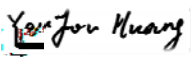
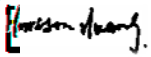


TEST REPORT EN 62471:2008 Photobiological safety of lamps and lamp systems	
Report reference No	: RSZ171228553-03
Compiled by (+ signature)	: Test Engineer: Youyou Huang 
Approved by (+ signature)	: Team Leader: Harrison Huang 
Date of issue	: 2018-01-03
Testing laboratory	: Bay Area Compliance Laboratories Corp. (Dongguan)
Address	: No.69, Pulongcun, Puxinhu Industry Area, Tangxia, Dongguan, Guangdong, China
Testing location	: Same as above
Applicant	: Hongli Zhihui Group Co.,Ltd.
Address	: No.1, Xianke Yi Road, Huadong Town, Huadu District, Guangzhou, China
Standard	: EN 62471:2008
Test sample(s)received.....	: 2018-01-02
Test in period.....	: 2018-01-03
Procedure deviation	: N.A.
Non-standard test method	: N.A.
<p>Note: The test data was only valid for the test sample(s). This test report is prepared for the customer shown above and for the specific product described herein. It must not be duplicated or used in part without prior written consent from Bay Area Compliance Laboratories Corp. (Dongguan).</p>	
Type of test object	: LED package
Trademark	: N.A.
Model/type reference	: HL-A-2835DW-S1-08-HR3
Manufacturer	: Hongli Zhihui Group Co.,Ltd. No.1, Xianke Yi Road, Huadong Town, Huadu District, Guangzhou, China
Rating.....	: Input: 2.8-3.4Vdc, 150mA
Copy of marking plate: None	

EN 62471:2008			
Clause	Requirement + Test	Result - Remark	Verdict

4.3.3	Retinal blue light hazard exposure limit		P
	To protect against retinal photochemical injury from chronic blue-light exposure, the integrated spectral radiance of the light source weighted against the blue-light hazard function, $B(\lambda)$, i.e., the blue-light weighted radiance, L_B , shall not exceed the levels defined by:		P

$$L_B \cdot t = \int_{300}^{700} L_\lambda(\lambda, t) \cdot B(\lambda) \cdot t \cdot \lambda \leq 10^6 \text{ J} \cdot \text{m}^{-2} \cdot \text{sr}^{-1}$$

N

FINAL

EN 62471:2008			
Clause	Requirement + Test	Result - Remark	Verdict
4.3.7	Infrared radiation hazard exposure limits for the eye		P
	The avoid thermal injury of the cornea and possible delayed effects upon the lens of the eye (cataractogenesis),ocular exposure to infrared radiation, EIR,over the wavelength range 780 nm to 3000 nm, for times less than 1000 s, shall not exceed:		N
	$E_{IR} = \sum_{780}^{3000} E_{\lambda} \cdot \Delta\lambda \leq 18000 \cdot t^{-0,75} \quad W \cdot m^{-2}$		N
	For times greater than 1000 s the limit becomes:		P
	$E_{IR} = \sum_{780}^{3000} E_{\lambda} \cdot \Delta\lambda \leq 100 \quad W \cdot m^{-2}$	$E_{IR} = 0 W \cdot m^{-2}$	P
4.3.8	Thermal hazard exposure limit for the skin		P
	Visible and infrared radiant exposure (380 nm to 3000 nm) of the skin shall be limited to:		P
	$E_H \cdot t = \sum_{380}^{3000} \sum_t E_{\lambda}(\lambda, t) \cdot \Delta t \cdot \Delta\lambda \leq 20000 \cdot t^{0,25} \quad J \cdot m^{-2}$	$E_H \cdot t = 1.5 W \cdot m^{-2} \times 10s = 15 J \cdot m^{-2}$	P
5	MEASUREMENT OF LAMPS AND LAMP SYSTEMS		P
5.1	Measurement conditions		P
	Measurement conditions shall be reported as part of the evaluation against the exposure limits and the assignment of risk classification.		P
5.1.1	Lamp ageing (seasoning)		N
	Seasoning of lamps shall be done as stated in the Appropriate EN lamp standard.		N
5.1.2	Test environment	25.0	P
	For specific test conditions, see the appropriate EN lamp standard or in absence of such standards, the appropriate national standards or manufacturer's recommendations.		P
5.1.3	Extraneous radiation		P
	Careful checks should be made to ensure that extraneous sources of radiation and reflections do not add significantly to the measurement results.		P
5.1.4	Lamp operation		P
	Operation of the test lamp shall be provided in accordance with:		P

EN 62471:2008			
Clause	Requirement + Test	Result - Remark	Verdict
	The calculation of source hazard values shall be performed by weighting the spectral scan by the appropriate function and calculating the total weighted energy.		P
5.3.3	Measurement uncertainty		P
	The quality of all measurement results must be quantified by an analysis of the uncertainty.		P
6	LAMP CLASSIFICATION		P
	For the purposes of this standard it was decided that the values shall be reported as follows:		P
	– for lamps intended for general lighting service, the hazard values shall be reported as either irradiance or radiance values at a distance which produces an illuminance of 500 lux, but not at a distance less than 200 mm		N
	– for all other light sources, including pulsed lamp sources, the hazard values shall be reported at a distance of 200 mm	At a distance of 200mm	P
6.1	Continuous wave lamps		P
6.1.1	Exempt Group		N
	In the exempt group are lamps, which does not pose any photobiological hazard. The requirement is met by any lamp that does not pose:		N
	– an actinic ultraviolet hazard (ES) within 8-hours exposure (30000 s), nor		N
	– a near-UV hazard (EUVA) within 1000 s, (about 16 min), nor		N
	– a retinal blue-light hazard (LB) within 10000 s (about 2,8 h), nor		N
	– a retinal thermal hazard (LR) within 10 s, nor		N
	– an infrared radiation hazard for the eye (EIR) within 1000 s		N
6.1.2	Risk Group 1 (Low-Risk)		P
	In this group are lamps, which exceeds the limits for the exempt group but that does not pose:		P
	– an actinic ultraviolet hazard (ES) within 10000 s, nor		P
	– a near ultraviolet hazard (EUVA) within 300 s, nor		P
	– a retinal blue-light hazard (LB) within 100 s, nor		P
	– a retinal thermal hazard (LR) within 10 s, nor		P
	– an infrared radiation hazard for the eye (EIR) within 100 s		P
	Lamps that emit infrared radiation without a strong visual stimulus and do not pose a near-infrared retinal hazard (LIR), within 100 s are in Risk Group 1.		P
6.1.3	Risk Group 2 (Moderate-Risk)		N
	This requirement is met by any lamp that exceeds the limits for Risk Group 1, but that does not pose:		N

EN 62471:2008			
Clause	Requirement + Test	Result - Remark	Verdict
	– an actinic ultraviolet hazard (ES) within 1000 s exposure, nor		N
	– a near ultraviolet hazard (EUVA) within 100 s, nor		N
	– a retinal blue-light hazard (LB) within 0,25 s (aversion response), nor		N
	– a retinal thermal hazard (LR) within 0,25 s (aversion response), nor		N
	– an infrared radiation hazard for the eye (EIR) within 10 s		N
	Lamps that emit infrared radiation without a strong visual stimulus and do not pose a near-infrared retinal hazard (LIR), within 10 s are in Risk Group 2.		N
6.1.4	Risk Group 3 (High-Risk)		N
	Lamps which exceed the limits for Risk Group 2 are in Group 3.		N
6.2	Pulsed lamps		N
	Pulse lamp criteria shall apply to a single pulse and to any group of pulses within 0,25 s.		N
	A pulsed lamp shall be evaluated at the highest nominal energy loading as specified by the manufacturer.		N
	The risk group determination of the lamp being tested shall be made as follows:		N
	– a lamp that exceeds the exposure limit shall be classified as belonging to Risk Group 3 (High-Risk)		N
	– for single pulsed lamps, a lamp whose weighted radiant exposure or weighted radiance does is below the EL shall be classified as belonging to the Exempt Group		N
	– for repetitively pulsed lamps, a lamp whose weighted radiant exposure or weighted radiance dose is below the EL, shall be evaluated using the continuous wave risk criteria discussed in clause 6.1, using time averaged values of the pulsed emission		N

EN 62471:2008

Clause	Requirement + Test	Result - Remark	Verdict
--------	--------------------	-----------------	---------

Wavelength nm	Blue-light hazard function B()	Burn hazard function R()
300	0.01	-
305	0.01	-
310	0.01	-
315	0.01	-
320	0.01	-
325	0.01	-
330	0.01	-
335	0.01	-
340	0.01	-
345	0.01	-
350	0.01	-
355	0.01	-
360	0.01	-
365	0.01	-
370	0.01	-
375	0.01	-
380	0.01	0.1
385	0.013	0.13
390	0.025	0.25
395	0.05	0.5
400	0.10	1.0
405	0.20	2.0
410	0.40	4.0
415	0.80	8.0
420	0.90	9.0
425	0.95	9.5
430	0.98	9.8
435	1.00	10.0
440	1.00	10.0
445	0.97	9.7
450	0.94	9.4
455	0.90	9.0
460	0.80	8.0
465	0.70	7.0
470	0.62	6.2
475	0.55	5.5
480	0.45	4.5
485	0.40	4.0
490	0.22	2.2
495	0.16	1.6
500-600	$10^{[(450-)/50]}$	1.0
600-700	0.001	1.0
700-1050	0.013	$10^{[(700-)/500]}$
1050-1150	0.025	0.2
1150-1200	0.05	$0.2^{100.02(1150-)}$
1200-1400	0.10	0.02

* 1 Wavelengths chosen are representative: other values should be obtained by logarithmic interpolation at intermediate wavelengths.

* Emission lines of a mercury discharge spectrum.

EN 62471:2008

Clause	Requirement + Test	Result - Remark	Verdict
--------	--------------------	-----------------	---------

Table 5.4					-
Summary of the ELs for the surface of the skin or cornea (irradiance based values)					-
Hazard Name	Relevant equation	Wavelength Range nm	Exposure aperture rad(deg)	Limiting aperture rad(deg)	EL in terms of constant irradiance $W.m^{-2}$
Actinic UV skin & eye	$E_s = E \cdot S(\cdot)$	200 – 400	< 30000	1.4 (80)	30/t
Eye UV-A	$E_{UVA} = E \cdot \cdot$	315 – 400	1000 >1000	1.4 (80)	10000/t 10
Blue-light small source	$E_B = E \cdot B(\cdot)$	300 – 700	100 >100	< 0.011	100/t 1,0
Eye IR	$E_{IR} = E \cdot \cdot$	780 – 3000	1000 >1000	1.4 (80)	18000/t ^{0.75} 100
Skin thermal	$E_H = E \cdot \cdot$	380 – 3000	< 10	2 sr	20000/t ^{0.75}

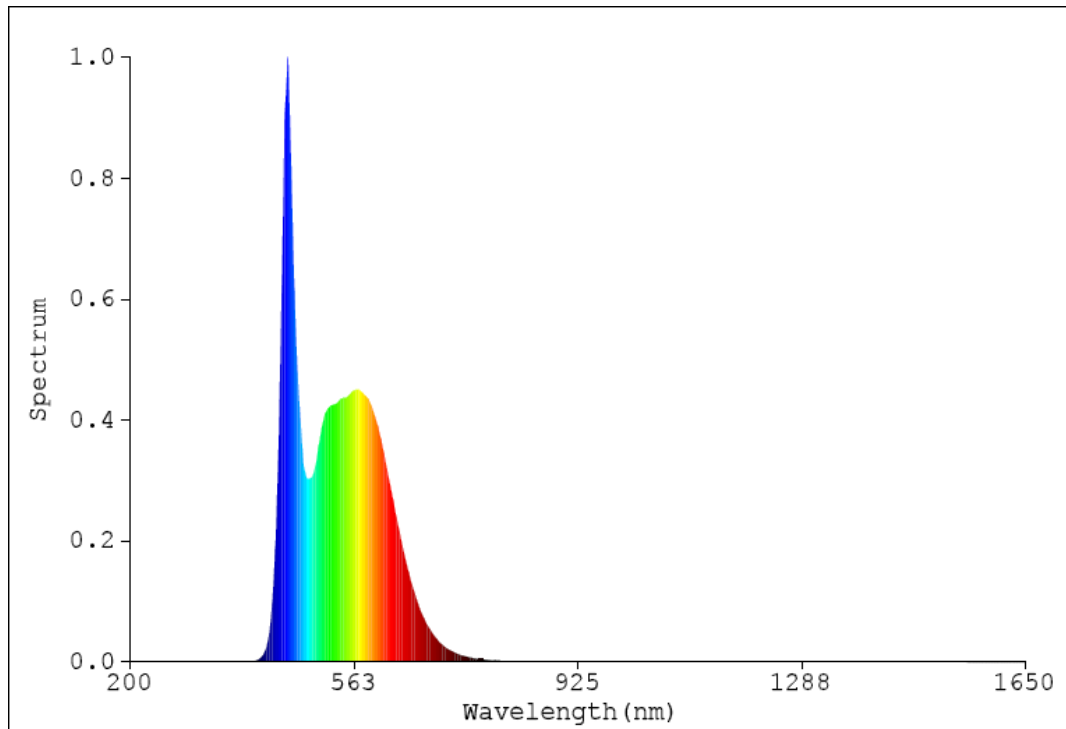
Table 5.5					-
Summary of the ELs for the retina (radiance based values)					-
Hazard Name	Relevant equation	Wavelength Range nm	Exposure duration Sec	Field of view radians	EL in terms of constant radiance $W.m^{-2}.sr^{-1}$
Blue light	$L_B = L \cdot B(\cdot) \cdot$	300 – 700	0.25 – 10 10-100 100-10000 10000	0.011• (t/10) 0.011 0.0011• t 0.1	10 ⁶ /t 10 ⁶ /t 10 ⁶ /t 100
Retinal thermal	$L_R = L \cdot R(\cdot) \cdot$	380 – 1400	< 0,25 0.25 – 10	0,0017 0.011• (t/10)	50000/(•t _{0.25}) 50000/(•t _{0.25})
Retinal thermal (weak visual stimulus)	$L_{IR} = L \cdot R(\cdot) \cdot$	780 – 1400	> 10	0.011	6000/

EN 62471:2008

Clause	Requirement + Test	Result - Remark	Verdict
--------	--------------------	-----------------	---------

Table 6.1	Emission limits for risk groups of continuous wave lamps base on Directive(2006/25/EC)								P
Risk	Action spectrum	Units	Symbol	Exempt		Low risk		Mod risk	
				Limit	Result	Limit	Result	Limit	Result
Actinic UV	Suv()	W.m ⁻²	E _S	0.001	--	0.003	7.7×10 ⁻⁵	0.03	--
Near UV		W.m ⁻²	E _{UVA}	0.33	--	33	5.8×10 ⁻⁵	100	--
Blue light	B()	W.m ⁻² .sr ⁻¹	L _B	100	--	10000	5.10×10 ³	4000000	--
Blue light,small source	B()	W.m ⁻²	E _B	0.01	--	1	4.23×10 ⁻¹	400	--
Retinal thermal	R()	W.m ⁻² .sr ⁻¹	L _R	28000/ (=0.0040)	--	28000/ (=0.0040)	6.1×10 ⁴	71000/ (=0.0040)	--
Retinal thermal, Weak visual stimulus**	R()	W.m ⁻² .sr ⁻¹	L _{IR}	6000/ (=0.0040)	--	6000/ (=0.0040)	3.8×10 ¹	28000/ (=0.0040)	--
IR radiation Eye		W.m ⁻²	E _{IR}	100	--	570	0	3200	--

Figure of Spectral distribution



Appendix B–Test equipment list

Equipment Description	Model No	BACL#	Manufacturer	Last Cal	Cal Due
UV-VIS-near IR Spectrophotocolorimeter	PMS-2000	T-08-SF213	EVERFINE	2017-08-08	2018-08-07
Imaging luminance meter	CX-2K	T-08-SF140-1	EVERFINE	2017-08-08	2018-08-07
Radiation illuminance meter	RD-2000	T-08-SF140-2	EVERFINE	2017-08-08	2018-08-07
Radiation illuminance meter	RD-2000	T-08-SF140-3	EVERFINE	2017-08-08	2018-08-07
High Accuracy Array	HAAS-2000	T-08-SF140-4	EVERFINE	2017-08-08	2018-08-07
Hygrothermograph	PWS280	T-08-QA026	N/A	2017-03-21	2018-03-20
Standard power spectral UV radiation-specific	UVS-8003	T-08-EE048	EVERFINE	2017-03-21	2018-03-20
80mm sample integrating sphere	SMS-300	F-08-SF130	EVERFINE	2016-12-26	2018-12-25
Steel tape	HILOCK-19	T-08-SF100	TAJIMA	2013-04-18	2018-04-17
Digital CC&CV DC Power Supply	WY305	T-08-EE098	EVERFINE	2017-03-04	2018-03-04

*** End of report ***