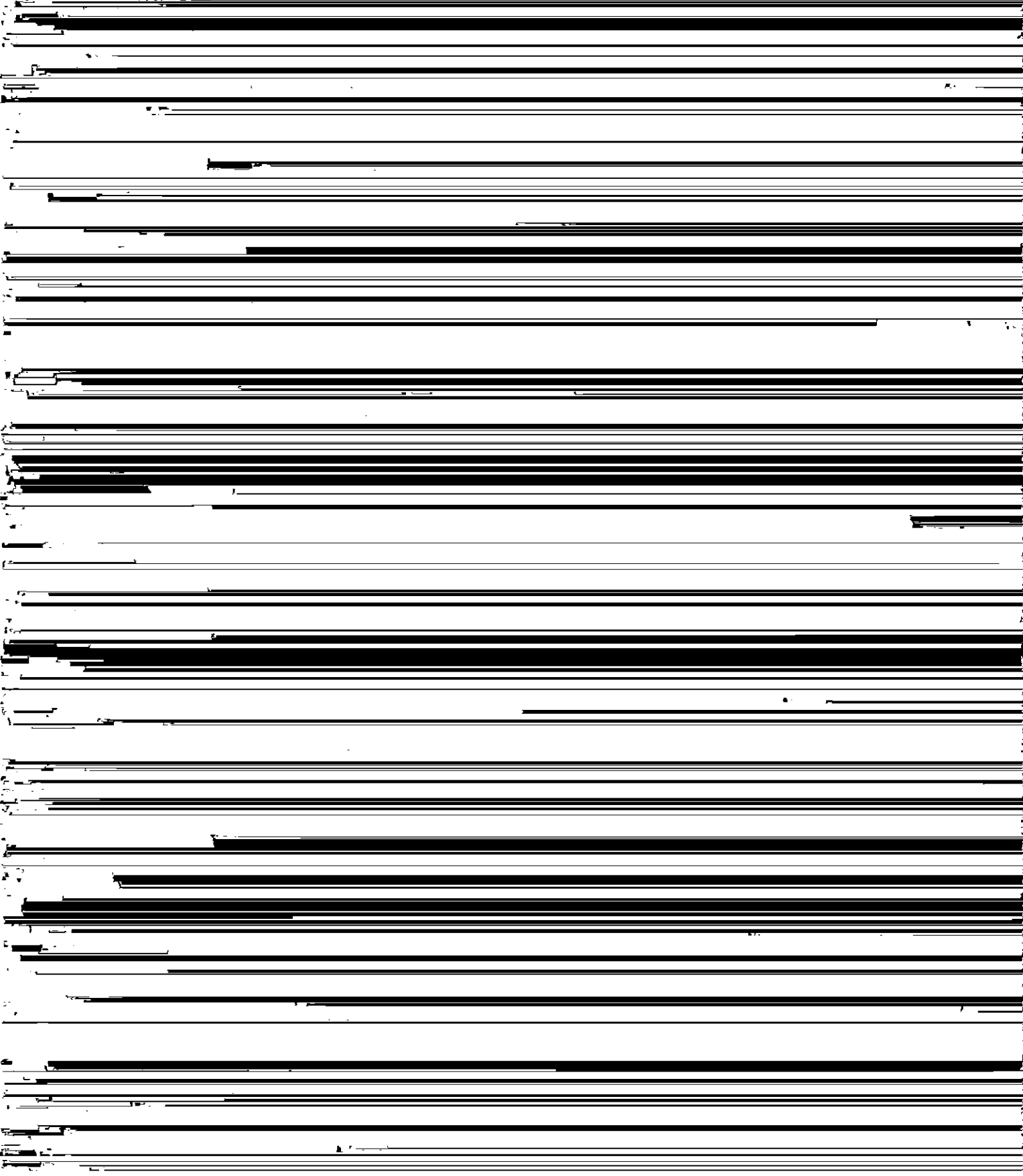




<p><b>TEST REPORT</b> <b>IEC 62471</b> <b>Photobiological safety of lamps and lamp systems</b></p>
<p>Report Reference No. .... GZES100600108901</p>



<p><b>Summary of testing:</b></p>	
<p><b>Tests performed (name of test and test clause):</b></p> <p>These tests fulfil the requirements of standard ISO/IEC 17025.</p> <p>When determining the test conclusion, the Measurement Uncertainty of test has been considered.</p> <p>Due to the physical properties of the Lamp, this product does not contain any radiation above 800nm. Therefore the measured spectral range has been limited from 200nm up to and including 800nm.</p> <p>The tests were conducted under 60 mA.</p>	<p><b>Testing location:</b></p> <p>SGS-CSTC Standards Technical Services Co., Ltd. GuangZhou Branch Testing Center No.198, Kezhu Road, Sciencetech Park, Guangzhou Economic &amp; Technology Development District, Guangzhou, Guangdong, CHINA</p>
<p><b>Summary of compliance with National Differences:</b></p> <p>--</p>	
<p><b>Copy of marking plate:</b></p> <p>--</p>	

<b>Test item particulars</b> .....	
Tested lamp .....	<input checked="" type="checkbox"/> continuous wave lamps <input type="checkbox"/> pulsed lamps
Tested lamp system .....	--
Lamp classification group .....	<input checked="" type="checkbox"/> exempt <input type="checkbox"/> risk 1 <input type="checkbox"/> risk 2 <input type="checkbox"/> risk 3
Lamp cap .....	--
Bulb .....	--
Rated of the lamp .....	--
Furthermore marking on the lamp.....	--
Seasoning of lamps according IEC standard .....	--
Used measurement instrument.....	Ref. to List of test equipment used
Temperature by measurement.....	25 ± 5 °C
Information for safety use.....	--
<b>Possible test case verdicts:</b>	
– test case does not apply to the test object ..... : N (N/A)	
– test object does meet the requirement..... : P (Pass)	
– test object does not meet the requirement..... : F (Fail)	
<b>Testing:</b>	
Date of receipt of test item.....	: June 21, 2010
Date (s) of performance of tests.....	: June 21, 2010 – June 28, 2010
<b>General remarks:</b>	
<p>The test results presented in this report relate only to the object tested.            This report shall not be reproduced, except in full, without the written approval of the Issuing testing laboratory.            "(See Enclosure #)" refers to additional information appended to the report.            "(See appended table)" refers to a table appended to the report.            Throughout this report a comma is used as the decimal separator.            List of test equipment must be kept on file and available for review.</p> <p>This document is issued by the Company subject to its General Conditions of Service, available on request or accessible at <a href="http://www.sgs.com/terms_and_conditions.htm">www.sgs.com/terms_and_conditions.htm</a> and, for electronic format documents, subject to Terms and Conditions for Electronic Documents at <a href="http://www.sgs.com/terms_e-document.htm">www.sgs.com/terms_e-document.htm</a>.</p> <p>Attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein. Any holder of this document is advised that information contained hereon reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents. This document cannot be produced except in full, without prior written approval of the Company. Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law.</p>	
<b>General product information:</b>	
The product can emit white light when powered.	

IEC 62471			
Clause	Requirement + Test	Result – Remark	Verdict
<b>4</b>	<b>EXPOSURE LIMITS</b>		--
4.1	General		P
	The exposure limits in this standard is not less than 0,01 ms and not more than any 8-hour period and should be used as guides in the control of exposure		P
	Detailed spectral data of a light source are generally required only if the luminance of the source exceeds $10^4 \text{ cd}\cdot\text{m}^{-2}$	see clause 4.3	P
4.3	Hazard exposure limits		P
4.3.1	Actinic UV hazard exposure limit for the skin and eye		P
	The exposure limit for effective radiant exposure is $30 \text{ J}\cdot\text{m}^{-2}$ within any 8-hour period		P
	To protect against injury of the eye or skin from ultraviolet radiation exposure produced by a broad-band source, the effective integrated spectral irradiance, $E_s$ , of the light source shall not exceed the levels defined by:		P
	$E_s \cdot t = \sum_{315}^{400} \sum E_\lambda(\lambda, t)$		P
	The permissible time for exposure to ultraviolet radiation incident upon the unprotected eye or skin shall be computed by:		P
	$t_{\max} = \frac{30}{E_s} \quad \text{s}$		P
4.3.2	Near-UV hazard exposure limit for eye		P
	For the spectral region 315 nm to 400 nm (UV-A) the total radiant exposure to the eye shall not exceed $10000 \text{ J}\cdot\text{m}^{-2}$ for exposure times less than 1000 s. For exposure times greater than 1000 s (approximately 16 minutes) the UV-A irradiance for the unprotected eye, $E_{\text{UVA}}$ , shall not exceed $10 \text{ W}\cdot\text{m}^{-2}$ .		P
	The permissible time for exposure to ultraviolet radiation incident upon the unprotected eye for time less than 1000 s, shall be computed by:		P
	$E_{\text{UVA}} \cdot t \leq 10000$		P
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:	see table 4.2	P

IEC 62471			
Clause	Requirement + Test	Result – Remark	Verdict
	$L_B \cdot t = \sum_{300}^{700} \sum_t L_\lambda(\lambda, t) \cdot B(\lambda) \cdot \Delta t \cdot \Delta \lambda \leq 10^6 \quad \text{J} \cdot \text{m}^{-2} \cdot \text{sr}^{-1}$	for t = 10 <sup>4</sup> s $t_{\max} = \frac{10^6}{L_B}$	P
			N
4.3.4	Retinal blue light hazard exposure limit - small source		N
	Thus the spectral irradiance at the eye E <sub>λ</sub> , weighted against the blue-light hazard function B( ) shall not exceed the levels defined by:		N
	$E_B \cdot t = \sum_{300}^{700} \sum_t E_\lambda(\lambda, t) \cdot B(\lambda) \cdot \Delta t \cdot \Delta \lambda \leq 100 \quad \text{J} \cdot \text{m}^{-2}$		N

$$E_B = \sum_{300}^{700} E_\lambda \cdot B(\lambda)$$

N

IEC 62471			
Clause	Requirement + Test	Result – Remark	Verdict
	$E_{IR} = \sum_{780}^{3000} E_{\lambda} \cdot \Delta\lambda \leq 100 \quad W \cdot m^{-2}$		N
4.3.8	Thermal hazard exposure limit for the skin		N
	Visible and infrared radiant exposure (380 nm to 3000 nm) of the skin shall be limited to:		N
	$E_{H \cdot t} = \sum_{380}^{3000} \sum_t E_{\lambda}(\lambda, t) \cdot \Delta t \cdot \Delta\lambda \leq 20\,000 \cdot t^{0,25} \quad J \cdot m^{-2}$		N
<b>5</b>	<b>MEASUREMENT OF LAMPS AND LAMP SYSTEMS</b>		--
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 IEC lamp standard.		N
5.1.2	Test environment		P
	For specific test conditions, see the appropriate IEC 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
	– the appropriate IEC lamp standard, or		N
	– the manufacturer' s recommendation		P
5.1.5	Lamp system operation		P
	The power source for operation of the test lamp shall be provided in accordance with:		P
	– the appropriate IEC standard, or		N
	– the manufacturer' s recommendation		P
5.2	Measurement procedure		P
5.2.1	Irradiance measurements		P
	Minimum aperture diameter 7mm.		P
	Maximum aperture diameter 50 mm.		P

IEC 62471			
Clause	Requirement + Test	Result – Remark	Verdict
	The measurement shall be made in that position of the beam giving the maximum reading.		P
	The measurement instrument is adequate calibrated.		P
5.2.2	Radiance measurements		P
5.2.2.1	Standard method		N
	The measurements made with an optical system.		N
	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.		N
5.2.2.2	Alternative method		P
	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.		P
5.2.3	Measurement of source size		P
	The determination of $\theta$ , the angle subtended by a source, requires the determination of the 50% emission points of the source.		P
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		P
5.3.1	Weighting curve interpolations		P
	To standardize interpolated values, use linear interpolation on the log of given values to obtain intermediate points at the wavelength intervals desired.		P
5.3.2	Calculations		P

IEC 62471			
Clause	Requirement + Test	Result – Remark	Verdict
	– 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	r = 200 mm	P
6.1	Continuous wave lamps		P
6.1.1	Exempt Group		P
	In the exempt group are lamps, which does not pose any photobiological hazard. The requirement is met by any lamp that does not pose:		P
	– an actinic ultraviolet hazard ( $E_S$ ) within 8-hours exposure (30000 s), nor		P
	– a near-UV hazard ( $E_{UVA}$ ) within 1000 s, (about 16 min), nor		P
	– a retinal blue-light hazard ( $L_B$ ) within 10000 s (about 2,8 h), nor		P
	– a retinal thermal hazard ( $L_R$ ) within 10 s, nor		P
	– an infrared radiation hazard for the eye ( $E_{IR}$ ) within 1000 s		N
6.1.2	Risk Group 1 (Low-Risk)		N
	In this group are lamps, which exceeds the limits for the exempt group but that does not pose:		N
	– an actinic ultraviolet hazard ( $E_S$ ) within 10000 s, nor		N
	– a near ultraviolet hazard ( $E_{UVA}$ ) within 300 s, nor		N
	– a retinal blue-light hazard ( $L_B$ ) within 100 s, nor		N
	– a retinal thermal hazard ( $L_R$ ) within 10 s, nor		N
	– an infrared radiation hazard for the eye ( $E_{IR}$ ) within 100 s		N
	Lamps that emit infrared radiation without a strong visual stimulus and do not pose a near-infrared retinal hazard ( $L_{IR}$ ), 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 ( $E_S$ ) within 1000 s		



IEC 62471			
Clause	Requirement + Test	Result – Remark	Verdict
	– a retinal thermal hazard ( $L_R$ ) within 0,25 s (aversion response), nor		N
	– an infrared radiation hazard for the eye ( $E_{IR}$ ) within 10 s		N
	Lamps that emit infrared radiation without a strong visual stimulus and do not pose a near-infrared retinal hazard ( $L_{IR}$ ), 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

IEC 62471			
Clause	Requirement + Test	Result – Remark	Verdict

Table 4.1 Spectral weighting function for assessing ultraviolet hazards for skin and eye			P
Wavelength <sup>1</sup> $\lambda$ , nm	UV hazard function $S_{uv}(\lambda)$	Wavelength $\lambda$ , nm	UV hazard function $S_{uv}(\lambda)$
200	0,030	313*	0,006
205	0,051	315	0,003
210	0,075	316	0,0024
215	0,095	317	0,0020
220	0,120	318	0,0016
225	0,150	319	0,0012
230	0,190	320	0,0010
235	0,240	322	0,00067
240	0,300	323	0,00054
245	0,360	325	0,00050
250	0,430	328	0,00044
254*	0,500	330	0,00041
255	0,520	333*	0,00037
260	0,650	335	0,00034
265	0,810	340	0,00028
270	1,000	345	0,00024
275	0,960	350	0,00020
280*	0,880	355	0,00016
285	0,770	360	0,00013
290	0,640	365*	0,00011
295	0,540	370	0,000093
297*	0,460	375	0,000077
300	0,300	380	0,000064
303*	0,120	385	0,000053
305	0,060	390	0,000044

IEC 62471			
Clause	Requirement + Test	Result – Remark	Verdict

Table 4.2	Spectral weighting functions for assessing retinal hazards from broadband optical sources	P
Wavelength nm	Blue-light hazard function B (λ)	Burn hazard function R (λ)
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	$10^{[(450-\lambda)/50]}$	1,0
600-700	0,001	1,0
700-1050	--	$10^{[(700-\lambda)/500]}$
1050-1150	--	0,2
1150-1200	--	$0,2 \cdot 10^{0,02(1150-\lambda)}$
1200-1400	--	0,02

IEC 62471			
Clause	Requirement + Test	Result – Remark	Verdict

Table 5.4		Summary of the ELs for the surface of the skin or cornea (irradiance based values)				P
Hazard Name	Relevant equation	Wavelength range nm	Exposure duration sec	Limiting aperture rad (deg)	EL in terms of constant irradiance $W \cdot m^{-2}$	
Actinic UV skin & eye	$E_S = E \cdot S(\ ) \cdot$	200 – 400	< 30000	1,4 (80)	30/t	
Eye UV-A	$E_{UVA} = E \cdot$	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	$E_{IR} = E \cdot$	780 – 3000	1000 >1000	1,4 (80)	$18000/t^{0,75}$ 100	
Skin thermal	$E_H = E \cdot$	380 – 3000	< 10	2 sr	$20000/t^{0,75}$	

Table 5.5		Summary of the ELs for the retina (radiance based values)				P
Hazard Name						

IEC 62471			
Clause	Requirement + Test	Result – Remark	Verdict

Table 6.1	Emission limits for risk groups of continuous wave lamps								P
Risk	Action spectrum	Symbol	Units	Emission Measurement					
				Exempt		Low risk		Mod risk	
				Limit	Result	Limit	Result	Limit	Result
Actinic UV	$S_{UV}(\ )$	$E_s$	$W \cdot m^{-2}$	0,001	0	0,003	--	0,03	--
Near UV	--	$E_{UVA}$	$W \cdot m^{-2}$	10	0,0002	33	--	100	--
Blue light	$B(\ )$	$L_B$	$W \cdot m^{-2} \cdot sr^{-1}$	100	5,8	10000	--	4000000	--
Blue light, small source	$B(\ )$	$E_B$	$W \cdot m^{-2}$	1,0*	--	1,0	--	400	--
Retinal thermal	$R(\ )$	$L_R$	$W \cdot m^{-2} \cdot sr^{-1}$	28000/	8722,2	28000/	--	71000/	--
Retinal thermal, weak visual stimulus**	$R(\ )$	$L_{IR}$	$W \cdot m^{-2} \cdot sr^{-1}$	6000/	--	6000/	--	6000/	--
IR radiation, eye	--	$E_{IR}$	$W \cdot m^{-2}$	100	--	570	--	3200	--

\* Small source defined as one with  $\omega < 0,011$  radian. Averaging field of view at 10000 s is 0,1 radian.  
 \*\* Involves evaluation of non-GLS source

**List of test equipment used:**

Clause	Measurement / testing	Testing / measuring equipment / material used	Range used	Calibration date
5	Irradiance and Radiance measurements	Spectroradiometer	200 – 800 nm	Last cal. date: 2010-04-08 Next cal. date: 2011-04-08
5	Irradiance and Radiance measurements	HP 34401A multimeter	--	Last cal. date: 2009-09-24 Next cal. date: 2010-09-24

**Photo documentation**

Details of: .....

View:

general

front

rear

right

left

top

bottom

Internal

--- END OF REPORT ---