Test Report

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University of Salford MANCHESTER

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Determination of airborne noise from an appliance

Measurements described in this test report comply with:-

BS EN ISO 3744:2010 'Acoustics. Determination of sound power levels and sound energy levels of noise sources using sound pressure. Engineering methods for an essentially free field over a reflecting plane'

COMPANY NAME & ADDRESS:	Chauvet UK POD 1 EVO Park Nottingham NG16 6NT
FOR ATTENTION OF:	Ben Virgo
UNIT UNDER TEST:	Lighting Unit, Storm 1 Hybrid
DATE OF TEST:	5th March 2024
TEST ENGINEER:	Sean Furlong
MEASUREMENT PURPOSE:	To determine airborne noise by measurements to the above standards.

Results relate only to samples tested. Items tested are the samples supplied by the manufacturer, who was responsible for selecting at random from a standard production run.

1.0 Description of Appliance Under Test

CATEGORY:	Lighting Unit
DESIGN CHARACTERISTICS:	Floor mounted
MANUFACTURER:	Chauvet
MODEL:	Storm 1 Hybrid
TEST REF NUMBERS:	06681/04_1 to 2
SERIAL NUMBER:	Not Stated
POWER:	Not Stated
POWER SOURCE:	UK Mains
SETTINGS: **See Table 1.0 below for explanation of settings*	06681/04_1 "Ambient" 06681/04_2 "Max"

** Table 1.0 – Explanation of the "Settings" used to create the Test Configuration of the sample for each measurement.*

Explanation of Settings Used for Each Test	
Setting Name	Test Configuration
Ambient	Unit is in idle state, switched on and no output or movements
Max	Unit is using all mechanical options and the light output is on

2.0 Test Conditions

2.1 The following conditions were measured over duration of the test:-

	Measured Average Value
TEST REF NUMBER:	**06681/04_1 to 2**
SERIAL NO. / SAMPLE REF.	Storm 1 Hybrid
Atmospheric Pressure	100.595
Ambient Temperature	22.6
Ambient Relative Humidity	33.8

2.2 The test was carried out in the hemi-anechoic chamber at the University of Salford.

2.3 The unit under test was mounted directly on the floor, in the centre of the hemi-anechoic chamber.

2.4 Unit operation was controlled by the client from outside the chamber, after initial configuration directly at the unit. Measurements were taken immediately after each setting of the unit was set and confirmed by the client.

2.5 For measurement of the sound pressure level of the Reference Sound Source (RSS), the RSS was placed directly on the floor of the hemi-anechoic chamber at the same location as the unit under test as defined in BS EN ISO 3744: 2010.

Figure 1 – unit under test mounted in the hemi-anechoic chamber at the University of Salford.

3 Acoustical Data

3.1 Measurement method

A direct measurement method was used as stated in BS EN ISO 3744: 2010.

3.2 Reference Sound Source

The Laboratory reference sound source (RSS) type B&K 4204, serial number 1460189 was used on mains supply.

3.3 Microphone Array

Ten laboratory free field, low noise microphones were used for the measurement, placed in fixed positions 1 to 10 on a hemispherical surface (d = 1.75 m) with guidance from BS EN ISO 3744: 2010. The location of each measurement position is provided in Appendix 1 to this report.

3.4 Measured sound pressure levels of the appliance

Each unit was run at the selected setting. Six measurements were made at each setting,

Mean sound pressure levels were measured over 30 seconds to give the measured sound pressure levels, L_{pi} at each measurement position in each third octave band. The sound power level was then calculated.

The background noise corrections K_1, environmental correction calculated from RSS levels K_2, measured sound pressure levels, L_{pi} at each measurement point, corrected sound pressure levels, L_{pf}, and the sound power level, L_w of the source in each third octave frequency band are given in Appendix 2 of this report. The measured time averaged sound pressure level of the RSS, $L'_{P(RSS)}$, at each microphone position is reported in Appendix 3 to this report.

3.5 Calculated sound power levels

The calculated A-Weighted sound power level, L_{WA} in dBA for each setting are given in table 3.1.

Table 3.1 –A-weighted noise emissions for each setting, averaged over 30 seconds and over 10 microphone positions.

Test Number	**06681/4_1**	**06681/4_2**
Setting	Ambient	Max
A-weighted sound power level, L_{wA} in dBA	53.4	54.6

3.6 Sound Pressure Level at 1 m from the source (not covered by BS EN 3744: 2010)

The A-weighted Sound Power Level can be used to calculate the A-weighted sound pressure level expected at different distances from the source in hemi-anechoic free field conditions*.

The calculation of the sound pressure levels is based on the formulae in BS EN 3744: 2010 for a parallelpiped measurement surface (for a noise source measured, in this case, above a single reflective plane).

The calculations show that to estimate the average sound pressure level expected at a distance of 1 m from the surface of the unit, 13.4 dB should be subtracted from the sound power value. This would give A-weighted average sound pressure levels in table 3.2 for each unit setting at 1 m from the surface of the unit:-

Table 3.2 – Calculated A-weighted sound pressure level for each setting at 1 m from the unit surface*

Test Number	**06681/4_1**	**06681/4_2**
Setting	Ambient	Max
A-weighted sound pressure level, L_p in dBA	40.0	41.2

**This calculation represents an estimate of the levels that would be obtained in hemi-anechoic free field conditions and should not be assumed to be valid for any specific building environments where the characteristics of the room should be accounted for.*

Appendix 1 – Locations of measurement positions

Defining measurement surface & Co-ordinates

Measurement distance, d 1.75 m

	x, mm	y, mm	z, mm
Microphone Position 1	280	-1680	385
Microphone Position 2	1365	-1050	350
Microphone Position 3	1365	962.5	542.5
Microphone Position 4	280	1575	717.5
Microphone Position 5	-1452.5	560	787.5
Microphone Position 6	-1452.5	-700	665
Microphone Position 7	-455	-1137.5	1242.5
Microphone Position 8	1295	-122.5	1172.5
Microphone Position 9	-455	875	1452.5
Microphone Position 10	175	-175	1732.5

Surface Area, m^2	19.24 m^2

Appendix 2 – Measurements and calculations according to BS EN ISO 3744

The following tables include measurement details that provide in each third octave band, for each of the seven settings:-

- measured L_{pi}, averaged over 30 s, at each measurement position
- background noise corrections K_1
- environmental correction K_2, calculated from RSS levels
- corrected sound pressure levels, L_{pf}
- the sound power level, L_w of the source
- the A-weighted sound power level, L_{wA} of the source

! The levels at these frequencies are affected by background level and therefore levels quoted represent an upper limit for the sound pressure levels of the noise source.

MEASURED TIME AVERAGED SPL at 1.75 m, L'P - [06681/4_1 – Ambient Setting]											Mean L_P over mic positions	ΔL_p [dB]	BG corr. K_1, [dB]	Env corr. K_2, [dB]	L_p [dB]	Sound Power, L_w [dB]	A-weighting corrections [dB]	Sound Power, L_{wA} [dB]
Frequency [Hz]	Mic 1 [dB]	Mic 2 [dB]	Mic 3 [dB]	Mic 4 [dB]	Mic 5 [dB]	Mic 6 [dB]	Mic 7 [dB]	Mic 8 [dB]	Mic 9 [dB]	Mic 10 [dB]								
100	26.0	18.0	19.2	25.3	16.3	17.6	19.8	14.8	19.5	14.8	20.9	8.1	0.72	-2.4	22.5	35.4	-19.1	16.3
125	29.3	25.8	24.7	29.1	22.2	23.9	26.1	20.9	25.7	18.2	25.7	18.9	0.00	1.1	24.6	37.4	-16.1	21.3
160	30.9	26.5	25.1	28.7	25.4	24.8	26.0	18.6	24.8	15.6	26.2	23.3	0.00	0.5	25.7	38.5	-13.4	25.1
200	31.0	28.8	28.3	28.6	26.1	28.7	26.3	21.5	24.4	17.6	27.4	31.7	0.00	1.3	26.0	38.9	-10.9	28.0
250	31.1	30.1	27.3	27.1	22.0	25.0	26.6	19.0	24.4	18.5	26.7	32.5	0.00	1.4	25.3	38.1	-8.6	29.5
315	31.4	28.6	26.7	27.8	24.5	27.2	25.5	21.2	23.1	24.0	26.9	34.8	0.00	-0.5	27.4	40.3	-6.6	33.7
400	31.8	30.6	27.5	25.7	25.0	27.5	24.5	23.5	25.1	24.1	27.5	35.7	0.00	0.6	26.8	39.7	-4.8	34.9
500	36.7	35.4	34.1	30.4	32.2	32.6	32.0	30.1	32.8	37.0	33.9	42.5	0.00	0.2	33.8	46.6	-3.2	43.4
630	33.5	32.2	30.9	30.4	30.4	29.8	32.1	30.0	33.0	36.2	32.3	41.4	0.00	-0.3	32.6	45.4	-1.9	43.5
800	29.3	28.0	28.1	27.6	28.8	26.8	27.7	31.9	29.1	27.9	28.8	37.6	0.00	-0.5	29.2	42.0	-0.8	41.2
1000	27.6	26.9	29.3	28.9	30.4	29.7	30.3	31.2	30.2	27.4	29.4	37.6	0.00	-0.9	30.3	43.2	0	43.2
1250	33.6	32.9	29.8	33.0	33.8	31.5	31.0	31.2	32.3	29.4	32.1	39.6	0.00	-0.7	32.8	45.7	0.6	46.3
1600	34.0	31.0	30.7	31.7	30.5	30.1	31.3	31.2	34.3	32.1	31.9	38.9	0.00	-0.2	32.1	45.0	1	46.0
2000	30.9	29.5	27.7	28.0	26.3	26.7	28.4	29.0	30.1	25.3	28.5	34.8	0.00	0.3	28.2	41.0	1.2	42.2
2500	30.1	31.1	27.6	27.1	25.4	28.3	28.3	29.6	29.8	24.2	28.6	34.1	0.00	-0.3	28.9	41.8	1.3	43.1
3150	23.7	24.1	24.9	25.3	25.1	23.8	26.2	23.5	26.3	22.4	24.7	29.5	0.00	0.1	24.6	37.4	1.2	38.6
4000	20.0	24.4	23.1	22.2	21.5	22.9	23.7	22.6	24.2	19.9	22.7	27.0	0.00	0.4	22.3	35.1	1	36.1
5000	18.4	16.7	19.0	17.6	17.4	18.3	19.7	17.8	20.0	14.7	18.2	22.1	0.00	-0.8	19.0	31.8	0.5	32.3
6300	14.3	16.0	18.1	15.6	15.4	14.4	14.8	14.6	17.3	10.2	15.5	19.6	0.00	-0.5	15.9	28.8	-0.1	28.7
8000	11.4	11.3	14.4	12.0	13.5	11.6	11.9	12.1	14.7	5.2	12.4	16.1	0.00	-0.2	12.6	25.4	-1.1	24.3
10000	5.9	7.6	9.5	7.9	10.2	11.4	8.8	6.5	12.0	1.2	8.9	11.7	0.31	0.1	8.5	21.4	-2.5	18.9
																	A-WEIGHTED SOUND POWER LEVEL	**53.4**

MEASURED TIME AVERAGED SPL at 1.75 m, L'P - [06681/4_2 – Max Setting]											Mean L_P over mic positions	ΔL_p [dB]	BG corr. K_1, [dB]	Env corr. K_2, [dB]	L_p [dB]	Sound Power, L_w [dB]	A-weighting corrections [dB]	Sound Power, L_{wA} [dB]
Frequency [Hz]	Mic 1 [dB]	Mic 2 [dB]	Mic 3 [dB]	Mic 4 [dB]	Mic 5 [dB]	Mic 6 [dB]	Mic 7 [dB]	Mic 8 [dB]	Mic 9 [dB]	Mic 10 [dB]								
100	21.4	20.3	19.2	18.9	20.6	20.7	19.3	21.5	19.5	21.4	20.4	7.6	0.82	-2.4	21.9	34.8	-19.1	15.7
125	24.3	24.9	24.3	23.8	24.4	24.6	24.2	25.5	23.8	25.5	24.6	17.8	0.00	1.1	23.4	36.3	-16.1	20.2
160	41.0	38.6	40.3	40.1	38.6	40.6	41.5	39.6	37.4	42.5	40.2	37.3	0.00	0.5	39.7	52.5	-13.4	39.1
200	38.7	38.2	37.2	36.1	38.0	37.6	38.0	37.8	37.2	40.0	38.0	42.3	0.00	1.3	36.7	49.5	-10.9	38.6
250	25.6	28.5	27.4	23.6	25.9	26.1	25.9	24.8	25.9	26.9	26.3	32.0	0.00	1.4	24.8	37.7	-8.6	29.1
315	29.3	30.2	27.5	26.4	27.9	27.0	26.6	28.1	26.8	26.4	27.8	35.7	0.00	-0.5	28.3	41.2	-6.6	34.6
400	28.9	29.0	28.1	26.6	26.5	27.0	27.0	27.0	26.3	27.1	27.5	35.7	0.00	0.6	26.8	39.7	-4.8	34.9
500	35.5	35.2	31.9	30.9	31.7	31.0	34.0	33.4	33.2	36.0	33.7	42.2	0.00	0.2	33.5	46.3	-3.2	43.1
630	31.8	33.3	29.4	30.3	31.6	30.5	34.1	33.5	33.2	34.7	32.6	41.6	0.00	-0.3	32.8	45.7	-1.9	43.8
800	27.9	28.8	27.9	29.9	30.4	29.8	31.0	29.9	29.7	29.5	29.6	38.5	0.00	-0.5	30.0	42.9	-0.8	42.1
1000	29.6	29.3	30.3	30.9	31.2	31.4	32.0	30.7	30.8	29.6	30.7	38.8	0.00	-0.9	31.6	44.4	0	44.4
1250	34.0	33.4	32.4	32.9	33.0	32.0	32.1	33.1	31.6	31.1	32.6	40.1	0.00	-0.7	33.4	46.2	0.6	46.8
1600	35.6	35.6	33.8	34.2	34.0	33.6	35.9	35.5	34.3	33.2	34.7	41.6	0.00	-0.2	34.9	47.7	1	48.7
2000	30.8	29.3	29.7	28.6	29.0	29.0	29.8	29.7	29.1	28.2	29.4	35.6	0.00	0.3	29.1	41.9	1.2	43.1
2500	27.9	26.8	27.7	27.0	28.1	27.5	28.6	29.1	27.8	25.6	27.7	33.2	0.00	-0.3	28.0	40.9	1.3	42.2
3150	24.1	25.0	24.8	24.8	25.1	25.1	26.0	25.9	25.4	23.7	25.0	29.9	0.00	0.1	24.9	37.8	1.2	39.0
4000	20.9	23.7	23.2	22.7	22.9	23.0	23.7	23.3	23.8	21.8	23.0	27.2	0.00	0.4	22.5	35.4	1	36.4
5000	21.3	20.2	21.2	21.4	21.4	21.5	22.5	21.7	23.2	18.1	21.4	25.4	0.00	-0.8	22.2	35.1	0.5	35.6
6300	16.4	16.7	16.0	15.3	15.6	15.4	16.3	16.1	16.8	14.7	16.0	20.1	0.00	-0.5	16.4	29.3	-0.1	29.2
8000	14.7	13.0	13.0	12.6	12.6	12.5	14.1	13.1	14.4	11.7	13.3	17.0	0.00	-0.2	13.5	26.3	-1.1	25.2
10000	11.3	10.4	11.3	11.0	11.0	11.4	11.6	10.9	12.6	7.3	11.0	13.8	0.19	0.1	10.7	23.6	-2.5	21.1
																	A-WEIGHTED SOUND POWER LEVEL	**54.6**

Appendix 3 – Measured time averaged sound pressure level of RSS, $L'_{P(RSS)}$ at each microphone position

Frequency	Mic 1	Mic 2	Mic 3	Mic 4	Mic 5	Mic 6	Mic 7	Mic 8	Mic 9	Mic 10	Average $L'_{P(RSS)}$ over microphone positions	Calculated Sound Power of RSS
[Hz]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]
100	63.7	60.7	60.1	62.6	60.5	59.3	59.1	61.7	57.7	55.2	60.6	73.5
125	65.0	65.0	63.5	64.2	64.1	64.2	62.2	64.9	62.9	56.7	63.7	76.6
160	65.8	63.9	63.9	64.0	66.1	65.5	61.8	62.7	61.2	57.9	63.8	76.7
200	65.2	66.7	66.3	63.6	66.4	66.8	61.4	64.7	60.5	56.5	64.7	77.5
250	65.6	67.7	66.6	64.1	64.2	65.0	63.5	63.3	61.5	58.7	64.6	77.5
315	64.6	65.1	64.0	62.8	63.2	63.6	61.3	62.0	60.0	60.0	63.0	75.8
400	66.4	66.2	65.9	64.9	64.4	65.3	59.9	61.9	59.2	58.8	64.1	76.9
500	67.2	66.4	65.7	63.9	63.2	64.6	59.8	60.6	59.7	60.1	64.0	76.8
630	66.4	66.8	65.7	63.2	62.0	63.7	62.1	59.7	62.7	64.0	64.1	77.0
800	66.8	68.0	65.1	61.5	60.4	62.9	65.9	62.8	66.6	67.5	65.4	78.3
1000	67.0	68.5	64.1	60.0	60.9	60.1	68.8	67.1	68.3	65.1	66.1	78.9
1250	67.4	68.2	60.9	66.7	68.0	64.8	69.3	70.8	66.8	69.4	67.9	80.7
1600	63.6	64.6	65.1	71.0	71.2	69.9	67.2	67.9	69.5	68.5	68.5	81.4
2000	65.4	61.7	69.3	71.3	70.0	70.8	69.4	67.0	68.6	65.9	68.7	81.6
2500	66.7	62.8	69.0	66.5	65.3	67.6	65.9	67.9	65.1	62.7	66.4	79.2
3150	68.1	68.3	68.0	66.8	67.7	65.6	65.3	66.7	63.9	61.0	66.6	79.4
4000	66.6	69.7	65.5	68.0	67.5	67.4	65.6	66.3	64.3	61.1	66.7	79.5
5000	64.5	64.6	66.2	66.0	65.5	65.8	64.8	65.5	63.7	58.9	64.9	77.7
6300	66.2	65.0	65.3	64.7	64.2	64.8	61.7	63.6	61.6	57.5	64.0	76.8
8000	65.3	63.0	63.3	62.7	62.7	62.9	61.7	62.4	61.4	55.6	62.6	75.4
10000	61.9	61.0	62.3	61.6	61.2	61.6	59.4	61.0	59.7	54.2	60.8	73.6