement Location: **Tsui Chuk Garden Block 5 (DIH-1-1), Ground Floor (G/F)**
Measurement Date and Time: **13/12/2018 02:00 to 04:00**

GBNSR	Train&Direction	Train Type [1]	Passby No.	Measured Event[2] Leq, dB(A) [A]	Background Noise Level, dB(A) [B]	[A] - [B], dB(A)	Event Duration, s	Correction for Event Duration, dB(A)	SEL[3], dB(A)	Averaged SEL, dB(A)
DIH-1-1	Uptrack	8 car SP-1900	U1	35.3	34.8	0.5	25	14.0	49.3	50.2
		8 car SP-1900	U2	35.7	34.6	1.1	25	14.0	49.7	
		8 car SP-1900	U3	37.2	34.8	2.4	25	14.0	51.2	
		8 car CRC	U4	34.8	34.0	0.8	25	14.0	48.8	
		8 car SP-1900	U5	36.6	34.3	2.3	25	14.0	50.6	
		8 car CRC	U6	37.0	34.3	2.7	25	14.0	51.0	
	Downtrack	8 car SP-1900	D1	36.5	35.5	1.0	25	14.0	50.5	50.1
		8 car SP-1900	D2	37.7	35.3	2.4	25	14.0	51.7	
		8 car SP-1900	D3	35.1	34.7	0.4	25	14.0	49.1	
		8 car CRC	D4	35.1	34.8	0.3	25	14.0	49.1	
		8 car SP-1900	D5	36.4	34.6	1.8	25	14.0	50.4	
		8 car CRC	D6	35.1	34.4	0.7	25	14.0	49.1	

Notes:

(1) The train type, which is in equivalent noise performance, adopted for the commissioning test is the same as the train type for future operation.

(2) Event duration includes the head-tail time period.

(3) As a conservative approach, the measured event noise levels without background correction were adopted to determine the SEL.

Prediction of Groundborne Railway Noise Level During Daytime/Evening Time Period

GBNSR	Train & Direction	Averaged SEL, dB(A)	Time Period	Train Frequency per 30mins	Correction for Train Frequency, dB(A)	Conversion Factor to LAeq 30mins, dB(A)	BCF Correction[1]	Att_{floor} Correction	LAeq 30mins[2], dB(A)
DIH-1-1	Uptrack	50.2	Daytime & Evening (0700-2300)	12	10.8	-32.6	0.0	0.0	28.4
	Downtrack	50.1		12	10.8	-32.6	0.0	0.0	28.3
								Predicted Noise Level, LAeq 30mins, dB(A)	**<31**
								GBN Criterion, dB(A)	**55**
								Compliance	**Yes**

Notes:

(1) Measurement was conducted inside the building and thus there is no correction of buidling coupling factor (BCF).

(2) The ground-borne noise level was measured on G/F while 1/F is the lowest sensitive floor. It is anticipated that the ground-borne noise railway level on 1/F would be lower than that on G/F due to floor-to-floor attenuation.

Prediction of Groundborne Railway Noise Level During Night-time Period

GBNSR	Train & Direction	Averaged SEL, dB(A)	Time Period	Train Frequency per 30mins	Correction for Train Frequency, dB(A)	Conversion Factor to LAeq 30mins, dB(A)	BCF Correction[1]	Att_{floor} Correction[2]	LAeq 30mins[2], dB(A)
DIH-1-1	Uptrack	50.2	Night-time (2300-0700)	6	7.8	-32.6	0.0	0.0	25.4
	Downtrack	50.1		6	7.8	-32.6	0.0	0.0	25.3
								Predicted Noise Level, LAeq 30mins, dB(A)	**<28**
								GBN Criterion, dB(A)	**45**
								Compliance	**Yes**

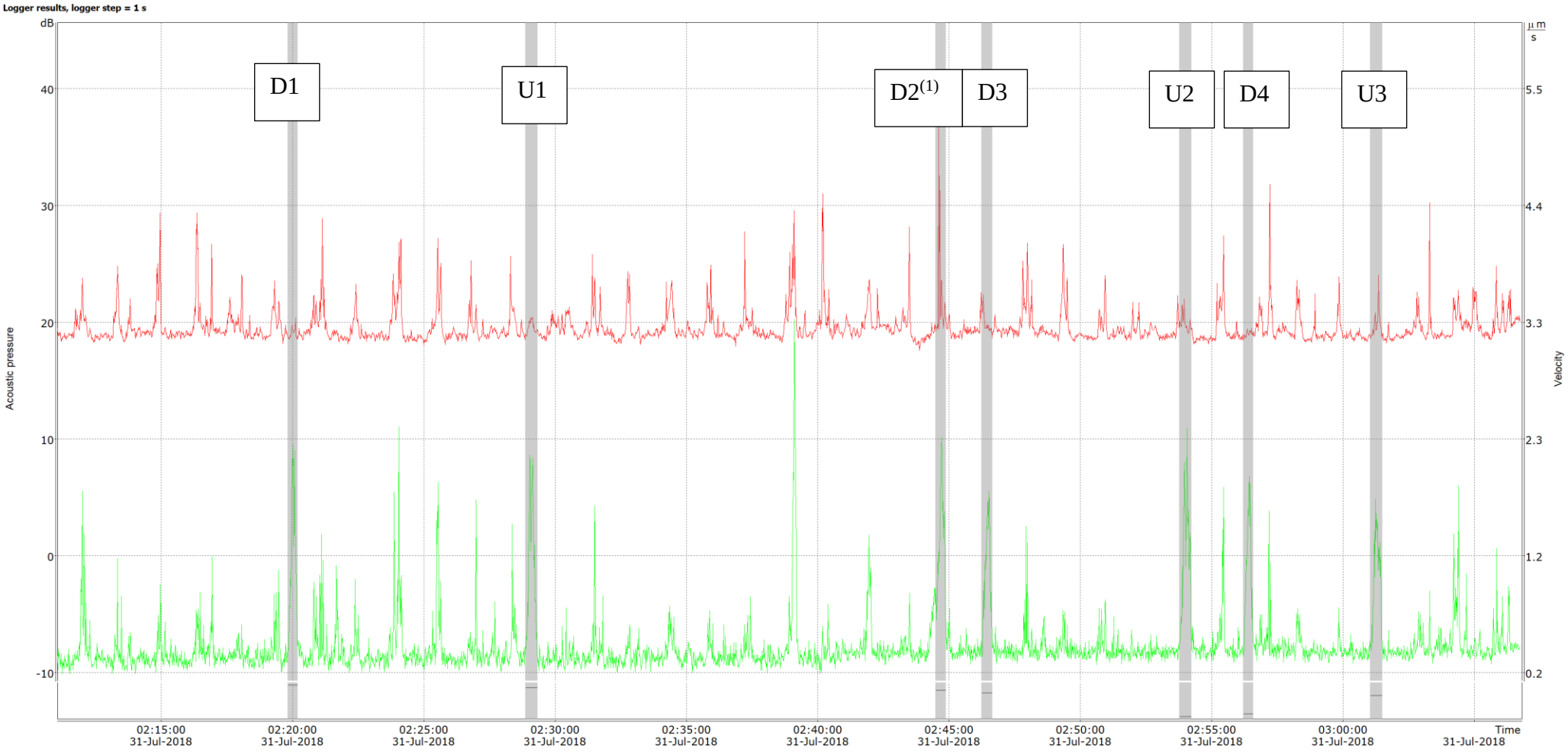
Notes:

(1) Measurement was conducted inside the building and thus there is no correction of buidling coupling factor (BCF).

(2) The ground-borne noise level was measured on G/F while 1/F is the lowest sensitive floor. It is anticipated that the ground-borne noise railway level on 1/F would be lower than that on G/F due to floor-to-floor attenuation.

Noise and Vibration Time History of Train Passby

Measurement Location: TKW-6-2, G/F



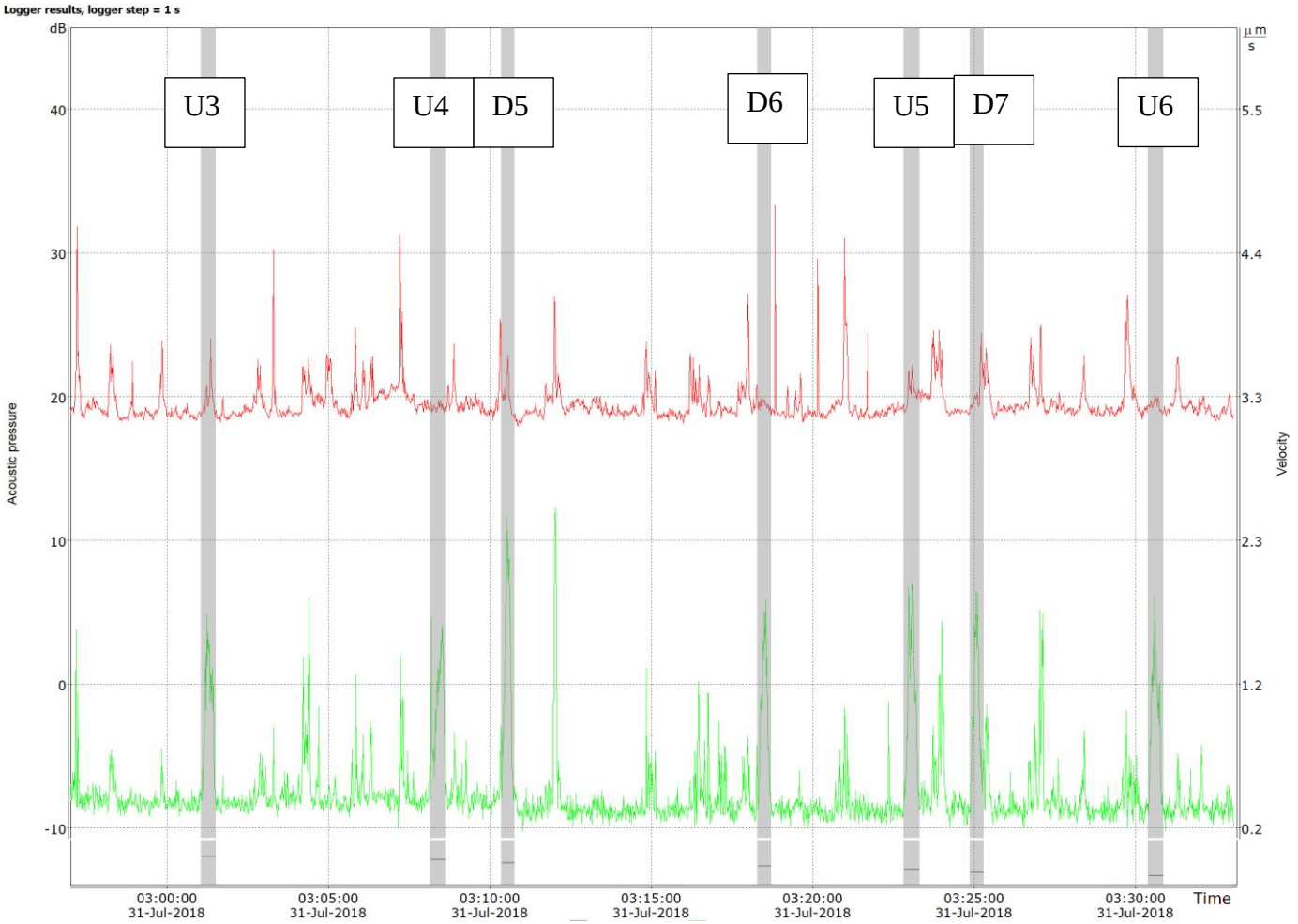
Note:

(1) Based on site observation, event passby D2 was affected by traffic noise, thus the result was discarded.

Legend:

——: Vibration level at 50Hz, μm/s

——: Overall noise level, dB(A)



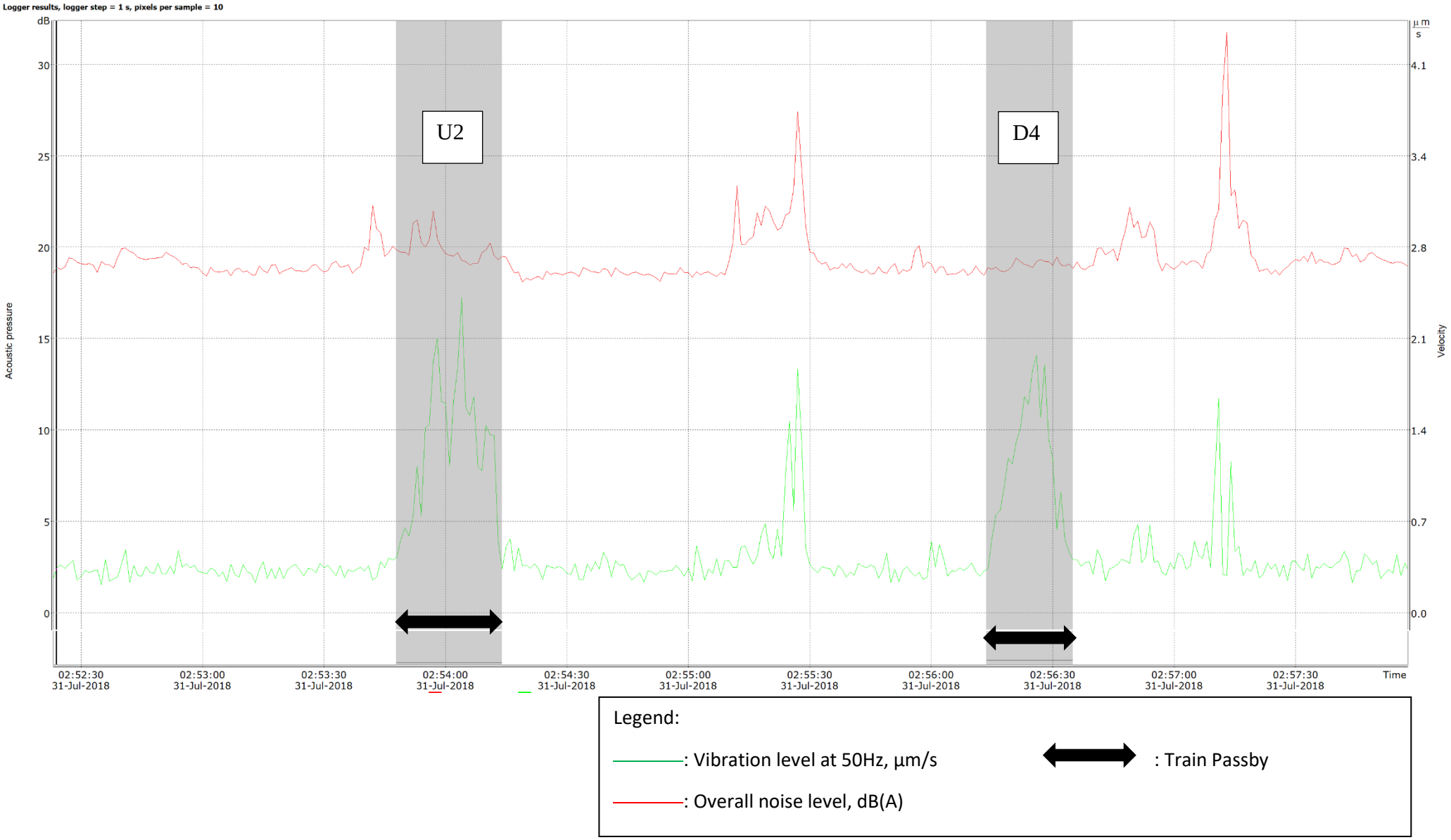
Legend:

: Vibration level at 50Hz, µm/s

: Overall noise level, dB(A)

Typical Train Passby

Measurement Location: TKW-6-2, G/F



Appendix D Ground-borne Noise Measurement Results and Detailed Calculation (Without Background Correction)

Measurement Location: **HK Society for the Protection of Children (TKW-6-2), G/F**
Measurement Date and Time: **31/7/2018 02:00 to 04:00**

GBNSR	Train&Direction	Train Type [1]	Passby No.	Measured Event[2] Leq, dB(A) [A]	Background Noise Level, dB(A) [B]	[A] - [B], dB(A)	Event Duration, s	Correction for Event Duration, dB(A)	SEL[3], dB(A)	Averaged SEL, dB(A)
TKW-6-2	Uptrack	8 car SP-1900	U1	19.6	19.1	0.5	28	14.5	34.1	34.2
		8 car SP-1900	U2	20.0	18.7	1.3	28	14.5	34.5	
		8 car CRC	U3	20.0	18.9	1.1	28	14.5	34.5	
		8 car CRC	U4	19.2	19.0	0.2	28	14.5	33.7	
		8 car SP-1900	U5	20.3	19.0	1.3	28	14.5	34.8	
		8 car CRC	U6	19.4	19.0	0.4	28	14.5	33.9	
	Downtrack	8 car SP-1900	D1	19.1	18.9	0.2	24	13.8	32.9	33.6
		8 car CRC	D3	19.9	19.1	0.8	24	13.8	33.7	
		8 car CRC	D4	19.0	18.7	0.3	24	13.8	32.8	
		8 car SP-1900	D5	20.2	19.3	0.9	24	13.8	34.0	
		8 car CRC	D6	19.4	18.7	0.7	24	13.8	33.2	
		8 car CRC	D7	20.7	19.2	1.5	24	13.8	34.5	

Notes:

(1) The train type, which is in equivalent noise performance, adopted for the commissioning test is the same as the train type for future operation.

(2) Event duration includes the head-tail time period.

(3) As a conservative approach, the measured event noise levels without background correction were adopted to determine the SEL.

Prediction of Groundborne Railway Noise Level During Daytime/Evening Time Period

GBNSR	Train & Direction	Averaged SEL, dB(A)	Time Period	Train Frequency per 30mins	Correction for Train Frequency, dB(A)	Conversion Factor to LAeq 30mins, dB(A)	BCF Correction[1]	Att_{floor} Correction[2]	LAeq 30mins, dB(A)
TKW-6-2	Uptrack	34.2	Daytime & Evening (0700-2300)	12	10.8	-32.6	0.0	0.0	12.5
	Downtrack	33.6		12	10.8	-32.6	0.0	0.0	11.8
								Predicted Noise Level, LAeq 30mins, dB(A)	**<15**
								GBN Criterion, dB(A)	**55**
								Compliance	**Yes**

Notes:

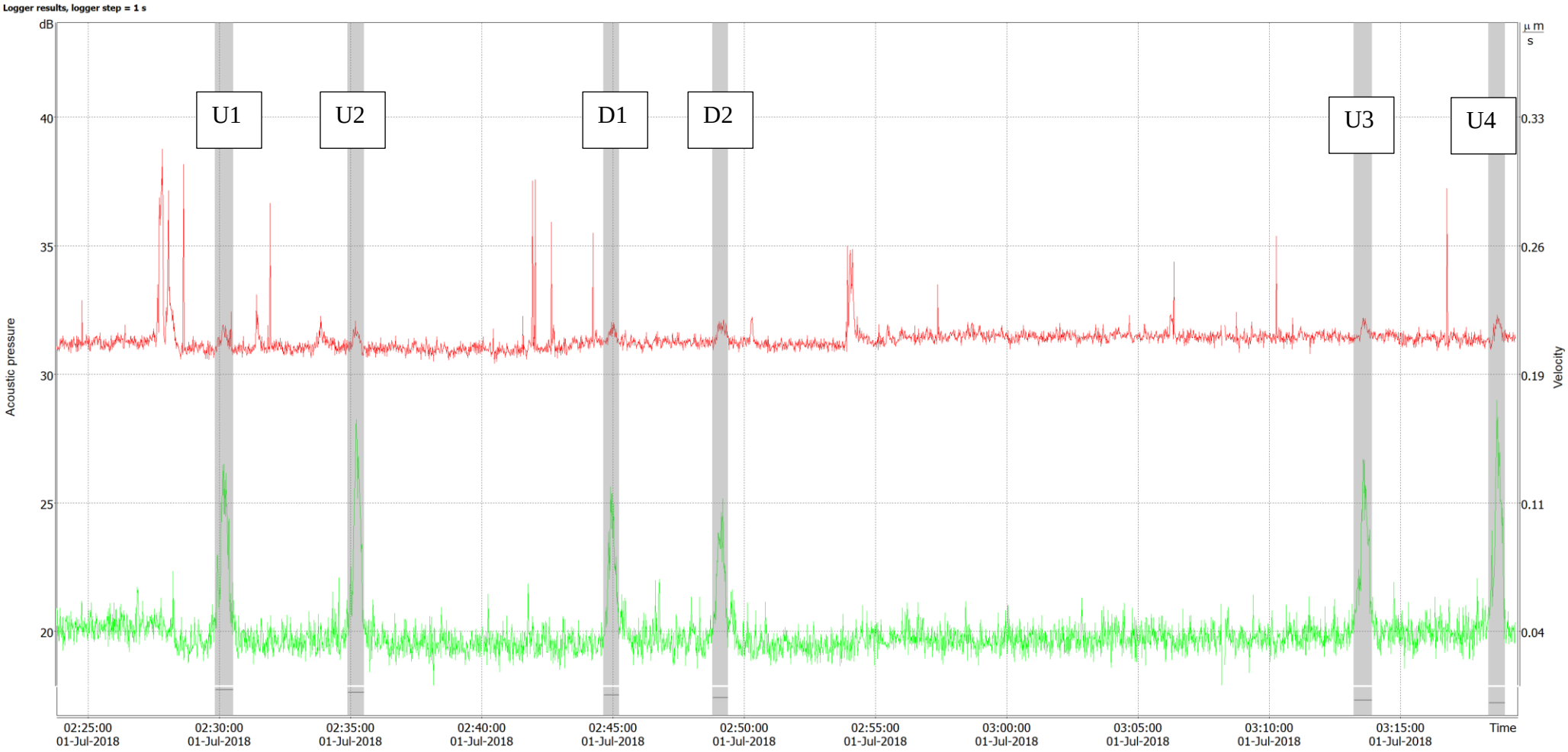
(1) Measurement was conducted inside the building and thus there is no correction of buidling coupling factor (BCF).

(2) G/F of TKW-6-2 is the lowest noise sensitive floor, and thus no floor-to-floor attenuation was applied to the measurement result.

(3) As there is no sensitive use at TKW-6-2 during night-time period, only daytime/evening predicted noise level is presented.

Noise and Vibration Time History of Train Passby

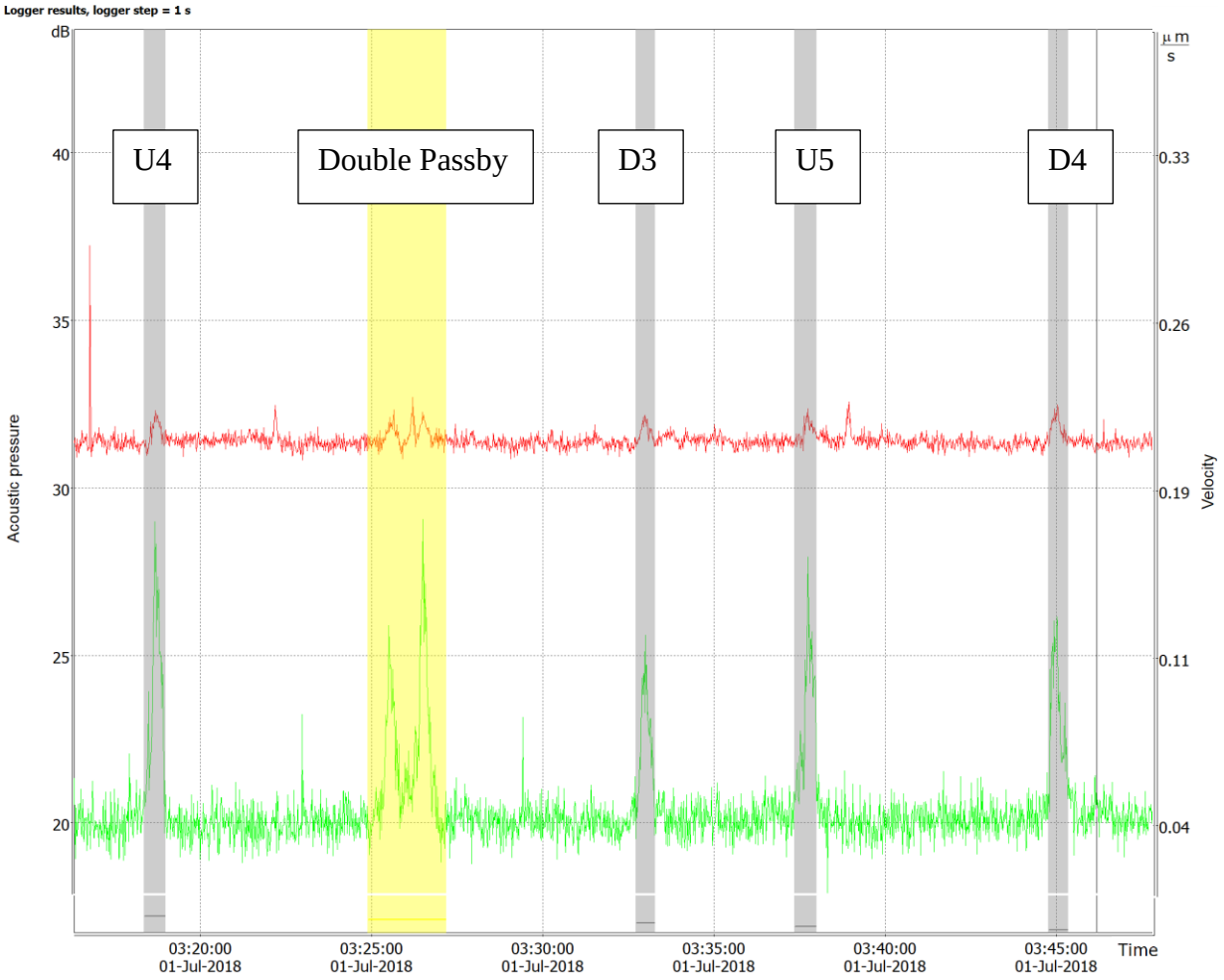
Measurement Location: HOM-1-1, G/F



Legend:

: Vibration level at 50Hz, μm/s

: Overall noise level, dB(A)



Legend:

: Vibration level at 50Hz, µm/s

: Overall noise level, dB(A)

Typical Train Passby

Measurement Location: HOM-1-1, G/F

Legend:

: Vibration level at 50Hz, µm/s

: Overall noise level, dB(A)

: Train Passby

Appendix D Ground-borne Noise Measurement Results and Detailed Calculation (Without Background Correction)

Measurement Location: **Ko Shan Theater (HOM-1-1), G/F**
Measurement Date and Time: **1/7/2018 02:00 to 04:00**

GBNSR	Train&Direction	Train Type [1]	Passby No.	Measured Event[2] Leq, dB(A) [A]	Background Noise Level, dB(A) [B]	[A] - [B], dB(A)	Event Duration, s	Correction for Event Duration, dB(A)	SEL[3], dB(A)	Averaged SEL, dB(A)
HOM-1-1	Uptrack	8 car SP-1900	U1	31.4	31.0	0.4	40	16.0	47.4	47.6
		8 car CRC	U2	31.3	31.0	0.3	40	16.0	47.3	
		8 car SP-1900	U3	31.7	31.5	0.2	40	16.0	47.7	
		8 car CRC	U4	31.7	31.4	0.3	40	16.0	47.7	
		8 car SP-1900	U5	31.7	31.3	0.4	40	16.0	47.7	
	Downtrack	8 car SP-1900	D1	31.6	31.1	0.5	34	15.3	46.9	47.0
		8 car CRC	D2	31.6	31.3	0.3	34	15.3	46.9	
		8 car CRC	D3	31.7	31.3	0.4	34	15.3	47.0	
		8 car CRC	D4	31.8	31.5	0.3	34	15.3	47.1	

Notes:

(1) The train type, which is in equivalent noise performance, adopted for the commissioning test is the same as the train type for future operation.

(2) Event duration includes the head-tail time period.

(3) As a conservative approach, the measured event noise levels without background correction were adopted to determine the SEL.

Prediction of Groundborne Railway Noise Level During Daytime/Evening Time Period

GBNSR	Train & Direction	Averaged SEL, dB(A)	Time Period	Train Frequency per 30mins	Correction for Train Frequency, dB(A)	Conversion Factor to LAeq 30mins, dB(A)	BCF Correction[1]	Att_{floor} Correction[2]	LAeq 30mins, dB(A)
HOM-1-1	Uptrack	47.6	Daytime & Evening (0700-2300)	12	10.8	-32.6	0.0	0.0	25.8
	Downtrack	47.0		12	10.8	-32.6	0.0	0.0	25.2
								Predicted Noise Level, LAeq 30mins, dB(A)	**<29**
								GBN Criterion, dB(A)	**55**
								Compliance	**Yes**

Notes:

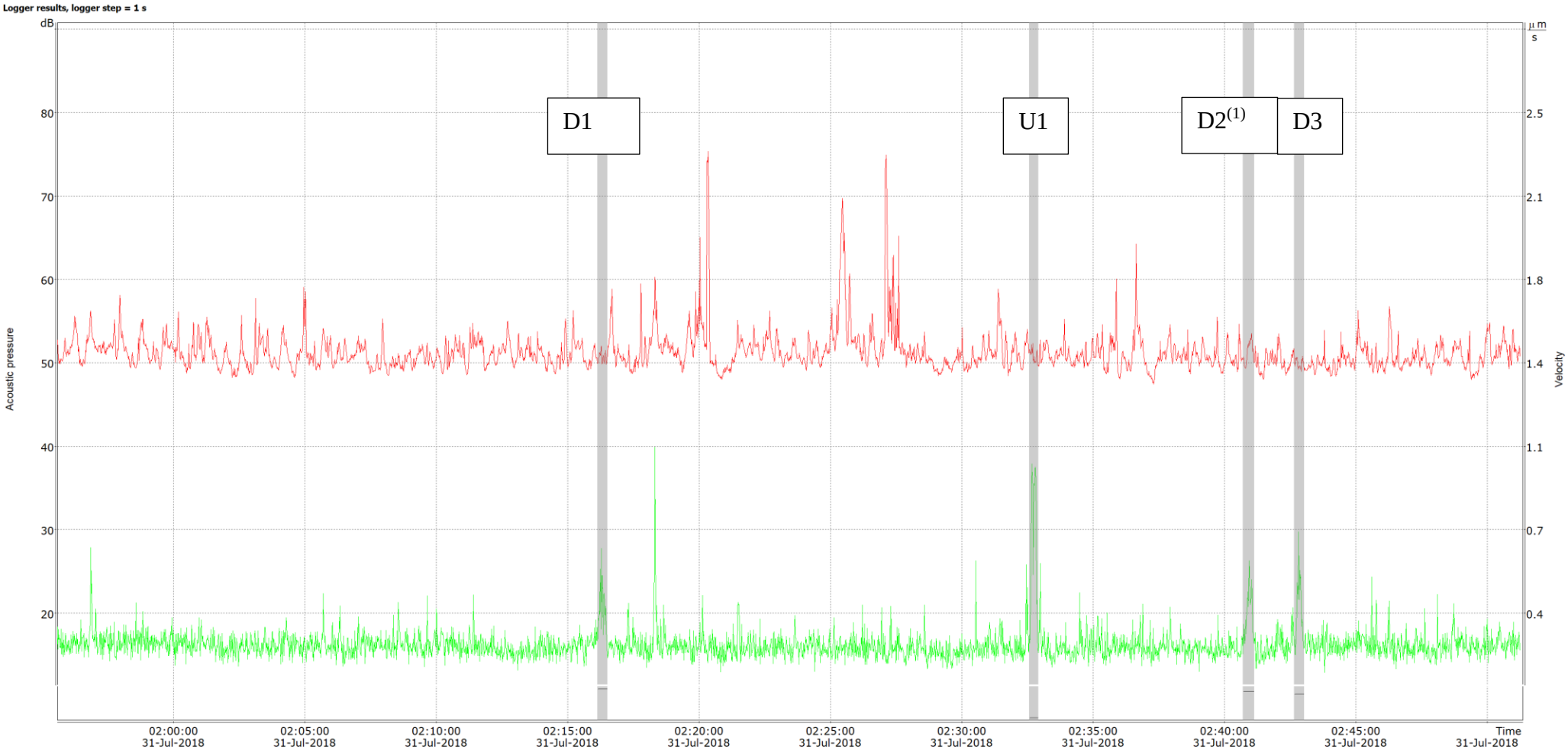
(1) Measurement was conducted inside the building and thus there is no correction of buidling coupling factor (BCF).

(2) G/F of HOM-1-1 is the lowest noise sensitive floor, and thus no floor-to-floor attenuation was applied to the measurement result.

(3) As there is no sensitive use at HOM-1-1 during night-time period, only daytime/evening predicted noise level is presented.

Noise and Vibration Time History of Train Passby

Measurement Location: HUH-1-3, 1/F



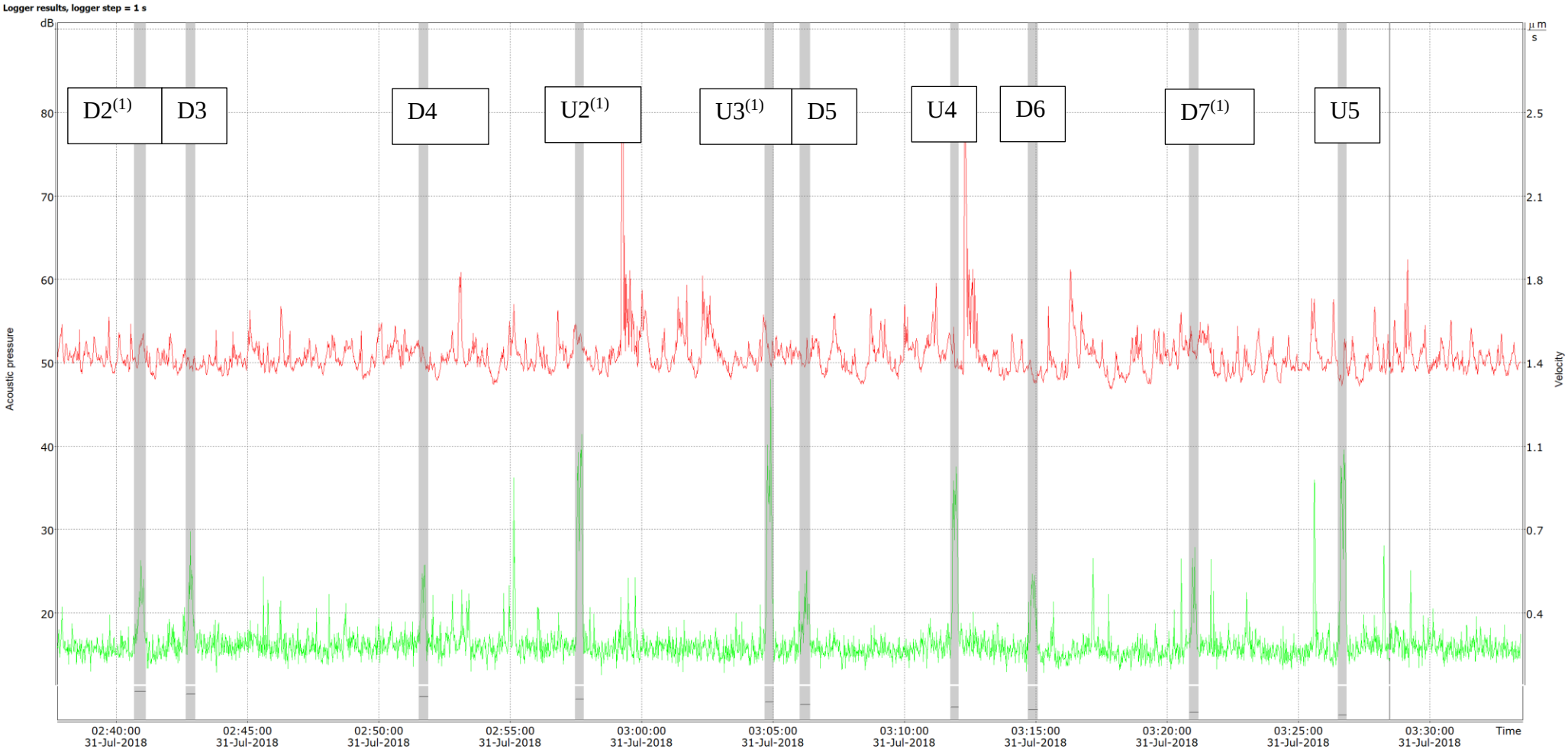
Note:

(1) Based on site observation, event passby D2 was affected by traffic noise, thus the result was discarded.

Legend:

——: Vibration level at 40Hz, μm/s

——: Overall noise level, dB(A)



Note:

(1) Based on site observation, event passby D2, U2, U3 and D7 were affected by traffic noise, thus the result was discarded.

Legend:

: Vibration level at 40Hz, µm/s

: Overall noise level, dB(A)

Typical Train Passby

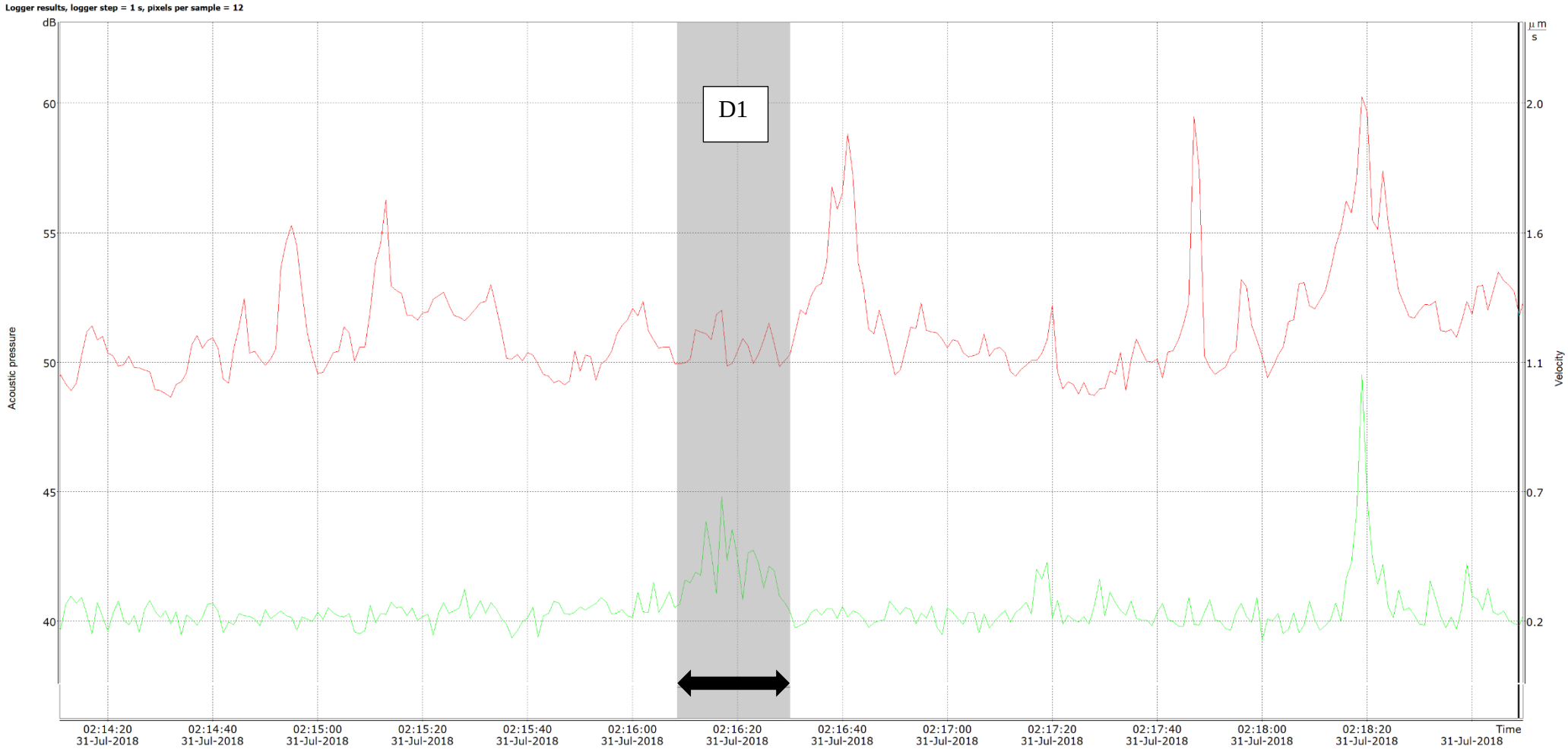
Measurement Location: HUH-1-3, 1/F

Legend:

: Vibration level at 40Hz, µm/s

: Overall noise level, dB(A)

: Train Passby



Legend:

: Vibration level at 40Hz, µm/s

: Train Passby

: Overall noise level, dB(A)

Appendix D Ground-borne Noise Measurement Results and Detailed Calculation (Without Background Correction)

Measurement Location: **Wing Fung Building (HUH-1-3), 1/F**
Measurement Date and Time: **31/7/2018 02:00 to 04:00**

GBNSR	Train&Direction	Train Type [1]	Passby No.	Measured Event[2] Leq, dB(A) [A]	Background Noise Level, dB(A) [B]	[A] - [B], dB(A)	Event Duration, s	Correction for Event Duration, dB(A)	SEL[3], dB(A)	Averaged SEL, dB(A)
HUH-1-3	Uptrack	8 car SP-1900	U1	50.8	49.9	0.9	18	12.6	63.4	63.1
		8 car CRC	U4	50.9	49.8	1.1	18	12.6	63.5	
		8 car SP-1900	U5	49.9	49.5	0.4	18	12.6	62.5	
	Downtrack	8 car SP-1900	D1	50.7	50.5	0.2	22	13.4	64.1	63.5
		8 car CRC	D3	50.0	49.8	0.2	22	13.4	63.4	
		8 car CRC	D4	50.5	50.2	0.3	22	13.4	63.9	
		8 car SP-1900	D5	50.4	49.1	1.3	22	13.4	63.8	
		8 car CRC	D6	48.7	48.6	0.1	22	13.4	62.1	

Notes:

(1) The train type, which is in equivalent noise performance, adopted for the commissioning test is the same as the train type for future operation.

(2) Event duration includes the head-tail time period.

(3) As a conservative approach, the measured event noise levels without background correction were adopted to determine the SEL.

Prediction of Groundborne Railway Noise Level During Daytime/Evening Time Period

GBNSR	Train & Direction	Averaged SEL, dB(A)	Time Period	Train Frequency per 30mins	Correction for Train Frequency, dB(A)	Conversion Factor to LAeq 30mins, dB(A)	BCF Correction[1]	Att_{floor} Correction[2]	LAeq 30mins, dB(A)
HUH-1-3	Uptrack	63.1	Daytime & Evening (0700-2300)	12	10.8	-32.6	0.0	0.0	41.3
	Downtrack	63.5		12	10.8	-32.6	0.0	0.0	41.7
								Predicted Noise Level, LAeq 30mins, dB(A)	**<45**
								GBN Criterion, dB(A)	**55**
								Compliance	**Yes**

Notes:

(1) Measurement was conducted inside the building and thus there is no correction of buidling coupling factor (BCF).

(2) 1/F of HUH-1-3 is the lowest noise sensitive floor, and thus no floor-to-floor attenuation was applied to the measurement result.

Prediction of Groundborne Railway Noise Level During Night-time Period

GBNSR	Train & Direction	Averaged SEL, dB(A)	Time Period	Train Frequency per 30mins	Correction for Train Frequency, dB(A)	Conversion Factor to LAeq 30mins, dB(A)	BCF Correction[1]	Att_{floor} Correction[2]	LAeq 30mins, dB(A)
HUH-1-3	Uptrack	63.1	Night-time (2300-0700)	6	7.8	-32.6	0.0	0.0	38.3
	Downtrack	63.5		6	7.8	-32.6	0.0	0.0	38.7
								Predicted Noise Level, LAeq 30mins, dB(A)	**<42**
								GBN Criterion, dB(A)	**45**
								Compliance	**Yes**

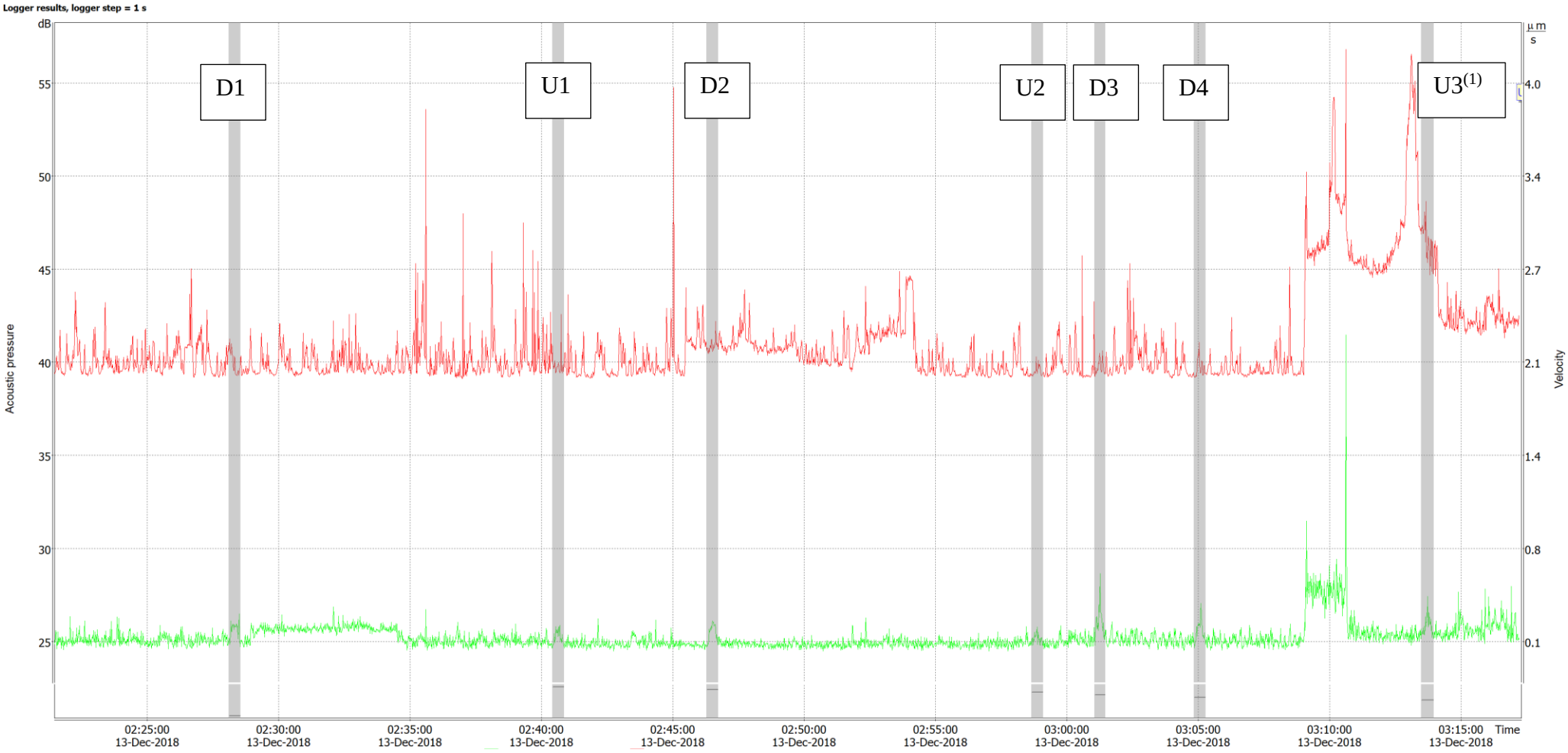
Notes:

(1) Measurement was conducted inside the building and thus there is no correction of buidling coupling factor (BCF).

(2) 1/F of HUH-1-3 is the lowest noise sensitive floor, and thus no floor-to-floor attenuation was applied to the measurement result.

Noise and Vibration Time History of Train Passby

Measurement Location: DIH-11-1, 1/F



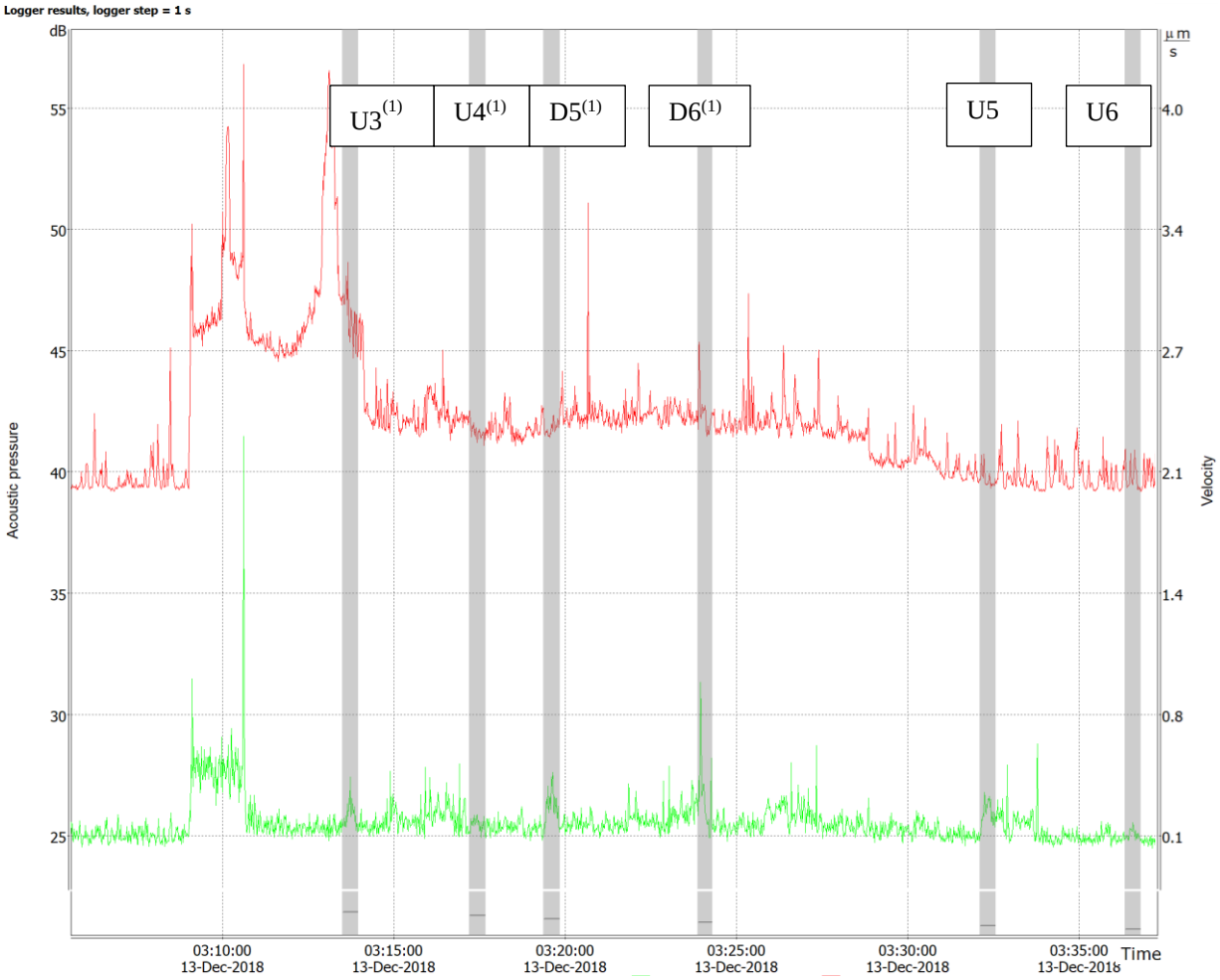
Note:

(1) Based on site observation, event passby U3 was affected by mechanical noise, thus the result was discarded.

Legend:

———: Vibration level at 50Hz, µm/s

———: Overall noise level, dB(A)



Note:

(1) Based on site observation, event passby U3, U4, D5 & D6 was affected by mechanical noise, thus the result was discarded.

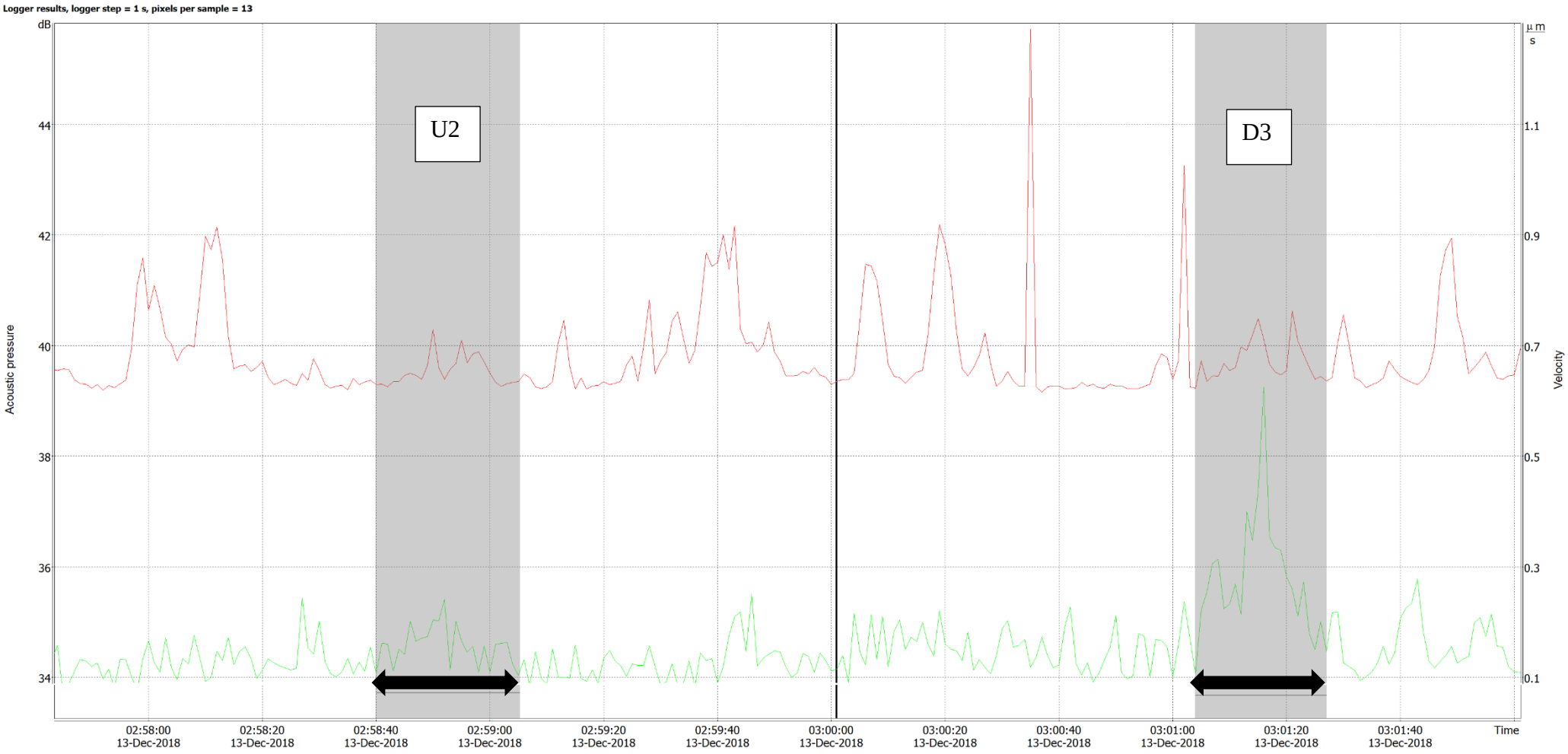
Legend:

———: Vibration level at 50Hz, µm/s

———: Overall noise level, dB(A)

Typical Train Passby

Measurement Location: DIH-11-1, 1/F



Legend:

: Vibration level at 50Hz, µm/s

: Overall noise level, dB(A)

: Train Passby

Appendix D Ground-borne Noise Measurement Results and Detailed Calculation (Without Background Correction)

Measurement Location: **Lung Wan House (DIH-11-1), 1/F**
Measurement Date and Time: **13/12/2018 02:00 to 04:00**

GBNSR	Train&Direction	Train Type [1]	Passby No.	Measured Event[2] Leq, dB(A) [A]	Background Noise Level, dB(A) [B]	[A] - [B], dB(A)	Event Duration, s	Correction for Event Duration, dB(A)	SEL[3], dB(A)	Averaged SEL, dB(A)
DIH-11-1	Uptrack	8 car SP-1900	U1	39.8	39.6	0.2	27	14.3	54.1	54.0
		8 car SP-1900	U2	39.5	39.4	0.1	27	14.3	53.8	
		8 car SP-1900	U5	39.7	39.5	0.2	27	14.3	54.0	
		8 car CRC	U6	39.7	39.5	0.2	27	14.3	54.0	
	Downtrack	8 car SP-1900	D1	39.9	39.5	0.4	26	14.1	54.0	54.3
		8 car SP-1900	D2	40.9	39.6	1.3	26	14.1	55.0	
		8 car SP-1900	D3	39.8	39.7	0.1	26	14.1	53.9	
		8 car CRC	D4	39.7	39.4	0.3	26	14.1	53.8	

Notes:

(1) The train type, which is in equivalent noise performance, adopted for the commissioning test is the same as the train type for future operation.

(2) Event duration includes the head-tail time period.

(3) As a conservative approach, the measured event noise levels without background correction were adopted to determine the SEL.

Prediction of Groundborne Railway Noise Level During Daytime/Evening Time Period

GBNSR	Train & Direction	Averaged SEL, dB(A)	Time Period	Train Frequency per 30mins	Correction for Train Frequency, dB(A)	Conversion Factor to LAeq 30mins, dB(A)	BCF Correction[1]	Att_{floor} Correction[2]	LAeq 30mins, dB(A)
DIH-11-1	Uptrack	54.0	Daytime & Evening (0700-2300)	12	10.8	-32.6	0.0	0.0	32.2
	Downtrack	54.3		12	10.8	-32.6	0.0	0.0	32.5
								Predicted Noise Level, LAeq 30mins, dB(A)	**<35**
								GBN Criterion, dB(A)	**55**
								Compliance	**Yes**

Notes:

(1) Measurement was conducted inside the building and thus there is no correction of buidling coupling factor (BCF).

(2) 1/F of DIH-11-1 is the lowest noise sensitive floor, and thus no floor-to-floor attenuation was applied to the measurement result.

Prediction of Groundborne Railway Noise Level During Night-time Period

GBNSR	Train & Direction	Averaged SEL, dB(A)	Time Period	Train Frequency per 30mins	Correction for Train Frequency, dB(A)	Conversion Factor to LAeq 30mins, dB(A)	BCF Correction[1]	Att_{floor} Correction[2]	LAeq 30mins, dB(A)
DIH-11-1	Uptrack	54.0	Night-time (2300-0700)	6	7.8	-32.6	0.0	0.0	29.2
	Downtrack	54.3		6	7.8	-32.6	0.0	0.0	29.5
								Predicted Noise Level, LAeq 30mins, dB(A)	**<32**
								GBN Criterion, dB(A)	**45**
								Compliance	**Yes**

Notes:

(1) Measurement was conducted inside the building and thus there is no correction of buidling coupling factor (BCF).

(2) 1/F of DIH-11-1 is the lowest noise sensitive floor, and thus no floor-to-floor attenuation was applied to the measurement result.

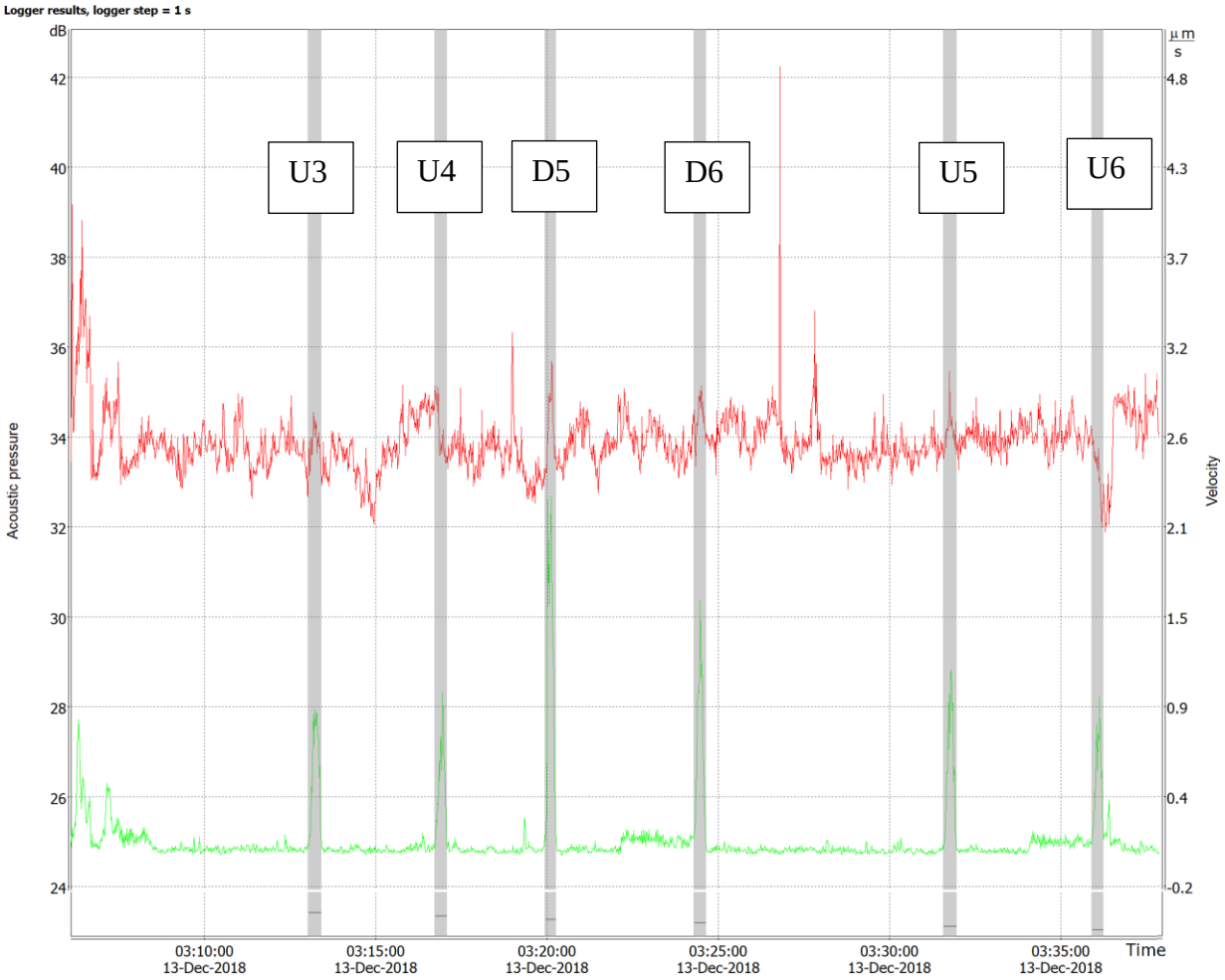
Noise and Vibration Time History of Train Passby

Measurement Location: DIH-6-1, 1/F

Legend:

: Vibration level at 50Hz, µm/s

: Overall noise level, dB(A)



Legend:

———: Vibration level at 50Hz, µm/s

———: Overall noise level, dB(A)

Typical Train Passby

Measurement Location: DIH-6-1, 1/F

Legend:

: Vibration level at 50Hz, µm/s

: Train Passby

: Overall noise level, dB(A)

Appendix D Ground-borne Noise Measurement Results and Detailed Calculation (Without Background Correction)

Measurement Location: **Wong Tai Sin Fire Service Department Quarters (DIH-6-1), 1/F**
Measurement Date and Time: **13/12/2018 02:00 to 04:00**

GBNSR	Train&Direction	Train Type [1]	Passby No.	Measured Event[2] Leq, dB(A) [A]	Background Noise Level, dB(A) [B]	[A] - [B], dB(A)	Event Duration, s	Correction for Event Duration, dB(A)	SEL[3], dB(A)	Averaged SEL, dB(A)
DIH-6-1	Uptrack	8 car SP-1900	U1	34.3	32.9	1.4	22	13.4	47.7	47.4
		8 car SP-1900	U2	34.0	33.8	0.2	22	13.4	47.4	
		8 car SP-1900	U3	33.9	33.6	0.3	22	13.4	47.3	
		8 car CRC	U4	34.1	33.0	1.1	22	13.4	47.5	
		8 car SP-1900	U5	34.2	33.6	0.6	22	13.4	47.6	
		8 car CRC	U6	33.2	32.7	0.5	22	13.4	46.6	
	Downtrack	8 car SP-1900	D1	33.5	32.7	0.8	21	13.2	46.7	47.5
		8 car SP-1900	D2	34.2	33.8	0.4	21	13.2	47.4	
		8 car SP-1900	D3	34.5	33.8	0.7	21	13.2	47.7	
		8 car CRC	D4	34.4	33.8	0.6	21	13.2	47.6	
		8 car SP-1900	D5	34.4	33.7	0.7	21	13.2	47.6	
		8 car CRC	D6	34.4	34.0	0.4	21	13.2	47.6	

Notes:

(1) The train type, which is in equivalent noise performance, adopted for the commissioning test is the same as the train type for future operation.

(2) Event duration includes the head-tail time period.

(3) As a conservative approach, the measured event noise levels without background correction were adopted to determine the SEL.

Prediction of Groundborne Railway Noise Level During Daytime/Evening Time Period

GBNSR	Train & Direction	Averaged SEL, dB(A)	Time Period	Train Frequency per 30mins	Correction for Train Frequency, dB(A)	Conversion Factor to LAeq 30mins, dB(A)	BCF Correction[1]	Att_{floor} Correction[2]	LAeq 30mins, dB(A)
DIH-6-1	Uptrack	47.4	Daytime & Evening (0700-2300)	12	10.8	-32.6	0.0	0.0	25.6
	Downtrack	47.5		12	10.8	-32.6	0.0	0.0	25.7
								Predicted Noise Level, LAeq 30mins, dB(A)	**<29**
								GBN Criterion, dB(A)	**55**
								Compliance	**Yes**

Notes:

(1) Measurement was conducted inside the building and thus there is no correction of buidling coupling factor (BCF).

(2) 1/F of DIH-6-1 is the lowest noise sensitive floor, and thus no floor-to-floor attenuation was applied to the measurement result.

Prediction of Groundborne Railway Noise Level During Night-time Period

GBNSR	Train & Direction	Averaged SEL, dB(A)	Time Period	Train Frequency per 30mins	Correction for Train Frequency, dB(A)	Conversion Factor to LAeq 30mins, dB(A)	BCF Correction[1]	Att_{floor} Correction[2]	LAeq 30mins, dB(A)
DIH-6-1	Uptrack	47.4	Night-time (2300-0700)	6	7.8	-32.6	0.0	0.0	22.6
	Downtrack	47.5		6	7.8	-32.6	0.0	0.0	22.7
								Predicted Noise Level, LAeq 30mins, dB(A)	**<26**
								GBN Criterion, dB(A)	**45**
								Compliance	**Yes**

Notes:

(1) Measurement was conducted inside the building and thus there is no correction of buidling coupling factor (BCF).

(2) 1/F of DIH-6-1 is the lowest noise sensitive floor, and thus no floor-to-floor attenuation was applied to the measurement result.