

TEST REPORT

IEC 62471:2006

Photobiological safety of lamps and lamp systems

RSZ160108551-03 Report reference No:

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Date of issue: 2016-01-14

Testing laboratory: Bay Area Compliance Laboratories Corp. (Dongguan)

Address: No.69 Pulong Village Puxinhu Industry Zone Tangxia, Dongguan,

China.

Testing location: Same as above

Applicant: Guangzhou Hongli Opto-Electronic Co.,Ltd.

Address: NO.1, Xianke Yi Road, Huadong Town, Huadu District, Guangzhou,

China

Standard: IEC 62471:2006

Test sample(s) received.....: 2016-01-13

Test in period...... 2016-01-13

Procedure deviation N.A.

Non-standard test method: N.A.

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Type of test object: LED

Trademark: N.A.

HL-AT-2835DW-S1-08-PCT-HR3 Model/type reference:

Manufacturer..... Guangzhou Hongli Opto-Electronic Co.,Ltd.

Rating: 150mA

Copy of marking plate:

None



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	t _{max} 10000/E _{UVA} s		N
4.3.3	Retinal blue light hazard exposure limit		Р
	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(_), i.e., the blue-light weighted radiance, LB, shall not exceed the levels defined by:		Р
	$L_{B} \stackrel{700}{t=} L_{\lambda}(\lambda, t) \cdot B(\lambda) \cdot t \cdot \lambda \leq 10^{6} \text{ J} \cdot \text{m}^{-2} \cdot \text{sr}^{-1}$		N
	$L_B = \int_{300}^{700} L_{\lambda} \cdot B(\lambda) \cdot \lambda \le 100 \qquad \text{W} \cdot \text{m}^{-2} \cdot \text{sr}^{-1}$	L _B =20W·m ⁻² ·sr ⁻¹	Р
4.3.4	Retinal blue light hazard exposure limit - small source	= 0.0090 rad	Р
	Thus the spectral irradiance at the eye E_, weighted against the blue-light hazard function B(_) shall not exceed the levels defined by: see table 4.2		Р
	$E_{\text{B}} \cdot t = \sum_{300 \text{ t}}^{700} E_{\lambda}(\lambda, t) \cdot B(\lambda) \cdot t \cdot \lambda \leq 100 \text{ J} \cdot \text{m}^{-2}$		N
	$E_B = \int_{300}^{700} E_{\lambda} \cdot B(\lambda) \cdot \lambda \le 1 \qquad \text{W} \cdot \text{m}^{-2}$	$E_B = 7.7 \times 10^{-2} \text{W} \cdot \text{m}^{-2}$	Р
4.3.5	Retinal thermal hazard exposure limit		Р
	To protect against retinal thermal injury, the integrated spectral radiance of the light source, L_, weighted by the burn hazard weighting function R(_) (from Figure 4.2 and Table 4.2), i.e., the burn hazard weighted radiance, shall not exceed the levels defined by:		Р
	$L_{R} = \sum_{\alpha} L_{\lambda} \cdot R(\lambda) \cdot \Delta \lambda \le \frac{50000}{2.4025} $ W·m ⁻² ·sr ⁻¹	$L_R = 1.4 \times 10^4 \text{W} \cdot \text{m}^{-2} \cdot \text{sr}^{-1}$	Р
4.3.6	Retinal thermal hazard exposure limit – weak visual stimulus		Р
	For an infrared heat lamp or any near-infrared source where a weak visual stimulus is inadequate to activate the aversion response, the near infrared (780 nm to 1400 nm) radiance, LIR, as viewed by the eye for exposure times greater than 10 s shall be limited to:		Р



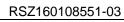
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	$L_{\rm IR} = \sum_{780}^{1400} L_{\lambda} \cdot R(\lambda) \cdot \Delta \lambda \le \frac{6000}{\alpha} $ W·m ⁻² ·sr ⁻¹	$L_{IR} = 7.6W \cdot m^{-2} \cdot sr^{-1}$	Р		
4.3.7	Infrared radiation hazard exposure limits for the eye		Р		
	The avoid thermal 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		
	$E_{IR} = \sum_{780}^{3000} E_{\lambda} \cdot \Delta \lambda \le 18000 \cdot t^{-0.75}$ W·m ⁻²		N		
	For times greater than 1000 s the limit becomes:		Р		
	$E_{\rm IR} = \sum_{780}^{3000} E_{\lambda} \cdot \Delta \lambda \le 100 \qquad \qquad \text{W} \cdot \text{m}^{-2}$	0 W·m ⁻²	Р		
4.3.8	Thermal hazard exposure limit for the skin		Р		
	Visible and infrared radiant exposure (380 nm to 3000 nm) of the skin shall be limited to:		Р		
	$E_{H} \cdot t = \sum_{380}^{3000} \sum_{t} E_{\lambda}(\lambda, t) \cdot \Delta t \cdot \Delta \lambda \le 20000 \cdot t^{0,25} $ J·m ⁻²	E _H ·t=0W·m ⁻² X10s=0J·m ⁻²	Р		
5	MEASUREMENT OF LAMPS AND LAMP		Р		
	SYSTEMS		Г		
5.1	Measurement conditions		Р		
	Measurement conditions shall be reported as part of the evaluation against the exposure limits and the assignment of risk classification.		Р		
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	25.3	Р		
	For specific test conditions, see the appropriate EN lamp standard or in absence of such standards, the appropriate national standards or manufacturer's recommendations.		Р		
5.1.3	Extraneous radiation		Р		
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	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		Р	
	Operation of the test lamp shall be provided in accordance with: - the appropriate EN lamp standard, or		Р	
	- the manufacturer's recommendation		N P	
5.1.5	Lamp system operation		N	
	The power source for operation of the test lamp shall be provided in accordance with:		N	
	- the appropriate EN standard, or	_	N	
	- the manufacturer's recommendation		N	
5.2	Measurement procedure		Р	
5.2.1	Irradiance measurements		Р	
	Minimum aperture diameter 7mm.		Р	
	Maximum aperture diameter 50 mm.		Р	
	The measurement shall be made in that position of the beam giving the maximum reading.		Р	
	The measurement instrument is adequate calibrated.	See appendix B	Р	
5.2.2	Radiance measurements	r	Р	
5.2.2.1	Standard method		Р	
	The measurements made with an optical system.		Р	
	The instrument shall be calibrated to read in absolute radiant power per unit receiving area and per unit solid angle to acceptance averaged over the field of view of the instrument.		Р	
5.2.2.2	Alternative method		N	
	Alternatively to an imaging radiance set-up, an irradiance measurement set-up with a circular field stop placed at the source can be used to perform radiance measurements.		N	
5.2.3	Measurement of source size		Р	
	The determination of , the angle subtended by a source, requires the determination of the 50% emission points of the source.		Р	
5.2.4	Pulse width measurement for pulsed sources		N	
	The determination of t, the nominal pulse duration of a source, requires the determination of the time during which the emission is > 50% of its peak value.		N	
5.3	Analysis methods		Р	
5.3.1	Weighting curve interpolations		N	



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	To standardize interpolated values, use linear interpolation on the log of given values to obtain intermediate points at the wavelength intervals desired.		N	
5.3.2	Calculations		Р	
	The calculation of source hazard values shall be performed by weighting the spectral scan by the appropriate function and calculating the total weighted energy.		Р	
5.3.3	Measurement uncertainty		Р	
	The quality of all measurement results must be quantified by an analysis of the uncertainty.		Р	
6	LAMP CLASSIFICATION	_	Р	
	For the purposes of this standard it was decided that the values shall be reported as follows:		Р	
	 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 	200mm	Р	
6.1	Continuous wave lamps		Р	
6.1.1	Exempt Group		Р	
	In the except group are lamps, which does not pose any photobiological hazard. The requirement is met by any lamp that does not pose:		Р	
	 an actinic ultraviolet hazard (ES) within 8-hours exposure (30000 s), nor 		Р	
	– a near-UV hazard (EUVA) within 1000 s, (about 16 min), nor		Р	
	 a retinal blue-light hazard (LB) within 10000 s (about 2,8 h), nor 		Р	
	- a retinal thermal hazard (LR) within 10 s, nor		Р	
	 an infrared radiation hazard for the eye (EIR) within 1000 s 		Р	
6.1.2	Risk Group 1 (Low-Risk)		N	
	In this group are lamps, which exceeds the limits for the except group but that does not pose:		N	
	– an actinic ultraviolet hazard (ES) within 10000 s, nor		N	
	- a near ultraviolet hazard (EUVA) within 300 s, nor		N	
	- a retinal blue-light hazard (LB) within 100 s, nor		N	
	- a retinal thermal hazard (LR) within 10 s, nor		N	
	 an infrared radiation hazard for the eye (EIR) within 100 s 		N	





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	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.		N
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
	- 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



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le 4.1	Opeciiai we	ighting function for assessing ι	illaviolet flazarus for sr	in and eye -
Wavelength¹ , nm		UV hazard function S _{uv} ()	Wavelength , nm	UV hazard function S _{uv} ()
2	200	0,030	313*	0,006
2	205	0,051	315	0,003
2	210	0,075	316	0,0024
2	215	0,095	317	0,0020
2	220	0,120	318	0,0016
2	225	0,150	319	0,0012
2	230	0,190	320	0,0010
2	235	0,240	322	0,00067
2	240	0,300	323	0,00054
2	245	0,360	325	0,00050
2	250	0,430	328	0,00044
2	:54*	0,500	330	0,00041
2	255	0,520	333*	0,00037
2	260	0,650	335	0,00034
2	265	0,810	340	0,00028
2	270	1,000	345	0,00024
2	275	0,960	350	0,00020
2	80*	0,880	355	0,00016
2	285	0,770	360	0,00013
2	290	0,640	365*	0,00011
2	295	0,540	370	0,000093
2	97*	0,460	375	0,000077
3	300	0,300	380	0,000064
3	03*	0,120	385	0,000053
305		0,060	390	0,000044
3	308	0,026	395	0,000036
310		0,015	400	0,000030

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

Emission lines of a mercury discharge spectrum.



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Table 4.2	Spectral weighting functions for assessing retinal hazards from broadband optical sources					
	Wavelength	Blue-light hazard function	Burn hazard function			
	nm	B()	R()			
	300	0,01	-			
	305	0,01	-			
	310	0,01	-			
	315	0,01	-			
	320	0,01				
	325	0,01-	-			



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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	Explosure aperture rad(deg)	Limiting aperture rad(deg)	EL in items of constant irradiance W.m ⁻²
Actinic UV skin & eye	E _S = E • S()	200 – 400	< 30000	1,4 (80)	30/t
Eye UV-A	E _{UVA} = E ◆	315 – 400	1000 >1000	1,4 (80)	10000/t 10
Blue-light small source	E _B = E • B()	300 – 700	100 >100	< 0,011	100/t 1,0
Eye IR	E _{IR} = E •	780 –3000	1000 >1000	1,4 (80)	18000/t ^{0,75} 100
Skin thermal	E _H = E •	380 – 3000	< 10	2 sr	20000/t ^{0,75}



Table 6.1	Emission limits for risk groups of continuous wave lamps base on Directive(2006/25/EC)								Р
Risk	Action spectrum	Units	Symbol	Exempt		Low risk		Mod risk	
				Limit	Result	Limit	Result	Limit	Result
Actinic UV	Suv()	W.m ⁻²	Es	0.001	2.7×10 ⁻⁷	0.003		0.03	-
Near UV		W.m ⁻²	E _{UVA}	10	4.5×10 ⁻⁵	33	-	100	-
Blue light	B()	W.m ⁻ ² .sr ⁻¹	L _B	100	20	10000	-	4000000	
Blue light,small source	B()	W.m ⁻²	E _B	1.0*	7.7×10 ⁻²	1.0	-	400	-
Retinal thermal	R()	W.m ⁻ 2.sr ⁻¹	L _R	28000/ (=0.009)	1.4×10 ⁴	28000/ (=0.009)	-	71000/ (=0.009)	-
Retinal thermal, Weak visual stimulus**	R()	W.m ⁻ ² .sr ⁻¹	L _{IR}	6000/ (=0.009)	7.9	6000/ (=0.009)	-	28000/ (=0.009)	-
IR radiation Eye		W.m ⁻²	E _{IR}	100	0	570	-	3200	-

^{*} Small source defined as one with < 0,011 radian. Averaging field of view at 10000 s is 0,1 radian.

NOTE The action functions: see Table 4.1 and Table 4.2

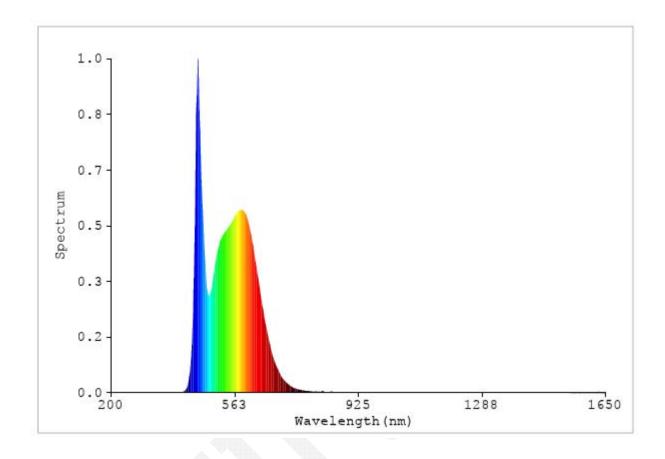
The applicance apertuer diameters: see 4.2.1
The limitations for the angular subtenses: see 4.2.2

The related measurement condition 5.2.3 and the range of acceptance angles: see Table 5.5

^{**} Involves evaluation of non-GLS source

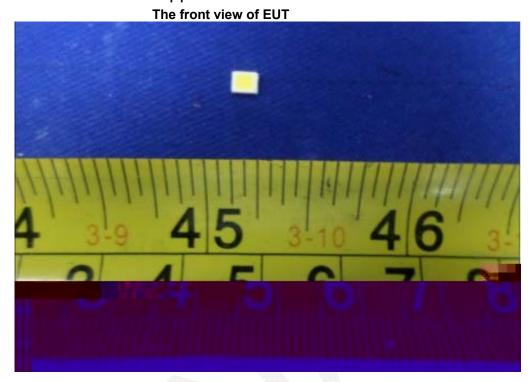


Appendix Firgure of Spectral distribution

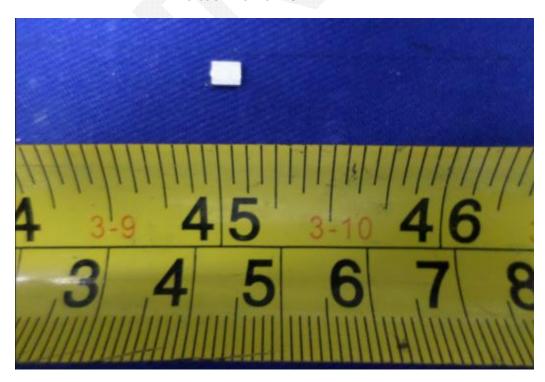




Appendix A - EUT Photos



The back view of EUT





Appendix B Test equipment list

Equipment Description	Model No	BACL#	Manufacturer	Last Cal	Cal Due
UV light leakage	PMS-300	T-08-EE042	EVERFINE	2015-03-25	2016-03-24
spectrum of					
biological safety					
systems					
Standard power	UVS-8003	T-08-EE048	EVERFINE	2015-08-02	2016-08-01
spectral UV					
radiation-specific					
80mm sample	SMS-300	T-08-EE055	EVERFINE	2015-03-25	2016-03-24
integrating sphere					
Radio meter	RD-2000	T-08-EE056	EVERFINE	2015-03-25	2016-03-24
high-accuracy	HAAS-2000	T-08-EE058	EVERFINE	2015-03-25	2016-03-24
digital photometer					
head					
Hygrothermograph	PWS280	T-08-QA026	N/A	2015-03-24	2016-03-23
Steel tape	HILOCK-19	T-08-SF100	TAJIMA	2013-04-18	2018-04-17