

Ocean Park Corporation, Hong Kong

Repositioning and Long Term
Operation Plan of Ocean Park:
*Noise Mitigation and Audit Report for
Phase 3*

August 2014

Environmental Resources Management

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Ocean Park Corporation, Hong Kong

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Operation Plan of Ocean Park:
*Noise Mitigation and Audit Report for
Phase 3*

August 2014

Reference 0238176

For and on behalf of ERM-Hong Kong, Limited
Approved by: <u>Frank Wan</u>
Signed: <u></u>
Position: <u>Partner</u>
Date: <u>28 August 2014</u>

This report has been prepared by ERM-Hong Kong, Limited with all reasonable skill, care and diligence within the terms of the Contract with the client, incorporating our General Terms and Conditions of Business and taking account of the resources devoted to it by agreement with the client.

We disclaim any responsibility to the client and others in respect of any matters outside the scope of the above.

This report is confidential to the client and we accept no responsibility of whatsoever nature to third parties to whom this report, or any part thereof, is made known. Any such party relies on the report at their own risk.

Ocean Park Master Redevelopment Project

Environmental Permit No. EP-249/2006/D - Condition 2.26

**Noise Mitigation and Audit Report for the Operation of the
Facilities and Venues for Special Events**

Submitted by ERM-Hong Kong, Limited dated 28-08-2014

This is to verify that

**Noise Mitigation and Audit Report for the Operation of the
Facilities and Venues for Special Events**

Submitted by ERM-Hong Kong, Limited

dated 28-08-2014

Has been verified by the undersigned.

Signed



Ir Eric Ching
Independent Environmental Checker (IEC)
Retained by Ocean Park Corporation
pursuant to Environmental Permit No. EP-249/2006/D

Date

29 August 2014

Ocean Park Master Redevelopment Project

EP-249/2006/D - Condition 2.26

Noise Mitigation and Audit Report for the Operation of the Facilities and Venues for Special Events

August 2014



Certified by _____ **on 28 August-2014**
Winnie Ko (ETL)

Verified by Independent Environmental Checker on 28 August 2014
IEC Certificate attached in the submission? Yes

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1 INTRODUCTION

1.1 BACKGROUND

Following the approval of the Repositioning and Long Term Operation Plan of Ocean Park (the Project) Environmental Impact Assessment (EIA) report (Register No.: AEIAR-101/2006) (hereafter referred to as the approved EIA Report), an Environmental Permit (EP) (EP-249/2006) was granted for the Project in July 2006 and amendments to the EP were approved in October 2006, November 2010 and December 2013. To update the opening hours of the Ocean Park (the Park) and the layout plans for the Waterfront and Summit, an application for Variation of EP (VEP) was submitted to the EPD and new EP (EP-249/2006/D) was issued on 2 July 2014.

In accordance with Condition 2.26 of the EP-249/2006/D, the Permit Holder shall deposit with the Director four hard copies and one electric copy of Noise Mitigation and Audit Report (NMAR), no later than two weeks after the completion of noise measurement and audit works are carried out. The Permit Holder shall carry out noise measurement and audit works according to the Noise Mitigation and Audit Plan(s) (NMAP) and submit a *Report on Commissioning Test Results* to the Director for approval, prior to the implementation of the specified periods of the proposed extension of opening hours.

1.2 PURPOSES OF THIS REPORT

If the results of the commissioning test demonstrate that the mitigation measures have achieved the required Sound Power Levels (SWLs), the extension of the opening hours will be implemented in three phases, as follows:

- Phase 1 - extension of the opening hours of the Park from 10:00 to 09:00 hours and from 22:00 to 23:00 hours (excluding the Sky Fair Plaza Performance Venue and attractions for special events);
- Phase 2 - extension of the opening hours of the Park during Special Events to 01:00 hours and extension of opening hours of Restaurants and Retail Shops from 09:00 to 08:00 hours and from 23:00 to 02:00 hours of the next day (excluding the Sky Fair Plaza Performance Venue); and
- Phase 3 - operation of the Sky Fair Plaza Performance Venue (*Figure 1.1*).

This NMAR presents the proposed noise measurement result for the commissioning test for Phase 3 in accordance with Condition 2.31 of the EP-249/2006/D.



SITE LOCATION PLAN (1:5000)

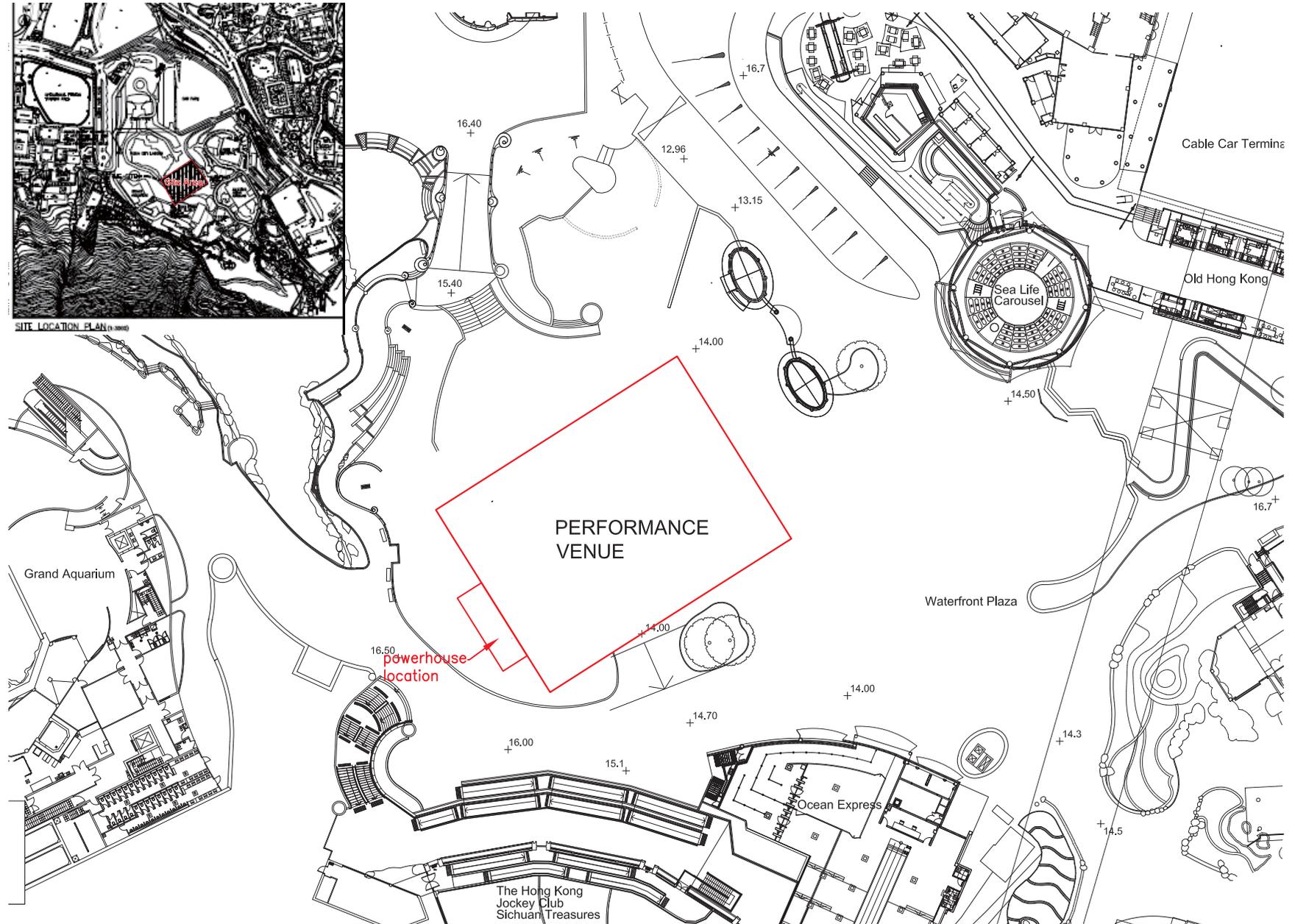


Figure 1.1

Location of Sky Fair Plaza Performance Venue

2 **COMMISSIONING REQUIREMENTS AND MEASUREMENT METHODOLOGY**

2.1 **COMMISSIONING REQUIREMENTS**

The Commissioning Requirements and the operational control for the Sky Fair Plaza Performance Venue during different time periods are given in *Table 2.1*.

Table 2.1 Commissioning Requirements and Operational Control

Item	Commissioning Requirements	Operational Control
Sky Fair Plaza Performance Venue	09:00 – 23:00 hrs - Not During Lagoon show:	
	Total SWL of the venue will not exceed 95dB(A).	Total SWL of the venue will not exceed 95dB(A).
	09:00 – 23:00 hrs - During Lagoon Show:	
	Total SWL of the venue will not exceed 90dB(A).	No Show, ie closed ^[a]
	During 23:00 – 01:00 hrs:	
	Total SWL of the venue will not exceed 85dB(A).	No Show, ie closed ^[a]
	During 01:00 – 02:00 hrs:	
	Closed	No Show, ie closed ^[a]
Note:		
[a] As confirmed by OPC, there will be no show at the Sky Fair Plaza Performance Venue during lagoon show and after 23:00 hrs.		

2.2 **NOISE SOURCES OF THE VENUE AND MEASUREMENT LOCATIONS**

Shows and performance activities will be held inside the Sky Fair Plaza Performance Venue (the venue). The potential noise sources include the loudspeaker system and noise from visitors inside the venue, two sets of chillers with three sets of associated water pumps, two sets of Air Handling Units (AHUs) and 2 split-type AC units.

The venue is fully enclosed by fixed wall, operable walls and roof constructed with acoustic panel, acoustic doors for side doors, sealed windows, and main entrance with double doors. Details of noise source identified, mitigation measure implemented, noise insulation performances of the mitigation measures and dimensions of noise sources are presented in the *Table 2.2* of the NMAP for Phase 3.

With consideration of the venue is constructed by propriety high noise insulation materials with gap sealing technique, the potential noise leakage locations are identified at the main entrance, two fresh air intakes from the AHU’s silencers, air intake of the chillers through the acoustic louver and exhaust of the chillers through the silencers. The sound power level of the venue is calculated by summation of the all sound power levels (SWL) of the

noise leakage locations and fixed plant items. Measurement locations are shown in *Annex A*.

2.3 COMMISSIONING NOISE MEASUREMENT METHODOLOGY

2.3.1 *Determination of the SWL of the Venue*

During noise measurement, sound tracks of show music and visitor noise was played by the loudspeaker system with the volume settings equivalent to the future operation. Volume of the loudspeaker will be controlled by a signal processor named "The Soundweb London BLU-160" which is scalable audio "Processing Objects" that can offer real-time control of parameters (see *Annex O* of the NMAP).

5-minutes A-weighted equivalent continuous noise level ($L_{Aeq, 5min}$) was measured at the main entrance. The measurement distance was 5m from the main entrance. For each measurement location, three sets of measurement data were taken.

In consideration that the main entrance will be used for visitors and/or crews for getting in/out the venue during the show, five scenarios of noise measurements were conducted at this location:

- With both doors closed;
- With 4 outer acoustic door leaves closed and two inner curtain doors opened;
- With 2 outer acoustic door leaves (the left door when viewing from outside) opened and two inner curtain doors closed;
- With 2 outer acoustic door leaves (right door when viewing from outside) opened and two inner curtain doors closed; and
- With both doors (inner and outer doors) open with low volume setting of the background music (for a scenario loading in and out the guests before and after the stage show).

All side doors, other than the main entrance doors, were closed during the noise measurement. Windows are all double-glazed and well-sealed, ie will not be opened at all time.

2.3.2 *Determination of the SWL of the Chillers and Water Pumps*

Two chillers and three associated water pumps are located inside the noise enclosure with provision of the acoustic louvre for air intake and two silencers for exhaust. Only one water pump is required to support the operation of a chiller. At most 2 water pumps will be operated simultaneously while the other one is a standby unit and water pumps are always operating with chillers. For each measurement location, three sets of measurement data were taken. Noise level was measured for each chiller and SWL of each chiller is determined individually.

2.3.3 *Determination of the SWL of the AHUs*

Noise measurement for AHUs was measured for each fresh air intake which has been installed with silencers. For each measurement location, three sets of measurement data were taken. SWL of each AHU is determined individually.

2.3.4 *Determination of the SWL of the Split-type AC unit*

Noise measurement for split-type AC units was carried out for each unit. For each measurement location, three sets of measurement data were taken. SWL of each split-type AC unit is determined individually.

2.3.5 *Measurement of Background Noise*

The background noise was measured in terms of $L_{Aeq, (1 \text{ min})}$ at the each measurement point with loudspeaker system, chillers and its associated water pumps, AHUs and the split-type AC units switching off. At each location, one set of background noise data was taken. If any abnormal intrusive noise exists during background noise measurement, the measurement data will be discarded. The measured noise levels are subject to background noise correction in accordance with standard acoustical principles.

2.3.6 *Comparison against Commissioning Requirement*

The SWL of the venue is calculated by summation of the all SWL of the noise leakage area. The total SWL should not exceed the commissioning requirement as given in *Table 2.1*. All noise measurement was supervised and endorsed by a qualified person possessing at least seven years of noise control experience and a corporate membership of Hong Kong Institute of Acoustics or equivalent.

The instruments that were used for the noise measurements comply with International Electrotechnical Commission Publications 651:1979 (Type 1) and 804:1985 (Type 1).

Before and after each series of measurements, a sound calibrator was applied to each microphone to verify the calibration of the measuring system. The difference between the readings made before and after each series of measurements shall be less than or equal to 0.5 dB. If this value is exceeded, the results of this series of measurements shall be discarded.

The sound calibrator is calibrated at intervals not exceeding 1 year and the compliance of the sound level meters with the requirements of IEC 61672-1 verified at intervals not exceeding 2 years. Sound level meters and calibrators used are listed in the *Table 3.1*. The equipment calibration certificates are shown in *Annex B*. For the above-mentioned requirement, reference was made to the approved EM&A plan for other theme park (ie Section 5.3 of EM&A Plan (Revision H) prepared under EP-01/059/2000/C⁽¹⁾) and relevant ISO standard (ie ISO 3746-2010, Section 5.2, 3rd paragraph).

Table 3.1 *Noise Measurement Equipment*

Equipment	Model	Serial Number
Sound Level Meter	01dB - Solo	65225
	01dB - Solo	65226
Calibrator	Svantek SV30A	No.7971
	01dB - CAL 21	No.34113609(2011)

The measurement parameter was set to A-weighted sound pressure level and the time weighting was set in fast response.

⁽¹⁾ <http://www.epd.gov.hk/eia/register/english/permit/vep3782012/documents/emarp/pdf/emarp.pdf>

4 MEASUREMENT RESULTS

4.1 MEASUREMENT DETAILS

Noise measurement was carried out by Isaac Chu, Samuel Lee, Ian Yuen and supervised by Mandy To from ERM-Hong Kong Limited on 12 and 13 August 2014. Noise measurement results are presented in the below sections.

Measurement parameter and measurement distance for each noise leakage location and fixed plant item followed the NMAP for Phase 3.

Table 4.1a *Noise Measurement Details*

Measurement Item	Before Calibration, dB(A)	After Calibration, dB(A)
Split type AC units and fresh air intake for AHUs	93.9	93.9
Venue music at main entrance, chillers and associated water pumps	93.9	93.9

4.2 MEASURED NOISE LEVELS AT THE MAIN ENTRANCE

The locations of measurement are shown in *Annex A1*. Measured noise levels and the calculated SWLs are summarized in *Tables 4.2a* and *4.2b*.

Table 4.2a *Noise Measurement Results for the Venue at the Main Entrance*

Scenario	Measurement Point	Measured Noise Levels, $L_{eq,5\ min}$ dB(A)			Highest Level, dB(A)	B/G noise level, dB(A)	B/G corrected noise level, dB(A)
		1	2	3			
Scenario 1	Point 1	56.2	54.5	55.1	56.2	48.8	55.3
	Point 2	56.4	54.6	55.7	56.4	48.3	55.7
Scenario 2	Point 1	54.8	56.3	55.7	56.3	48.5	55.5
	Point 2	55.6	55.0	55.5	55.6	48.2	54.7
Scenario 3	Point 1	60.4	60.1	60.9	60.9	48.7	60.6
Scenario 4	Point 2	61.3	58.7	58.4	61.3	48.2	61.1
Scenario 5	Point 1	51.9	51.8	50.4	51.9	48.5	49.2
	Point 2	50.8	51.1	50.4	51.1	47.9	48.3

Table 4.2b Sound Power Level of the Noise Leakage Location at the Main Entrance

Scenario	Measurement Point	B/G corrected noise level, dB(A)	Measurement distance to the center of the main entrance, m	SWL, dB(A)
Scenario 1	Point 1	55.3	5	77.3
	Point 2	55.7	5	77.7
Total for Scenario 1:				80.5
Scenario 2	Point 1	55.5	5	77.5
	Point 2	54.7	5	76.7
Total for Scenario 2:				80.1
Scenario 3	Point 1	60.6	5	82.6
Scenario 4	Point 2	61.1	5	83.1
Scenario 5	Point 1	49.2	5	71.2
	Point 2	48.3	5	70.3
Total for Scenario 5:				73.8

The highest SWL of 83.1dB(A) is obtained from Scenario 4. To represent the worst case scenario, SWL of 83.1 dB(A) is adopted in the noise calculation.

4.3 MEASURED NOISE LEVELS FOR THE CHILLERS AND WATER PUMPS

The locations of measurement are shown in Annex A2. Measured noise levels and calculated SWL are summarized in Tables 4.3a and 4.3b.

Table 4.3a Noise Measurement Results for Chiller Air Intake and Exhaust Silencers

Fixed Plant Item	Measurement Point	Measured Noise Levels, $L_{eq,1min}$, dB(A)			Highest Level, dB(A)	B/G noise level, dB(A)	B/G corrected noise level, dB(A)
		1	2	3			
Chiller 1 and 1 associated Water Pump	Point 1	57.4	57.7	57.6	57.7	54.4	55.0
	Point 2	66.6	66.7	66.5	66.7	54.7	66.4
Chiller 2 and 1 associated Water Pump	Point 3	59.4	58.4	58.7	59.4	53.1	58.2
	Point 4	66.3	66.3	66.3	66.3	54.1	66.0
3 water pumps only ^(a)	Point 4	54.8	54.3	55.0	55.0	54.4	- (b)
	Point 5	53.3	53.4	53.8	53.8	53.5	- (b)

Notes:

- (a) In real operation, the water pumps will always be operated with the chillers. The water pumps were switched on with chillers switched off for the purpose of noise measurement only.
- (b) The differences between the near field noise levels measured with and without the operation of the 3 water pumps are less than 1dB(A). Based on this, the water pumps are not considered as a major noise source with the provision of acoustic louvre and silencers.

Table 4.3b Sound Power Level of Chiller Air Intake and Exhaust Silencers

Fixed Plant Item	Measurement Point	B/G corrected noise level, dB(A)	Measurement distance to the center, m	SWL, dB(A)
Chiller 1 and 1 associated Water Pump	Point 1	55.0	6	78.6
	Point 2	66.4	2	80.4
			Total:	82.6
Chiller 2 and 1 associated Water Pump	Point 3	58.2	6	81.8
	Point 4	66.0	2	80.0
			Total:	84.0

4.4 MEASURED NOISE LEVELS FOR THE AHUS

The locations of measurement are shown in Annex A3. Measured noise levels and calculated SWL are summarized in Tables 4.4a and 4.4b.

Table 4.4a Noise Measurement Results for Fresh Air Intakes of AHU

Fixed Plant Item	Measurement Point	Measured Noise Levels, Highest Level, dB(A)			B/G noise level, dB(A)	B/G corrected noise level, dB(A)	
		$L_{eq, 1 min}$, dB(A)	1	2			3
Fresh air intake 1	Point 1	63.1	62.7	62.7	63.1	46.3	63.0
Fresh air intake 2	Point 2	62.9	63.5	63.8	63.8	45.1	63.7

Table 4.4b Sound Power Level of Fresh Air Intakes of AHU

Fixed Plant Item	Measurement Point	B/G corrected noise level, dB(A)	Measurement distance to the center, m	SWL, dB(A)
Fresh air intake 1	Point 1	63.0	2	77.0
Fresh air intake 2	Point 2	63.7	2	77.7

4.5 MEASURED NOISE LEVELS FOR THE SPLIT-TYPE AC UNITS

The locations of measurement are shown in Annex A4. Measured noise levels and calculated SWL are summarized in Tables 4.5a and 4.5b.

Table 4.5a Noise Measurement Results for Split-type AC units

Fixed Plant Item	Measurement Point	Measured Noise Levels, $L_{eq, 1 min}$, dB(A)			Highest Level, dB(A)	B/G noise level, dB(A)	B/G corrected noise level, dB(A)
		1	2	3			
Split-type AC unit 1	Point 1	56.4	54.5	54.5	56.4	43.9	56.1
Split-type AC unit 2	Point 2	56.5	56.0	54.9	56.5	44.9	56.2

Table 4.5b Sound Power Level of Split-type AC units

Fixed Plant Item	Measurement Point	B/G corrected noise level, dB(A)	Measurement distance to the center, m	SWL, dB(A)
Split-type AC unit 1	Point 1	56.1	2.5	72.1

Fixed Plant Item	Measurement Point	B/G corrected noise level, dB(A)	Measurement distance to the center, m	SWL, dB(A)
Split-type AC unit 2	Point 2	56.2	2.5	72.2

4.6 TOTAL SWL AND COMPARISON AGAINST COMMISSIONING REQUIREMENT

The total SWL of the venue is calculated by summation of the SWL from all noise leakage location and fixed plant items, as presented in the *Table 4.6*.

Table 4.6 *Total SWL of the Sky Fair Plaza Performance Venue*

Noise leakage area/Fixed Plant Item	SWL, dB(A)
Main entrance (Worst case scenario: Scenario 4)	83.1
Chiller 1 and 1 associated Water Pump	82.6
Chiller 2 and 1 associated Water Pump	84.0
Fresh air intake 1	77.0
Fresh air intake 2	77.7
Split-type AC unit 1	72.1
Split-type AC unit 2	72.2
Total SWL: 89	
Commissioning requirement (09:00–23:00hrs Not During Lagoon Show): 95	
Compliance Yes	

CONCLUSION

Noise measurements have been conducted based on the commissioning requirements given in *Table 2.2* of the NMAP for Phase 3 deposited in accordance with Condition 2.25 of the EP-249/2006/D. Results of noise measurements indicated that the design and performance of the noise mitigation measures implemented complies with the maximum SWL determined in the VEP application document (VEP-438/2014). All measures implemented will be properly operated and maintained during the operation for Phase 3.

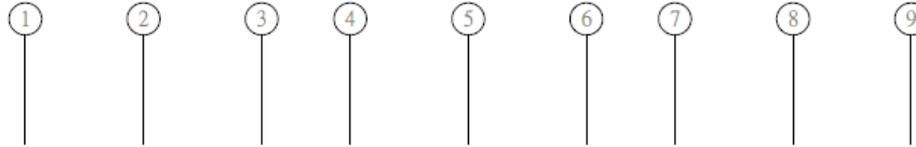
Annex A

Measurement locations for
the Sky Fair Plaza
Performance Venue

Key



Noise measurement Point



NOTIONAL
BOUNDARY LINE

ROOF TOP LEV.
10.00

METAL CLADDING
11.00

12.00

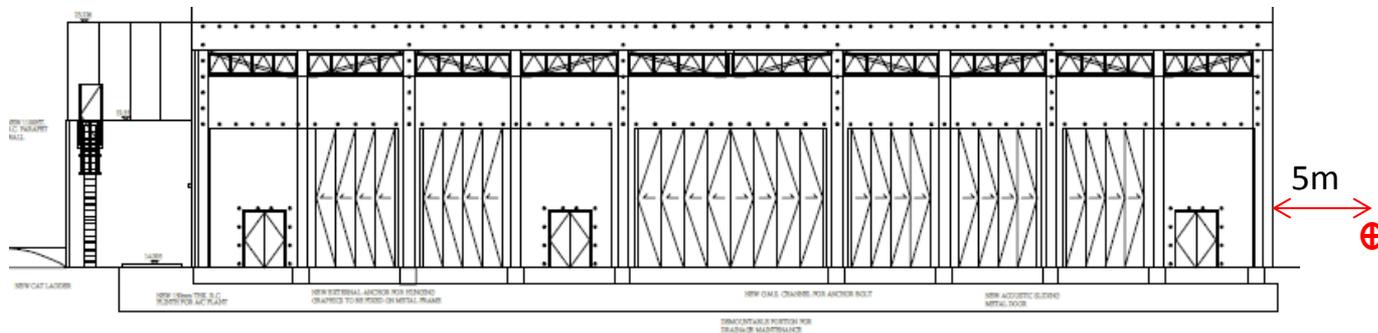
13.00

NEW ALLUMINIUM WINDOW

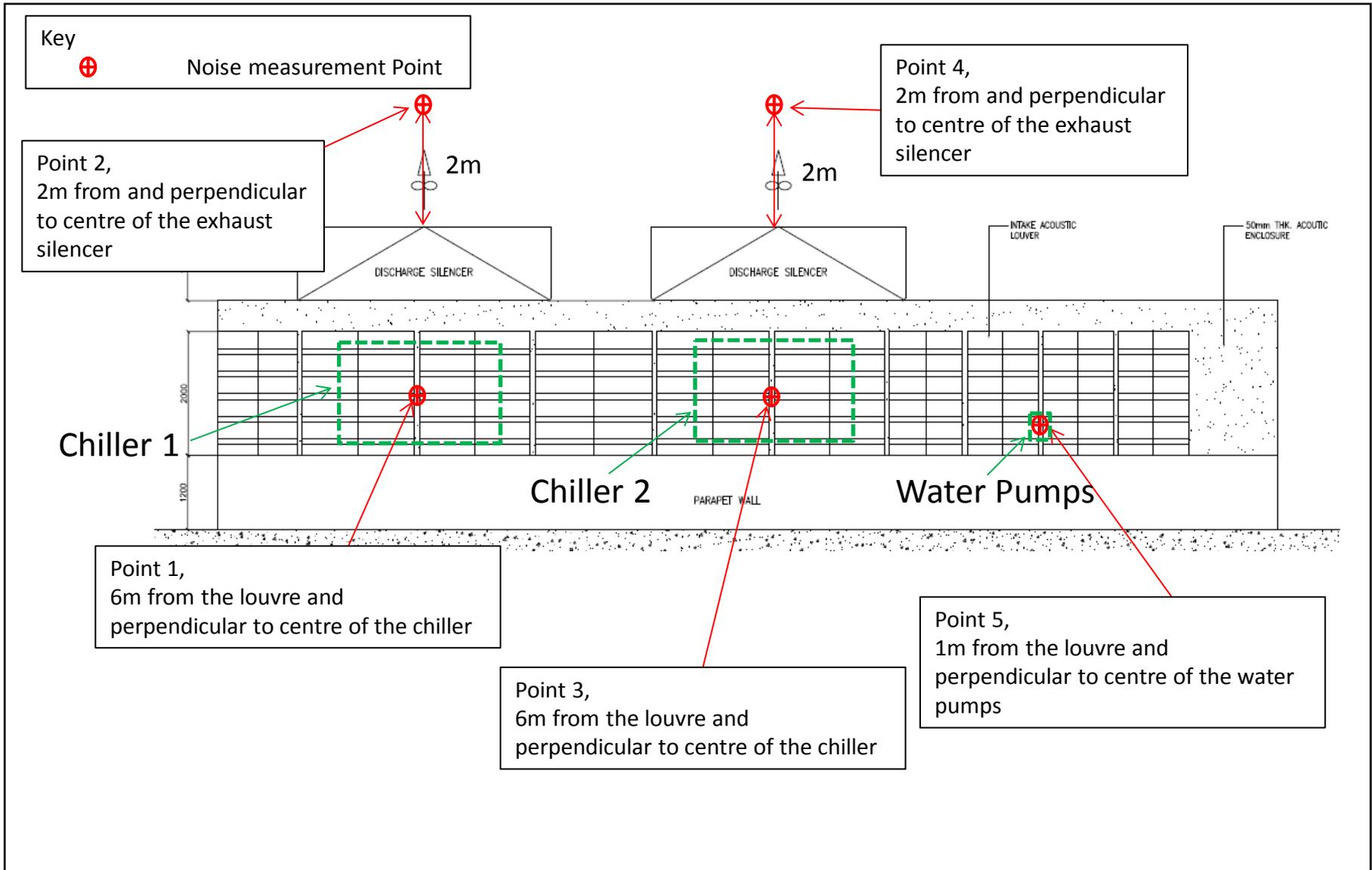
NEW METAL CLADDING

Point 1
5m from and perpendicular to
centre of the outer door

Point 2
5m from and perpendicular to
centre of the outer door



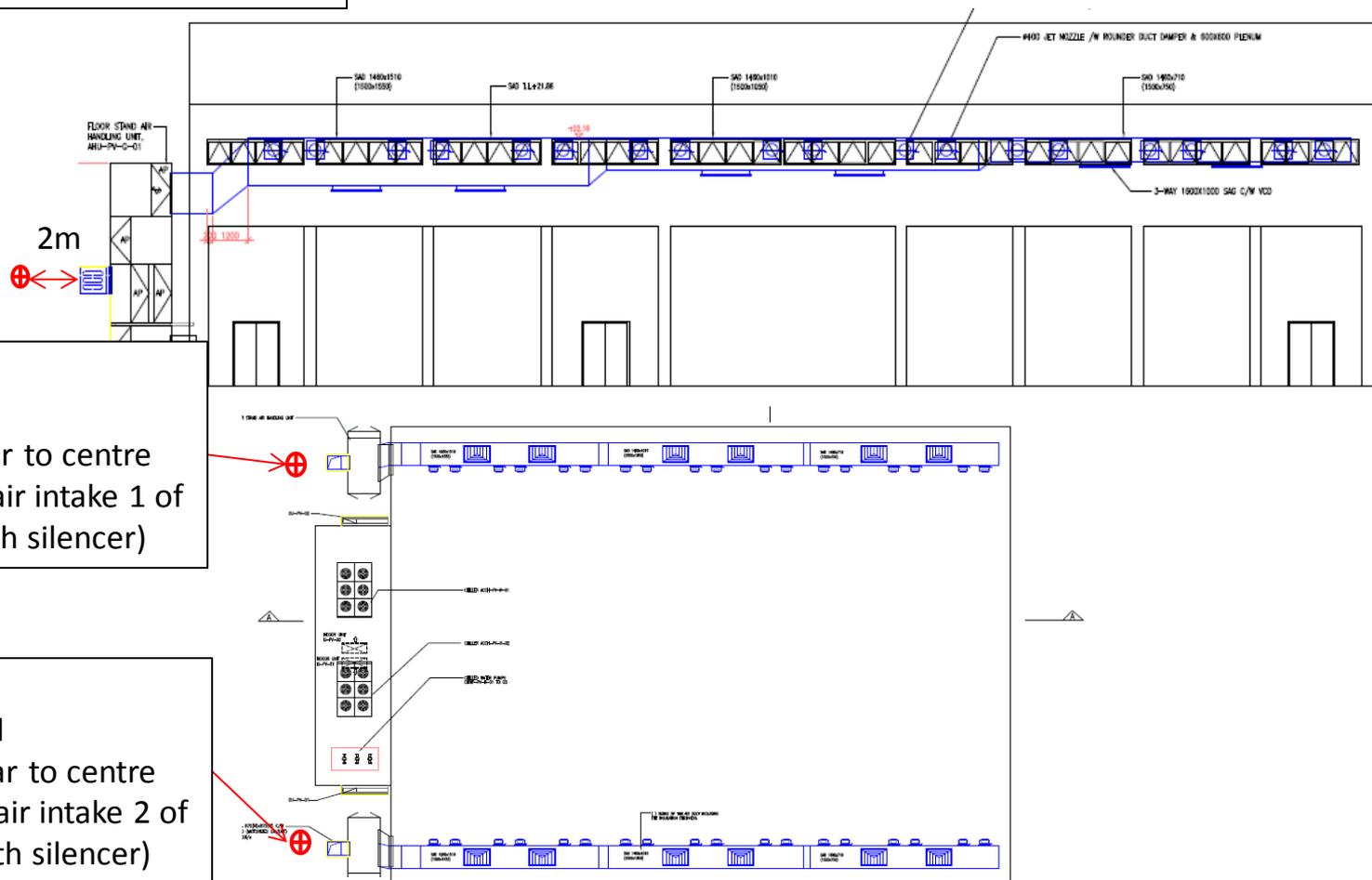
5m
⊕



Key



Noise measurement Point



Point 1,
2m from and
perpendicular to centre
of the fresh air intake 1 of
the AHU (with silencer)

Point 2,
2m from and
perpendicular to centre
of the fresh air intake 2 of
the AHU (with silencer)

Figure A3

Measurement location at the fresh air intake of the AHUs

DATE: 15/08/2014

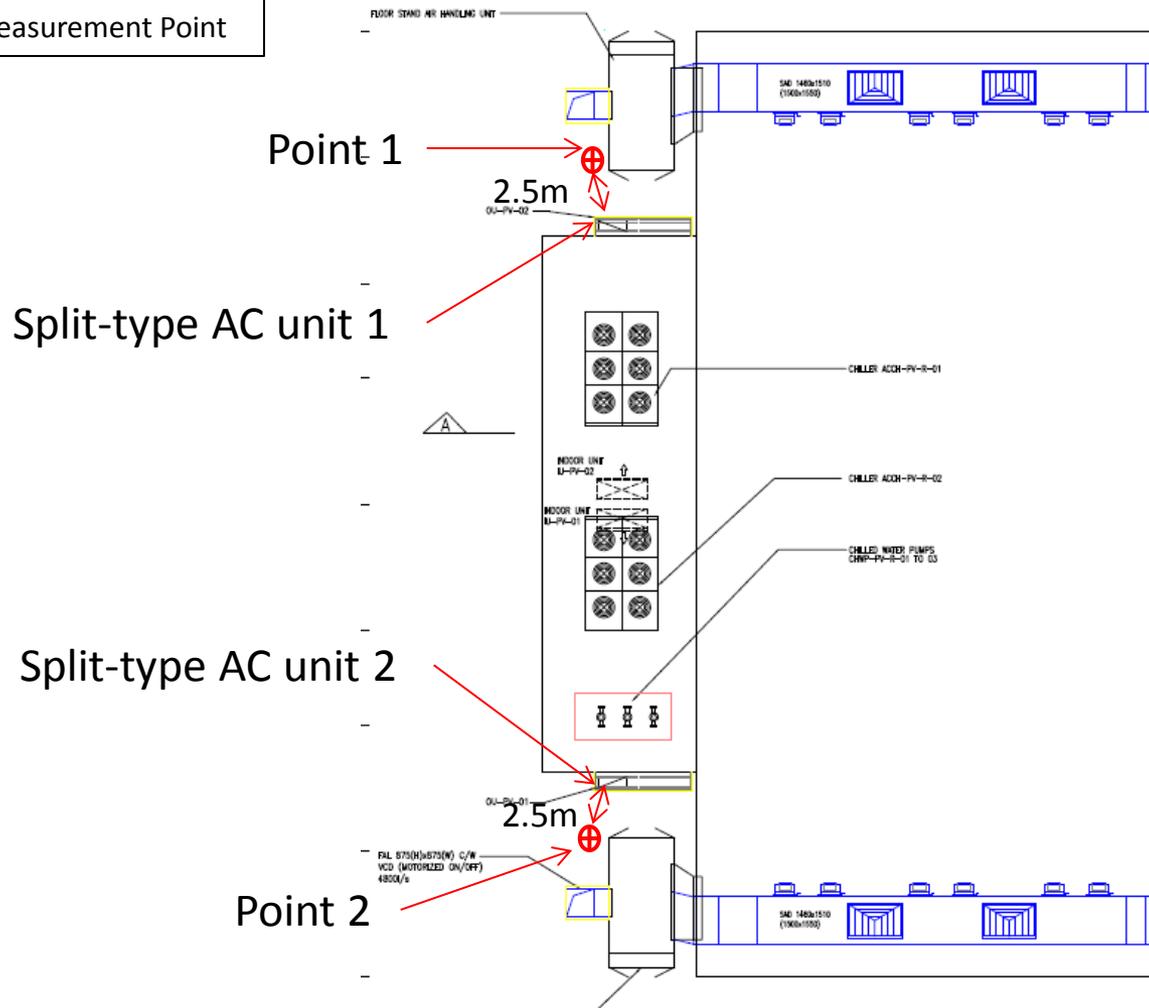
Environmental
Resources
Management



Key



Noise measurement Point



Annex B

Calibration Certificates



Calibration Certificate

Certificate No. **404229**

Page 1 of 2 Pages

Customer : Environmental Resources Management

Address : 16/F DCH Commercial Centre 25 Westlands Road Quarry Bay Hong Kong

Order No. : Q41594

Date of receipt : 20-Jun-14

Item Tested

Description : Sound Level Calibrator

Manufacturer : Svantek

Model : SV30A

Serial No. : 7971

Test Conditions

Date of Test : 23-Jun-14

Supply Voltage : --

Ambient Temperature : (23 ± 3)°C

Relative Humidity : (50 ± 25) %

Test Specifications

Calibration check.

Ref. Document/Procedure : F21, Z02.

Test Results

All results were within the IEC 942 Class 1 specification.

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

Main Test equipment used:

<u>Equipment No.</u>	<u>Description</u>	<u>Cert. No.</u>	<u>Traceable to</u>
S014	Spectrum Analyzer	35730	NIM-PRC & SCL-HKSAR
S205	Ref. Sound Level Calibrator	PHCO40002	SCL-HKSAR
S041	Universal Counter	34621	SCL-HKSAR
S206	Sound Level Meter	36203	SCL-HKSAR

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

The test equipment used for calibration are traceable to International System of Units (SI).

The test results apply to the above Unit-Under-Test only

Calibrated by : 
Dorothy Cheuk

Approved by : 
Steve Kwan

Date: 23-Jun-14

This Certificate is issued by:
Hong Kong Calibration Ltd
Unit 8B, 24/F., Well Fung Industrial Centre, No. 58-76, Ta Chuen Ping Street, Kwai Chung, NT, Hong Kong.
Tel: 2425 8801 Fax: 2425 8646



Calibration Certificate

Certificate No. **404229**

Page 2 of 2 Pages

Results :

1. Level Accuracy

UUT Nominal Value (dB)	Measured Value (dB)	IEC 942 Class 1 Spec.
94	94.15	± 0.3 dB
114	114.17	

Uncertainty : ± 0.2 dB

2. Frequency

UUT Nominal Value	Measured Value	IEC 942 Class 1 Spec.
1 kHz	1.000 kHz	± 2 %

Uncertainty : ± 3.6 x 10⁻⁶

3. Level Stability : 0.0 dB

IEC 942 Class 1 Spec. : ± 0.1 dB

Uncertainty : ± 0.01 dB

4. Total Harmonic Distortion : < 0.8 %

IEC 942 Class 1 Spec. : < 3 %

Uncertainty : ± 2.3 % of reading

Remark : 1. UUT : Unit-Under-Test

2. The above measured values are the mean of 3 measurements.

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

4. Atmospheric Pressure : 991 hPa.

----- END -----



Calibration Certificate

Certificate No. 404228

Page 1 of 2 Pages

Customer : Environmental Resources Management

Address : 16/F DCH Commercial Centre 25 Westlands Road Quarry Bay Hong Kong

Order No. : Q41594

Date of receipt : 20-Jun-14

Item Tested

Description : Sound Level Calibrator

Manufacturer : 01dB-Stell

Model : CAL21

Serial No. : 34113609(2011)

Test Conditions

Date of Test : 23-Jun-14

Supply Voltage : --

Ambient Temperature : (23 ± 3)°C

Relative Humidity : (50 ± 25) %

Test Specifications

Calibration check.

Calibration procedure : Z02, IEC 942.

Test Results

All results were within the IEC 942 Class 2 specification.

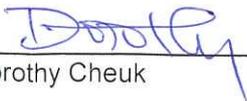
The results are shown in the attached page(s).

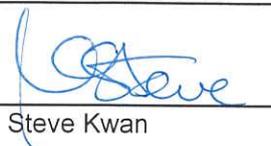
Main Test equipment used:

<u>Equipment No.</u>	<u>Description</u>	<u>Cert. No.</u>	<u>Traceable to</u>
S205	Ref. Sound Level Calibrator	PHCO40002	SCL-HKSAR
S041	Universal Counter	34621	SCL-HKSAR
S206	Sound Level Meter	36203	SCL-HKSAR

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

The test equipment used for calibration are traceable to International System of Units (SI).
The test results apply to the above Unit-Under-Test only

Calibrated by : 
Dorothy Cheuk

Approved by : 
Steve Kwan

Date: 23-Jun-14

This Certificate is issued by:
Hong Kong Calibration Ltd.

Unit 8B, 24/F., Well Fung Industrial Centre, No. 58-76, Ta Chuen Ping Street, Kwai Chung, NT, Hong Kong.
Tel: 2425 8801 Fax: 2425 8646



Calibration Certificate

Certificate No. 404228

Page 2 of 2 Pages

Results :

1. Level Accuracy

UUT Nominal Value (dB)	Measured Value (dB)	IEC 942 Class 1 Spec.
94	93.98	± 0.3 dB

Uncertainty : ± 0.2 dB

2. Frequency

UUT Nominal Value	Measured Value	IEC 942 Class 1 Spec.
1 kHz	1.008 kHz	± 2 %

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

3. Level Stability : 0.0 dB

IEC 942 Class 1 Spec. : ± 0.1 dB

Uncertainty : ± 0.1 dB

4. Total Harmonic Distortion : < 1.6 %

IEC 942 Class 1 Spec. : < 3 %

Uncertainty : ± 2.3 % of reading

Remark : 1. UUT : Unit-Under-Test

2. The above measured values are the mean of 3 measurement.

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

4. Atmospheric Pressure : 991 hPa.

----- END -----



Calibration Certificate

Certificate No. **32987**

Page 1 of 3 Pages

Customer : Environmental Resources Management

Address : 21/F, Lincoln House, 979 King's Road, Taikoo Place, Island East, Hong Kong.

Order No. : Q31162

Date of receipt : 3-May-13

Item Tested

Description : Sound Level Meter

Manufacturer : Solo

Model : 01dB

Serial No. : 65226

Test Conditions

Date of Test : 21-May-13

Supply Voltage : --

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

Relative Humidity : $(50 \pm 25) \%$

Test Specifications

Calibration check.

Calibration procedure : Z01.

Test Results

All results were within the IEC 651 Type1, IEC 804 Type1 and IEC 1260 Class1 specification.

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

Test equipment used:

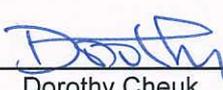
<u>Equipment No.</u>	<u>Description</u>	<u>Cert. No.</u>	<u>Traceable to</u>
S017	Multi-Function Generator	C127181	SCL-HKSAR
S024	Sound Level Calibrator	30620	NIM-PRC & SCL-HKSAR

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

The test equipment used for calibration are traceable to International System of Units (SI).

The test results apply to the above Unit-Under-Test only

Calibrated by : 
Liam Wong

Approved by : 
Dorothy Cheuk

Date: 21-May-13



Calibration Certificate

Certificate No. **32987**

Page 2 of 4 Pages

Results :

1. Accuracy Check

UUT Setting			Applied Value (dB)	UUT Reading (dB)
Range (dB)	Response	Weighting		
20 - 140	Fast	L _A	94.0	93.8
	Slow			93.8
	Fast	L _C		93.9
	Slow			93.9
	Fast	L _A	114.0	113.9
	Slow			113.9
	Fast	L _C		113.9
	Slow			113.9

IEC 651 Type 1 Spec. : ± 0.7 dB

Uncertainty : ± 0.1 dB

2. Level Stability : 0.0 dB

IEC 651 Type 1 Spec. : ± 0.3 dB

Uncertainty : ± 0.1 dB

3. Linearity

Differential level linearity

UUT Range	Applied Value (dB)	UUT Reading (dB)	Variation (dB)	IEC 651 Type 1 Spec.
140	84.0	83.8	0.0	± 0.4 dB
	94.0	93.8 (Ref.)	--	
	95.0	94.8	0.0	± 0.2 dB

Uncertainty : ± 0.1 dB



Calibration Certificate

Certificate No. 32987

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4. Frequency Weighting

A weighting

Frequency	Attenuation (dB)	IEC 651 Type 1 Spec.
31.5 Hz	-39.5	- 39.4 dB, ± 1.5 dB
63 Hz	-26.1	- 26.2 dB, ± 1.5 dB
125 Hz	-16.1	- 16.1 dB, ± 1 dB
250 Hz	-8.6	- 8.6 dB, ± 1 dB
500 Hz	-3.3	- 3.2 dB, ± 1 dB
1 kHz	0.0 (Ref.)	0 dB, ± 1 dB
2 kHz	+1.2	+ 1.2 dB, ± 1 dB
4 kHz	+0.8	+ 1.0 dB, ± 1 dB
8 kHz	-1.8	- 1.1 dB, + 1.5 dB \sim - 3 dB
16 kHz	-12.1	- 6.6 dB, + 3 dB \sim ∞

Uncertainty : ± 0.1 dB

5. Time Averaging

Applied Burst duty Factor	Applied Leq Value (dB)	UUT Reading (dB)	IEC 804 Type 1 Spec.
continuous	40.0	--	--
1/10	40.0	40.0	± 0.5 dB
1/10 ²	40.0	39.9	± 1.0 dB
1/10 ³	40.0	39.9	
1/10 ⁴	40.0	39.9	

Uncertainty : ± 0.1 dB



Calibration Certificate

Certificate No. 32987

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6. Filter Characteristics

6.1 1/1 – Octave Filter

Frequency	Attenuation (dB)	IEC 1260 Class 1 (dB)
125 Hz	-74.8	< - 61
250 Hz	-55.0	< - 42
500 Hz	-24.4	< - 17.5
707 Hz	-3.0	- 2 ~ - 5
1 kHz (Ref)	--	--
1.414 kHz	-2.8	- 2 ~ - 5
2 kHz	-48.3	< - 17.5
4 kHz	-88.6	< - 42
8 kHz	-89.0	< - 61

Uncertainty : ± 0.25 dB

6.2 1/3 – Octave Filter

Frequency	Attenuation (dB)	IEC 1260 Class 1 (dB)
326 Hz	-68.4	< - 61
530 Hz	-58.4	< - 42
772 Hz	-28.4	< - 17.5
891 Hz	-3.5	+ 0.3 ~ - 5.0
1 kHz (Ref)	--	--
1.122 kHz	-3.7	+ 0.3 ~ - 5.0
1.296 kHz	-31.5	< - 17.5
1.887 kHz	-66.5	< - 42
3.070 kHz	-90.0	< - 61

Uncertainty : ± 0.25 dB

- Remarks :
1. UUT : Unit-Under-Test
 2. The uncertainty claimed is for a confidence probability of not less than 95%.
 3. Atmospheric Pressure : 996 hPa.

----- END -----



Calibration Certificate

Certificate No. **34249**

Page 1 of 3 Pages

Customer : Environmental Resources Management

Address : 21/F, Lincoln House, 979 King's Road, Taikoo Place, Island East, Hong Kong.

Order No. : Q31652

Date of receipt : 24-Jun-13

Item Tested

Description : Sound Level Meter

Manufacturer : Solo

Model : 01dB

Serial No. : 65225

Test Conditions

Date of Test : 5-Jul-13

Supply Voltage : --

Ambient Temperature : (23 ± 3)°C

Relative Humidity : (50 ± 25) %

Test Specifications

Calibration check.

Calibration procedure : Z01.

Test Results

All results were within the IEC 651 Type1, IEC 804 Type1 and IEC 1260 Class1 specification.

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

Test equipment used:

<u>Equipment No.</u>	<u>Description</u>	<u>Cert. No.</u>	<u>Traceable to</u>
S017	Multi-Function Generator	C127181	SCL-HKSAR
S024	Sound Level Calibrator	30620	NIM-PRC & SCL-HKSAR

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

The test equipment used for calibration are traceable to International System of Units (SI).
The test results apply to the above Unit-Under-Test only

Calibrated by : 
Liam Wong

Approved by : 
Dorothy Cheuk

Date: 5-Jul-13



Calibration Certificate

Certificate No. 34249

Page 2 of 4 Pages

Results :

1. SPL Accuracy

Level Range	UUT Setting			Applied Value (dB)	UUT Reading (dB)	
	Octave Filter	Weight	Time Const.			
20 – 140 dB	OFF	A	Fast	94.0	93.7	
			Slow		93.7	
		C	Fast		93.7	
		ON (1/1)	--		Fast	93.7
		ON (1/3)	--		Fast	93.7
		OFF	A		Fast	114.0
			Slow	113.7		
		C	Fast	113.7		
	ON (1/1)	--	Fast	113.7		
	ON (1/3)	--	Fast	113.7		

IEC 651 Type 1 Spec. : ± 0.7 dB

Uncertainty : ± 0.2 dB

2. Level Stability : 0.0 dB

IEC 651 Type 1 Spec. : ± 0.3 dB

Uncertainty : ± 0.1 dB

3. Linearity

UUT Range (dB)	Applied Value (dB)	UUT Reading (dB)	Variation (dB)	IEC 651 Type 1 Spec.
20 – 140 dB	84.0	83.8	+0.1	± 0.4 dB
	94.0	93.7 (Ref.)	--	
	95.0	94.7	0.0	± 0.2 dB



Calibration Certificate

Certificate No. 34249

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4. Frequency Weighting

A weighting

Frequency	Attenuation (dB)	IEC 651 Type 1 Spec.
31.5 Hz	-39.2	- 39.4 dB, ± 1.5 dB
63 Hz	-25.9	- 26.2 dB, ± 1.5 dB
125 Hz	-16.0	- 16.1 dB, ± 1 dB
250 Hz	-8.5	- 8.6 dB, ± 1 dB
500 Hz	-3.1	- 3.2 dB, ± 1 dB
1 kHz	0.0 (Ref.)	0 dB, ± 1 dB
2 kHz	+1.2	+ 1.2 dB, ± 1 dB
4 kHz	+0.9	+ 1.0 dB, ± 1 dB
8 kHz	-1.7	- 1.1 dB, + 1.5 dB ~ - 3 dB
16 kHz	-12.1	- 6.6 dB, + 3 dB ~ - ∞

Uncertainty : ± 0.1 dB

5. Time Averaging

Applied Burst duty Factor	Applied Leq Value (dB)	UUT Reading (dB)	IEC 804 Type 1 Spec.
continuous	40.0	40.0	--
1/10	40.0	40.0	± 0.5 dB
1/10 ²	40.0	40.0	
1/10 ³	40.0	40.0	± 1.0 dB
1/10 ⁴	40.0	40.0	

Uncertainty : ± 0.1 dB



Calibration Certificate

Certificate No. 34249

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6. Filter Characteristics

6.1 1/1 – Octave Filter

Frequency	Attenuation (dB)	IEC 1260 Class 1 (dB)
125 Hz	-74.4	< - 61
250 Hz	-55.0	< - 42
500 Hz	-24.4	< - 17.5
707 Hz	-3.0	- 2 ~ - 5
1 kHz (Ref)	--	--
1.414 kHz	-2.8	- 2 ~ - 5
2 kHz	-18.3	< - 17.5
4 kHz	-83.6	< - 42
8 kHz	-84.5	< - 61

Uncertainty : ± 0.25 dB

6.2 1/3 – Octave Filter

Frequency	Attenuation (dB)	IEC 1260 Class 1 (dB)
326 Hz	-69.1	< - 61
530 Hz	-59.8	< - 42
772 Hz	-28.4	< - 17.5
891 Hz	-3.4	+ 0.3 ~ - 5.0
1 kHz (Ref)	--	--
1.122 kHz	-3.7	+ 0.3 ~ - 5.0
1.296 kHz	-31.5	< - 17.5
1.887 kHz	-66.8	< - 42
3.070 kHz	-80.7	< - 61

Uncertainty : ± 0.25 dB

Remark : 1. UUT : Unit-Under-Test

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

3. Atmospheric Pressure : 1001 hPa.

----- END -----