



Photo biological safety test report (IEC 62471:2006) & (IEC 62778:2014)

DURIS® S 8

PLEASE CAREFULLY READ THE BELOW TERMS AND CONDITIONS BEFORE USING THE INFORMATION. IF YOU DO NOT AGREE WITH ANY OF THESE TERMS AND CONDITIONS, DO NOT USE THE INFORMATION.

The Information shown in this document was produced with due care, but is provided by OSRAM Opto Semiconductors GmbH "as is" and without OSRAM Opto Semiconductors GmbH assuming, express or implied, any warranty or liability whatsoever, including, but not limited to the warranties of correctness, completeness, merchantability, fitness for a particular purpose, title or non-infringement. In no event shall OSRAM Opto Semiconductors GmbH be liable - regardless of the legal theory - for any direct, indirect, special, incidental, exemplary, consequential, or punitive damages related to the use of the Information. This limitation shall apply even if OSRAM Opto Semiconductors GmbH has been advised of possible damages. As some jurisdictions do not allow exclusion of certain warranties or limitations of liability, the above limitations or exclusions may not apply. The liability of OSRAM Opto Semiconductors GmbH would in such case be limited to the greatest extent permitted by law.

OSRAM Opto Semiconductors GmbH may change the Information at anytime without notice to user and is not obligated to provide any maintenance or support related to the Information. The Information is based on specific Conditions and, therefore, alterations to the Information can not be excluded.

Any rights not expressly granted herein are reserved. Except for the right to use the Information included in this document, no other rights are granted nor shall any obligation be implied requiring the grant of further rights. Any and all rights or licenses to patents or patent applications are expressly excluded.

Further explanations:

Information: The information provided in this document consists of the list of individual LED types which are considered in the respective LED family.

Document: The document has the purpose to list the individual LED types which are considered in the respective LED family with respect to the photo optical safety.

Conditions: The photo optical safety tests according to IEC 62471:2006 have been conducted using the worst case LED type of the LED family. Therefore the less critical LED types are also grouped into the respective highest risk group determined by the worst case LED types.

Reproduction, transfer, distribution or storage of part or all of the contents of this document in any form without the prior written permission of OSRAM Opto Semiconductors GmbH is prohibited except in accordance with applicable mandatory law.

Test Report No. 7191184236-EEC18-CMF

dated 27 Apr 2018



PSB Singapore

Choose certainty.
Add value.

Note: This report is issued subject to the Testing and Certification Regulations of the TÜV SÜD Group and the General Terms and Conditions of Business of TÜV SÜD PSB Pte Ltd. In addition, this report is governed by the terms set out within this report.

Subject

PHOTOBIOLOGICAL SAFETY OF LED PACKAGE

Client

OSRAM Opto Semiconductors (M) Sdn. Bhd.

Bayan Lepas Free Industrial Zone, Phase 1,
11900 Penang, Malaysia

Attention: Ms. Jacqueline Yeap

Sample Submission Date

9 Apr 2018

Description of Sample

Trade Name : OSRAM
Model / type : GW P9LR34.PM
Ratings : 10mA to 300mA; 5700K
Quantity : One (1) piece
Manufacturer(s) : OSRAM Opto Semiconductors (M) Sdn. Bhd.
Country of origin : Malaysia



LA-2007-0380-A
LA-2007-0381-F
LA-2007-0382-B
LA-2007-0383-G

LA-2007-0384-G
LA-2007-0385-E
LA-2007-0386-C
LA-2010-0464-D

The results reported herein have been performed in accordance with the terms of accreditation under the Singapore Accreditation Council. Inspections/Calibrations/Tests marked "Not SAC-SINGLAS Accredited" in this Report are not included in the SAC-SINGLAS Accreditation Schedule for our inspection body/laboratory.

Laboratory:
TÜV SÜD PSB Pte. Ltd.
No.1 Science Park Drive
Singapore 118221

Phone : +65-6885 1333
Fax : +65-6776 8670
E-mail: enquiries@tuv-sud-psb.sg
www.tuv-sud-psb.sg
Co. Reg : 199002667R

Regional Head Office:
TÜV SÜD Asia Pacific Pte. Ltd.
1 Science Park Drive, #02-01
Singapore 118221
TUV®

Test Report No. 7191184236-EEC18-CMF
dated 27 Apr 2018



PSB Singapore

TEST REPORT IEC 62471 Photobiological safety of lamps and lamp systems	
Report Reference No.	7191184236-EEC18-CMF
Date of issue	27 Apr 2018
Total number of pages	32
CB Testing Laboratory	TÜV SÜD PSB Pte Ltd
Address	No. 1 Science Park Drive Singapore 118221
Applicant's name	OSRAM Opto Semiconductors (M) Sdn. Bhd.
Address	Bayan Lepas Free Industrial Zone, Phase 1, 11900 Penang, Malaysia
Test specification:	
Standard	IEC 62471:2006 (First Edition)
Test procedure	N/A
Non-standard test method	N/A
Test Report Form No.	IEC62471A
TRF Originator	VDE Testing and Certification Institute
Master TRF	Dated 2009-05
<p>Copyright © 2009 IEC System for Conformity Testing and Certification of Electrical Equipment (IECEE), Geneva, Switzerland. All rights reserved.</p> <p>This publication may be reproduced in whole or in part for non-commercial purposes as long as the IECEE is acknowledged as copyright owner and source of the material. IECEE takes no responsibility for and will not assume liability for damages resulting from the reader's interpretation of the reproduced material due to its placement and context.</p> <p>If this Test Report Form is used by non-IECEE members, the IECEE/IEC logo and the reference to the CB Scheme procedure shall be removed.</p>	
<p>This report is not valid as a CB Test Report unless signed by an approved CB Testing Laboratory and appended to a CB Test Certificate issued by an NCB in accordance with IECEE 02.</p>	
Test item description	LED Package
Trade Mark	OSRAM
Manufacturer	OSRAM Opto Semiconductors (M) Sdn. Bhd.
Model/Type reference	GW P9LR34.PM
Ratings	10mA to 300mA; 5700K

Test Report No. 7191184236-EEC18-CMF
dated 27 Apr 2018



PSB Singapore

Testing procedure and testing location:	
<input checked="" type="checkbox"/> CB Testing Laboratory: Testing location/ address : <input type="checkbox"/> Associated CB Laboratory: Testing location/ address : Tested by (name + signature) : Approved by (+ signature)..... :	TÜV SÜD PSB Pte Ltd No. 1 Science Park Drive Singapore 118221 <div style="display: flex; justify-content: space-between;"> <div>Chai Ming Fui</div> <div style="text-align: right;"><i>Chai</i></div> </div> <div style="display: flex; justify-content: space-between;"> <div>Derrick Sim</div> <div style="text-align: right;"><i>Sim</i></div> </div>
<input type="checkbox"/> Testing procedure: TMP Tested by (name + signature) : Approved by (+ signature)..... : Testing location/ address :	
<input type="checkbox"/> Testing procedure: WMT Tested by (name + signature) : Witnessed by (+ signature) : Approved by (+ signature)..... : Testing location/ address :	
<input type="checkbox"/> Testing procedure: SMT Tested by (name + signature) : Approved by (+ signature)..... : Supervised by (+ signature) : Testing location/ address :	
<input type="checkbox"/> Testing procedure: RMT Tested by (name + signature) : Approved by (+ signature)..... : Supervised by (+ signature) : Testing location/ address :	

Test Report No. 7191184236-EEC18-CMF
dated 27 Apr 2018



PSB Singapore

Summary of testing:	
Tests performed (name of test and test clause): All applicable tests were conducted	Testing location: As above testing laboratory
Summary of compliance with National Differences: - i) Test was conducted at 45mA (rated) & 300mA (max.). ii) The item tested was found to be in conformity with IEC 62471:2006, and was classified under Risk Group 1 for safety use at 45mA rated current and Risk Group 2 for safety use at 300mA max. current respectively. Labelling and other information provision in accordance to IEC/TR 62471-2 shall be applied. iii) The item tested was found to be in conformity with IEC/TR 62778:2014, refer to Appendix I for test results.	
Copy of marking plate:	
Test item particulars:	
Tested lamp	<input checked="" type="checkbox"/> continuous wave lamps <input type="checkbox"/> pulsed lamps
Tested lamp system	N/A
Lamp classification group	<input type="checkbox"/> exempt <input type="checkbox"/> risk 1 <input checked="" type="checkbox"/> risk 2 <input type="checkbox"/> risk 3
Lamp cap	N/A
Bulb.....	N/A
Rated of the lamp.....	10mA to 300mA
Furthermore marking on the lamp.....	N/A
Seasoning of lamps according IEC standard	N/A
Used measurement instrument.....	In accordance to IEC 62471
Temperature by measurement.....	24 °C
Information for safety use	a) Risk Group 2 based on distance of 200mm for IEC 62471:2006. b) E _{thr} : Tested at 300mA: 1202.72 lux Distance to reach RG1: Tested at 300mA: 570mm min.

Test Report No. 7191184236-EEC18-CMF
dated 27 Apr 2018



PSB Singapore

Possible test case verdicts:

- test case does not apply to the test object : N/A
- test object does meet the requirement..... : P (Pass)
- test object does not meet the requirement..... : F (Fail)

Testing:

Date of receipt of test item : 9 Apr 2018

Date (s) of performance of tests..... : 24 Apr 2018 to 25 Apr 2018

General remarks:

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 point is used as the decimal separator.

List of test equipment must be kept on file and available for review.

This test report contains a total of 32 pages, including appendices (pages 19 to 31) which consist of:

- Appendix I : Test results with IEC/TR 62778:2014
- Appendix II : European Group Differences and National Differences with EN 62471 : 2008
- Appendix III : General view of test setup
- Appendix IV : Additional information
- Appendix V : List of test equipment used

General product information: -

Test Report No. 7191184236-EEC18-CMF
dated 27 Apr 2018



PSB Singapore

IEC 62471			
Clause	Requirement + Test	Result – Remark	Verdict
4	EXPOSURE LIMITS		P
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 broadband source, the effective integrated spectral irradiance, E_s , of the light source shall not exceed the levels defined by:		P
	$E_s \cdot t = \sum_{200}^{400} \sum_t E_\lambda(\lambda, t) \cdot S_{UV}(\lambda) \cdot \Delta t \cdot \Delta \lambda \leq 30 \quad \text{J}\cdot\text{m}^{-2}$		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_{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
	$t_{\max} \leq \frac{10\,000}{E_{UVA}} \quad \text{s}$		P
4.3.3	Retinal blue light hazard exposure limit		P

Test Report No. 7191184236-EEC18-CMF
dated 27 Apr 2018



PSB Singapore

IEC 62471			
Clause	Requirement + Test	Result – Remark	Verdict
	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
	$L_B \cdot t = \sum_{300}^{700} \sum_t L_\lambda(\lambda, t) \cdot B(\lambda) \cdot \Delta\lambda \leq 10^6 \quad \text{J} \cdot \text{m}^{-2} \cdot \text{sr}^{-1}$	for $t \leq 10^4$ s $t_{\max} = \frac{10^6}{L_B}$	N/A
	$L_B = \sum_{300}^{700} L_\lambda \cdot B(\lambda) \cdot \Delta\lambda \leq 100 \quad \text{W} \cdot \text{m}^{-2} \cdot \text{sr}^{-1}$	for $t > 10^4$ s	P
4.3.4	Retinal blue light hazard exposure limit - small source		N/A
	Thus the spectral irradiance at the eye E_λ , weighted against the blue-light hazard function $B(\lambda)$ shall not exceed the levels defined by:	see table 4.2	N/A
	$E_B \cdot t = \sum_{300}^{700} \sum_t E_\lambda(\lambda, t) \cdot B(\lambda) \cdot \Delta\lambda \leq 100 \quad \text{J} \cdot \text{m}^{-2}$	for $t \leq 100$ s	N/A
	$E_B = \sum_{300}^{700} E_\lambda \cdot B(\lambda) \cdot \Delta\lambda \leq 1 \quad \text{W} \cdot \text{m}^{-2}$	for $t > 100$ s	N/A
4.3.5	Retinal thermal hazard exposure limit		P
	To protect against retinal thermal injury, the integrated spectral radiance of the light source, L_λ , weighted by the burn hazard weighting function $R(\lambda)$ (from Figure 4.2 and Table 4.2), i.e., the burn hazard weighted radiance, shall not exceed the levels defined by:		P
	$L_R = \sum_{380}^{1400} L_\lambda \cdot R(\lambda) \cdot \Delta\lambda \leq \frac{50\,000}{\alpha \cdot t^{0,25}} \quad \text{W} \cdot \text{m}^{-2} \cdot \text{sr}^{-1}$	($10 \mu\text{s} \leq t \leq 10$ s)	P
4.3.6	Retinal thermal hazard exposure limit – weak visual stimulus		N/A
	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, L_{IR} , as viewed by the eye for exposure times greater than 10 s shall be limited to:		N/A
	$L_{IR} = \sum_{780}^{1400} L_\lambda \cdot R(\lambda) \cdot \Delta\lambda \leq \frac{6\,000}{\alpha} \quad \text{W} \cdot \text{m}^{-2} \cdot \text{sr}^{-1}$	$t > 10$ s	N/A
4.3.7	Infrared radiation hazard exposure limits for the eye		P

Test Report No. 7191184236-EEC18-CMF
dated 27 Apr 2018



PSB Singapore

IEC 62471			
Clause	Requirement + Test	Result – Remark	Verdict
	The avoid thermal injury of the cornea and possible delayed effects upon the lens of the eye (cataractogenesis), ocular exposure to infrared radiation, E_{IR} , over the wavelength range 780 nm to 3000 nm, for times less than 1000 s, shall not exceed:		P
	$E_{IR} = \sum_{780}^{3000} E_{\lambda} \cdot \Delta\lambda \leq 18\,000 \cdot t^{-0,75} \quad W \cdot m^{-2}$	$t \leq 1000 \text{ s}$	N/A
	For times greater than 1000 s the limit becomes:		P
	$E_{IR} = \sum_{780}^{3000} E_{\lambda} \cdot \Delta\lambda \leq 100 \quad W \cdot m^{-2}$	$t > 1000 \text{ s}$	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
	$E_H \cdot t = \sum_{380}^{3000} \sum_t E_{\lambda}(\lambda, t) \cdot \Delta t \cdot \Delta\lambda \leq 20\,000 \cdot t^{0,25} \quad J \cdot m^{-2}$		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/A
	Seasoning of lamps shall be done as stated in the appropriate IEC lamp standard.		N/A
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/A

Test Report No. 7191184236-EEC18-CMF
dated 27 Apr 2018



PSB Singapore

IEC 62471			
Clause	Requirement + Test	Result – Remark	Verdict
	– the manufacturer' s recommendation		P
5.1.5	Lamp system operation		N/A
	The power source for operation of the test lamp shall be provided in accordance with:		N/A
	– the appropriate IEC standard, or		N/A
	– the manufacturer' s recommendation		N/A
5.2	Measurement procedure		P
5.2.1	Irradiance measurements		P
	Minimum aperture diameter 7mm.		P
	Maximum aperture diameter 50 mm.		P
	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		P
	The measurements made with an optical system.		P
	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.		P
5.2.2.2	Alternative method		N/A
	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/A
5.2.3	Measurement of source size		P
	The determination of α , 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/A
	The determination of Δt , the nominal pulse duration of a source, requires the determination of the time during which the emission is > 50% of its peak value.		N/A
5.3	Analysis methods		P
5.3.1	Weighting curve interpolations		P

Test Report No. 7191184236-EEC18-CMF
dated 27 Apr 2018



PSB Singapore

IEC 62471			
Clause	Requirement + Test	Result – Remark	Verdict
	To standardize interpolated values, use linear interpolation on the log of given values to obtain intermediate points at the wavelength intervals desired.	see table 4.1	P
5.3.2	Calculations		P
	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.	see Annex C in the norm	P
6	LAMP CLASSIFICATION		P
	For the purposes of this standard it was decided that the values shall be reported as follows:	see table 6.1	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/A
	– for all other light sources, including pulsed lamp sources, the hazard values shall be reported at a distance of 200 mm		P
6.1	Continuous wave lamps		P
6.1.1	Exempt Group		N/A
	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/A
	– an actinic ultraviolet hazard (E_s) within 8-hours exposure (30000 s), nor		N/A
	– a near-UV hazard (E_{UVA}) within 1000 s, (about 16 min), nor		N/A
	– a retinal blue-light hazard (L_B) within 10000 s (about 2,8 h), nor		N/A
	– a retinal thermal hazard (L_R) within 10 s, nor		N/A
	– an infrared radiation hazard for the eye (E_{IR}) within 1000 s		N/A
6.1.2	Risk Group 1 (Low-Risk)		P
	In this group are lamps, which exceeds the limits for the except group but that does not pose:	45mA rated current	P

Test Report No. 7191184236-EEC18-CMF
dated 27 Apr 2018



PSB Singapore

IEC 62471			
Clause	Requirement + Test	Result – Remark	Verdict
	– an actinic ultraviolet hazard (E_s) within 10000 s, nor		P
	– a near ultraviolet hazard (E_{UVA}) within 300 s, nor		P
	– a retinal blue-light hazard (L_B) within 100 s, nor		P
	– a retinal thermal hazard (L_R) within 10 s, nor		P
	– an infrared radiation hazard for the eye (E_{IR}) within 100 s		P
	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.		P
6.1.3	Risk Group 2 (Moderate-Risk)		P
	This requirement is met by any lamp that exceeds the limits for Risk Group 1, but that does not pose:	300mA max. current	P
	– an actinic ultraviolet hazard (E_s) within 1000 s exposure, nor		P
	– a near ultraviolet hazard (E_{UVA}) within 100 s, nor		P
	– a retinal blue-light hazard (L_B) within 0,25 s (aversion response), nor		P
	– a retinal thermal hazard (L_R) within 0,25 s (aversion response), nor		P
	– an infrared radiation hazard for the eye (E_{IR}) within 10 s		P
	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.		P
6.1.4	Risk Group 3 (High-Risk)		N/A
	Lamps which exceed the limits for Risk Group 2 are in Group 3.		N/A
6.2	Pulsed lamps		N/A
	Pulse lamp criteria shall apply to a single pulse and to any group of pulses within 0,25 s.		N/A
	A pulsed lamp shall be evaluated at the highest nominal energy loading as specified by the manufacturer.		N/A
	The risk group determination of the lamp being tested shall be made as follows:		N/A
	– a lamp that exceeds the exposure limit shall be classified as belonging to Risk Group 3 (High-Risk)		N/A

Test Report No. 7191184236-EEC18-CMF
dated 27 Apr 2018



PSB Singapore

IEC 62471			
Clause	Requirement + Test	Result – Remark	Verdict
	– 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/A
	– 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/A



Test Report No. 7191184236-EEC18-CMF
dated 27 Apr 2018



PSB Singapore

IEC 62471			
Clause	Requirement + Test	Result – Remark	Verdict

Table 4.1		Spectral weighting function for assessing ultraviolet hazards for skin and eye	
Wavelength ¹ λ , nm	UV hazard function $S_{uv}(\lambda)$	Wavelength λ , 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
308	0,026	395	0,000036
310	0,015	400	0,000030

¹ Wavelengths chosen are representative: other values should be obtained by logarithmic interpolation at intermediate wavelengths.
* Emission lines of a mercury discharge spectrum.

Test Report No. 7191184236-EEC18-CMF
dated 27 Apr 2018



PSB Singapore

IEC 62471			
Clause	Requirement + Test	Result – Remark	Verdict

Table 4.2	Spectral weighting functions for assessing retinal hazards from broadband optical sources		
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	

Test Report No. 7191184236-EEC18-CMF
dated 27 Apr 2018



PSB Singapore

IEC 62471			
Clause	Requirement + Test	Result – Remark	Verdict

Table 4.2	Spectral weighting functions for assessing retinal hazards from broadband optical sources		
	700-1050		$10^{[(700-\lambda)/500]}$
	1050-1150		0,2
	1150-1200		$0,2 \cdot 10^{0,02(1150-\lambda)}$
	1200-1400		0,02



Test Report No. 7191184236-EEC18-CMF
dated 27 Apr 2018



PSB Singapore

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	$E_S = \sum E_\lambda \cdot S(\lambda) \cdot \Delta\lambda$	200 – 400	< 30000	1,4 (80)	30/t
Eye UV-A	$E_{UVA} = \sum E_\lambda \cdot \Delta\lambda$	315 – 400	≤ 1000 > 1000	1,4 (80)	10000/t 10
Blue-light small source	$E_B = \sum E_\lambda \cdot B(\lambda) \cdot \Delta\lambda$	300 – 700	≤ 100 > 100	< 0,011	100/t 1,0
Eye IR	$E_{IR} = \sum E_\lambda \cdot \Delta\lambda$	780 – 3000	≤ 1000 > 1000	1,4 (80)	18000/t ^{0,75} 100
Skin thermal	$E_H = \sum E_\lambda \cdot \Delta\lambda$	380 – 3000	< 10	2π sr	20000/t ^{0,75}

Table 5.5 Summary of the ELs for the retina (radiance based values)					P
Hazard Name	Relevant equation	Wavelength range nm	Exposure duration sec	Field of view radians	EL in terms of constant radiance $W \cdot m^{-2} \cdot sr^{-1}$
Blue light	$L_B = \sum L_\lambda \cdot B(\lambda) \cdot \Delta\lambda$	300 – 700	0,25 – 10 10-100 100-10000 ≥ 10000	$0,011 \cdot \sqrt{(t/10)}$ 0,011 $0,0011 \cdot \sqrt{t}$ 0,1	$10^6/t$ $10^6/t$ $10^6/t$ 100
Retinal thermal	$L_R = \sum L_\lambda \cdot R(\lambda) \cdot \Delta\lambda$	380 – 1400	< 0,25 0,25 – 10	0,0017 $0,011 \cdot \sqrt{(t/10)}$	$50000/(\alpha \cdot t^{0,25})$ $50000/(\alpha \cdot t^{0,25})$
Retinal thermal (weak visual stimulus)	$L_{IR} = \sum L_\lambda \cdot R(\lambda) \cdot \Delta\lambda$	780 – 1400	> 10	0,011	6000/α

Test Report No. 7191184236-EEC18-CMF
dated 27 Apr 2018



PSB Singapore

IEC 62471			
Clause	Requirement + Test	Result – Remark	Verdict

Table 6.1	Emission limits for risk groups of continuous wave lamps				Model: GW P9LR34.PM (measured at 45mA)				P
Risk	Action spectrum	Symbol	Units	Emission Measurement					
				Exempt		Low risk		Mod risk	
				Limit	Result	Limit	Result	Limit	Result
Actinic UV	S _{UV} (λ)	E _s	W•m ⁻²	0,001	0.000E+00	0,003	0.000E+00	0,03	0.000E+00
Near UV		E _{UVA}	W•m ⁻²	10	3.802E-03	33	3.802E-03	100	3.802E-03
Blue light	B(λ)	L _B	W•m ⁻² •sr ⁻¹	100	1.823E+02	10000	3.271E+03	4000000	6.006E+03
Blue light, small source	B(λ)	E _B	W•m ⁻²	1,0*	-	1,0	-	400	-
Retinal thermal	R(λ)	L _R	W•m ⁻² •sr ⁻¹	28000/α	4.066E+04	28000/α	4.066E+04	71000/α	7.466E+04
Retinal thermal, weak visual stimulus**	R(λ)	L _{IR}	W•m ⁻² •sr ⁻¹	6000/α	9.555E-01	6000/α	9.555E-01	6000/α	9.555E-01
IR radiation, eye		E _{IR}	W•m ⁻²	100	1.925E-03	570	1.925E-03	3200	1.925E-03
Angular subtense of apparent source					α= 18.82mrad				
* Small source defined as one with α < 0,011 radian. Averaging field of view at 10000 s is 0,1 radian.									
** Involves evaluation of non-GLS source									

Test Report No. 7191184236-EEC18-CMF
dated 27 Apr 2018



PSB Singapore

IEC 62471			
Clause	Requirement + Test	Result – Remark	Verdict

Table 6.1	Emission limits for risk groups of continuous wave lamps				Model: GW P9LR34.PM (measured at 300mA)				P
Risk	Action spectrum	Symbol	Units	Emission Measurement					
				Exempt		Low risk		Mod risk	
				Limit	Result	Limit	Result	Limit	Result
Actinic UV	S _{UV} (λ)	E _s	W•m ⁻²	0,001	0.000E+00	0,003	0.000E+00	0,03	0.000E+00
Near UV		E _{UVA}	W•m ⁻²	10	2.143E-02	33	2.143E-02	100	2.143E-02
Blue light	B(λ)	L _B	W•m ⁻² •sr ⁻¹	100	1.164E+03	10000	2.051E+04	4000000	3.934E+04
Blue light, small source	B(λ)	E _B	W•m ⁻²	1,0*	-	1,0	-	400	-
Retinal thermal	R(λ)	L _R	W•m ⁻² •sr ⁻¹	28000/α	2.513E+05	28000/α	2.513E+05	71000/α	4.820E+05
Retinal thermal, weak visual stimulus**	R(λ)	L _{IR}	W•m ⁻² •sr ⁻¹	6000/α	3.378E+01	6000/α	3.378E+01	6000/α	3.378E+01
IR radiation, eye		E _{IR}	W•m ⁻²	100	6.773E-03	570	6.773E-03	3200	6.773E-03
Angular subtense of apparent source					α= 18.59mrad				
* Small source defined as one with α < 0,011 radian. Averaging field of view at 10000 s is 0,1 radian.									
** Involves evaluation of non-GLS source									

Test Report No. 7191184236-EEC18-CMF
dated 27 Apr 2018



PSB Singapore

Appendix I

IEC TR 62778			
Clause	Requirement + Test	Result - Remark	Verdict
7	MEASUREMENT INFORMATION FLOW		P
7.1	Basic flow		N/A
	'Law of conservation of luminance' applied		N/A
	Use of only true luminance/radiance values		N/A
	In case of luminaire: The light source is operated in the luminaire under similar conditions as when tested as a component		N/A
	In case E_{thr} value for RG2 was established the peak value was derived from angular light distribution		N/A
7.2	Conditions for the radiance measurement		P
	Standard condition applied (200mm distance, 0,011rad field of view)		P
	Non-standard condition applied		N/A
7.3	Special cases (I): Replacement by a lamp or LED module of another type		N/A
	Light source is a white light source		N/A
	Evaluation done based on highest luminance		N/A
	Evaluation done based on CCT value		N/A
7.4	Special cases (II): Arrays and clusters of primary light sources		N/A
	LED package is evaluated as: <input type="checkbox"/> RG0 unlimited <input type="checkbox"/> RG1 unlimited		N/A
	E_{thr} of LED package applies to array		N/A
8	RISK GROUP CLASSIFICATION		P
	Risk group achieved:		P
	-...Risk Group 0 unlimited		N/A
	-...Risk Group 1 unlimited		P
	- E_{thr} (lx) : Distance to reach RG1 (m) :	Tested at 300mA: 1202.72 Tested at 300mA: 570mm min.	P

Test Report No. 7191184236-EEC18-CMF
dated 27 Apr 2018



PSB Singapore

Appendix I – Cont'd

IEC TR 62778				
Clause	Requirement + Test		Result - Remark	Verdict
	TABLE: Spectroradiometric measurement			
	Measurement performed on:	<input checked="" type="checkbox"/> LED package <input type="checkbox"/> LED module <input type="checkbox"/> Lamp <input type="checkbox"/> Luminaire		
	Model number	GW P9LR34.PM		
	Test voltage (V)	N/A 22.1 (measured)		—
	Test current (mA)	45mA (rated)		—
	Test frequency (Hz)	DC		—
	Ambient, t (°C)	25°C (thermally stabilized)		—
	Measurement distance	<input checked="" type="checkbox"/> 20 cm <input type="checkbox"/> ... cm		—
	Source size	<input checked="" type="checkbox"/> Non-small <input type="checkbox"/> Small :mm		—
	Field of view	<input type="checkbox"/> 100 mrad <input checked="" type="checkbox"/> 11 mrad <input type="checkbox"/> 1,7 mrad (for small sources)		—
	Item	Symbol	Units	Result
	Correlated colour temperature	CCT	K	5814
	x/y colour coordinates			0.3256/0.3374
	Blue light hazard radiance	L _B	W/(m ² •sr ¹)	3271
	Blue light hazard irradiance	E _B	W/m ²	N/A
	Luminance	L	cd/m ²	4273000
	Illuminance	E	lx	N/A
	See Remark 1)			
	Additional information:			
	Peak wavelength		nm	450
	Blue light hazard radiance	L _B	W/(m ² •sr ¹)	182.3
	Luminance	L	cd/m ²	238200
	Blue light hazard radiance	L _B	W/(m ² •sr ¹)	6006
	Luminance	L	cd/m ²	7846000
	At 100mrad (20mm source size)			
	At 1.7mrad (0.34mm source size)			
	Supplementary information:			
	1) Test was performed in accordance to clause 5.2.2.1 Standard radiance measurement method of IEC 62471:2006 (First edition).			

Test Report No. 7191184236-EEC18-CMF
dated 27 Apr 2018



PSB Singapore

Appendix I – Cont'd

IEC TR 62778					
Clause	Requirement + Test	Result - Remark	Verdict		
	TABLE: Spectroradiometric measurement				
	Measurement performed on:	<input checked="" type="checkbox"/> LED package <input type="checkbox"/> LED module <input type="checkbox"/> Lamp <input type="checkbox"/> Luminaire			
	Model number	GW P9LR34.PM			
	Test voltage (V)	N/A 26.3 (measured)	—		
	Test current (mA)	300mA (max.)	—		
	Test frequency (Hz)	DC	—		
	Ambient, t (°C)	25°C (thermally stabilized)	—		
	Measurement distance	<input checked="" type="checkbox"/> 20 cm <input type="checkbox"/> ... cm	—		
	Source size	<input checked="" type="checkbox"/> Non-small <input type="checkbox"/> Small :mm	—		
	Field of view	<input type="checkbox"/> 100 mrad <input checked="" type="checkbox"/> 11 mrad <input type="checkbox"/> 1,7 mrad (for small sources)	—		
	Item	Symbol	Units	Result	Remark
	Correlated colour temperature	CCT	K	6008	
	x/y colour coordinates			0.3220/0.3315	
	Blue light hazard radiance	L _B	W/(m ² •sr ¹)	20510	See Remark 1)
	Blue light hazard irradiance	E _B	W/m ²	N/A	See Remark 1)
	Luminance	L	cd/m ²	24660000	
	Illuminance	E	Lx	N/A	See Remark 1)
Additional information:					
	Peak wavelength		Nm	445	
	Blue light hazard radiance	L _B	W/(m ² •sr ¹)	1164	At 100mrad (20mm source size)
	Luminance	L	cd/m ²	1400000	At 100mrad (20mm source size)
	Blue light hazard radiance	L _B	W/(m ² •sr ¹)	39340	At 1.7mrad (0.34mm source size)
	Luminance	L	cd/m ²	47310000	At 1.7mrad (0.34mm source size)
Supplementary information:					
1) Test was performed in accordance to clause 5.2.2.1 Standard radiance measurement method of IEC 62471:2006 (First edition).					

Test Report No. 7191184236-EEC18-CMF
dated 27 Apr 2018



PSB Singapore

Appendix I – Cont'd

IEC TR 62778			
Clause	Requirement + Test	Result - Remark	Verdict
	TABLE: Angular light distribution		N/A



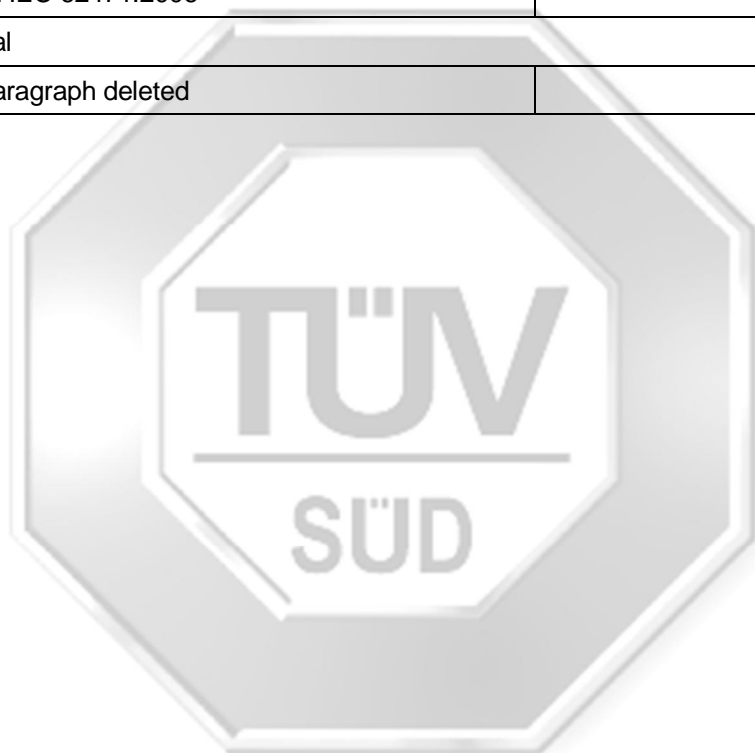
Test Report No. 7191184236-EEC18-CMF
dated 27 Apr 2018



PSB Singapore

Appendix II

EN 62471			
Clause	Requirement + Test	Result – Remark	Verdict
	CENELEC COMMON MODIFICATIONS (EN)		P
4	EXPOSURE LIMITS		P
	Contents of the whole Clause 4 of IEC 62471:2006 moved into a new informative Annex ZB		—
	Clause 4 replaced by the following:		P
	Limits of the Artificial Optical Radiation Directive (2006/25/EC) have been applied instead of those fixed in IEC 62471:2006	See appended Table 6.1 on pages 24-27	P
4.1	General		N/A
	First paragraph deleted		—



Test Report No. 7191184236-EEC18-CMF
dated 27 Apr 2018



PSB Singapore

Appendix II – Cont'd

EN 62471			
Clause	Requirement + Test	Result – Remark	Verdict

Table 6.1	Emission limits for risk groups of continuous wave lamps (based on EU Directive 2006/25/EC)				Model: GW P9LR34.PM (measured at 45mA)				P
Risk	Action spectrum	Symbol	Units	Emission Measurement					
				Exempt		Low risk		Mod risk	
				Limit	Result	Limit	Result	Limit	Result
Actinic UV	S _{UV} (λ)	E _s	W•m ⁻²	0,001	0.00E+00	-	-	-	-
Near UV		E _{UVA}	W•m ⁻²	0,33	3.802E-03	-	-	-	-
Blue light	B(λ)	L _B	W•m ⁻² •sr ⁻¹	100	1.823E+02	10000	3.271E+03	4000000	6.006E+03
Blue light, small source	B(λ)	E _B	W•m ⁻²	0,01*	-	1,0	-	400	-
Retinal thermal	R(λ)	L _R	W•m ⁻² •sr ⁻¹	28000/α	4.066E+04	28000/α	4.066E+04	71000/α	7.466E+04
Retinal thermal, weak visual stimulus**	R(λ)	L _{IR}	W•m ⁻² •sr ⁻¹	545000 0,0017≤ α ≤ 0,011	-				
				6000/α 0,011≤ α ≤ 0,1					
IR radiation, eye		E _{IR}	W•m ⁻²	100	1.925E-03	570	1.925E-03	3200	1.925E-03
Angular subtense of apparent source					α= 18.82mrad				

Test Report No. 7191184236-EEC18-CMF
dated 27 Apr 2018



PSB Singapore

Appendix II – Cont'd

Table 6.1	Emission limits for risk groups of continuous wave lamps (based on EU Directive 2006/25/EC)	Model: GW P9LR34.PM (measured at 45mA)	P
<p>* Small source defined as one with $\alpha < 0,011$ radian. Averaging field of view at 10000 s is 0,1 radian.</p> <p>** Involves evaluation of non-GLS source</p> <p>NOTE The action functions: see Table 4.1 and Table 4.2 The applicable aperture 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.</p>			



Test Report No. 7191184236-EEC18-CMF
dated 27 Apr 2018



PSB Singapore

Appendix II – Cont'd

EN 62471			
Clause	Requirement + Test	Result – Remark	Verdict

Table 6.1		Emission limits for risk groups of continuous wave lamps (based on EU Directive 2006/25/EC)			Model: GW P9LR34.PM (measured at 300mA)			P	
Risk	Action spectrum	Symbol	Units	Emission Measurement					
				Exempt		Low risk		Mod risk	
				Limit	Result	Limit	Result	Limit	Result
Actinic UV	S _{UV} (λ)	E _s	W•m ⁻²	0,001	0.00E+00	-	-	-	-
Near UV		E _{UVA}	W•m ⁻²	0,33	2.143E-02	-	-	-	-
Blue light	B(λ)	L _B	W•m ⁻² •sr ⁻¹	100	1.164E+03	10000	2.051E+04	4000000	3.934E+04
Blue light, small source	B(λ)	E _B	W•m ⁻²	0,01*	-	1,0	-	400	-
Retinal thermal	R(λ)	L _R	W•m ⁻² •sr ⁻¹	28000/α	2.513E+05	28000/α	2.513E+05	71000/α	4.820E+05
Retinal thermal, weak visual stimulus**	R(λ)	L _{IR}	W•m ⁻² •sr ⁻¹	545000 0,0017≤ α ≤ 0,011	-				
				6000/α 0,011≤ α ≤ 0,1	3.378E+01				
IR radiation, eye		E _{IR}	W•m ⁻²	100	6.773E-03	570	6.773E-03	3200	6.773E-03
Angular subtense of apparent source					α= 18.59mrad				

Test Report No. 7191184236-EEC18-CMF
dated 27 Apr 2018



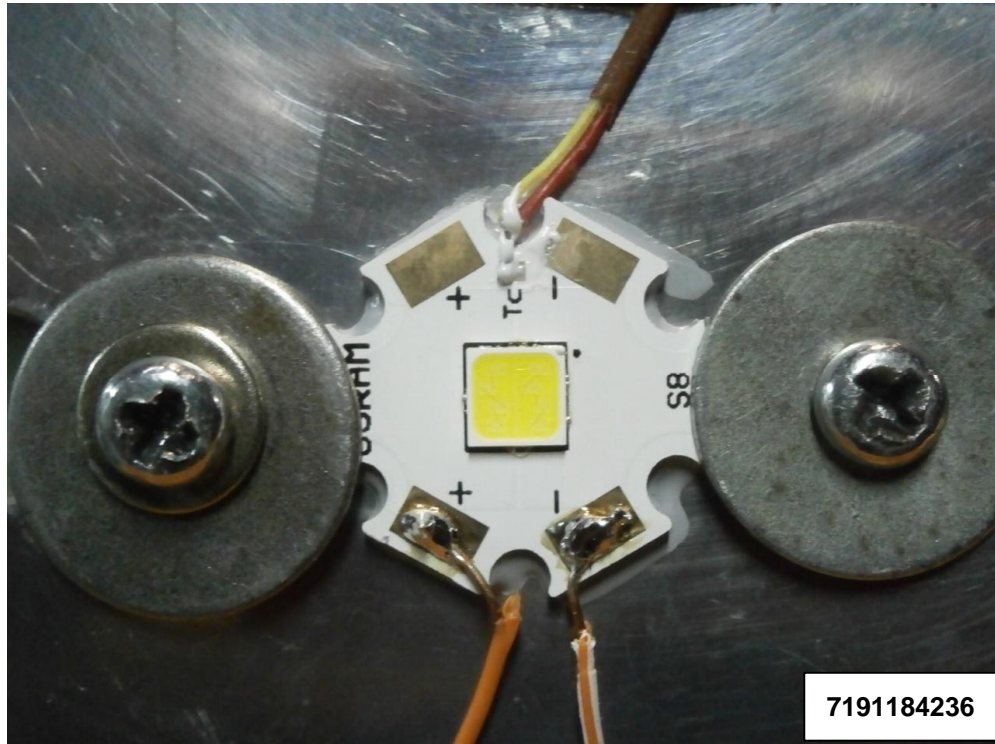
PSB Singapore

Appendix II – Cont'd

Table 6.1	Emission limits for risk groups of continuous wave lamps (based on EU Directive 2006/25/EC)	Model: GW P9LR34.PM (measured at 300mA)	P
<p>* Small source defined as one with $\alpha < 0,011$ radian. Averaging field of view at 10000 s is 0,1 radian.</p> <p>** Involves evaluation of non-GLS source</p> <p>NOTE The action functions: see Table 4.1 and Table 4.2 The applicable aperture 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.</p>			

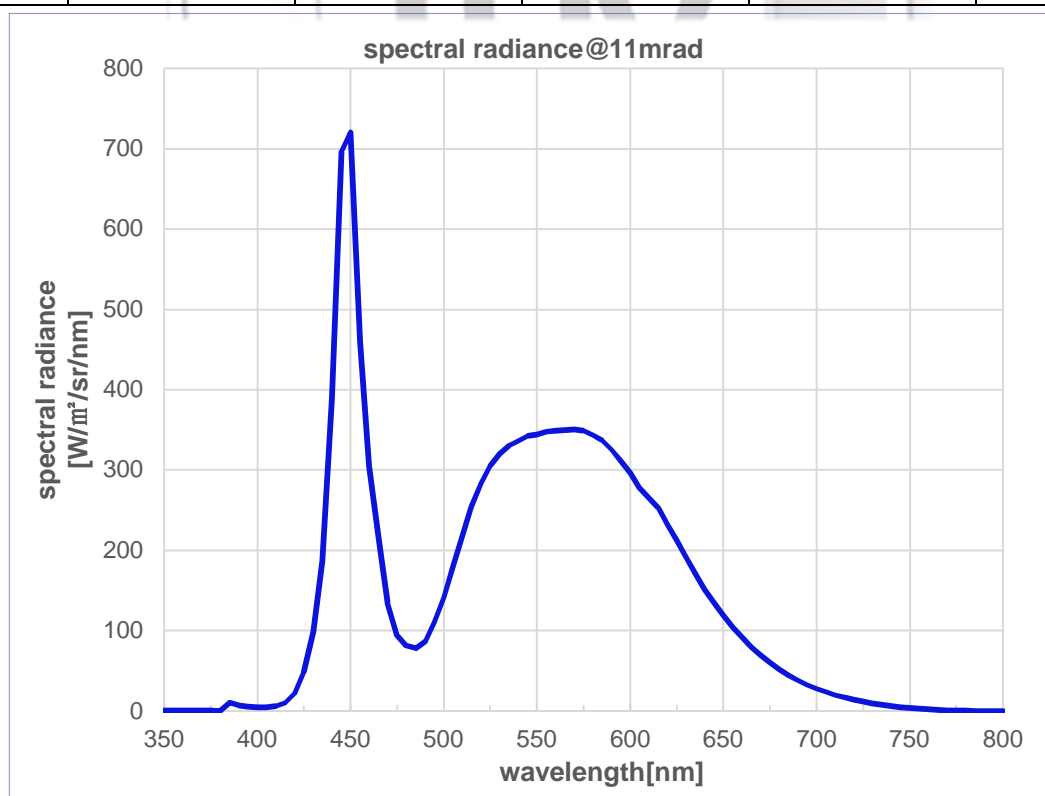


Appendix III
General view of test setup



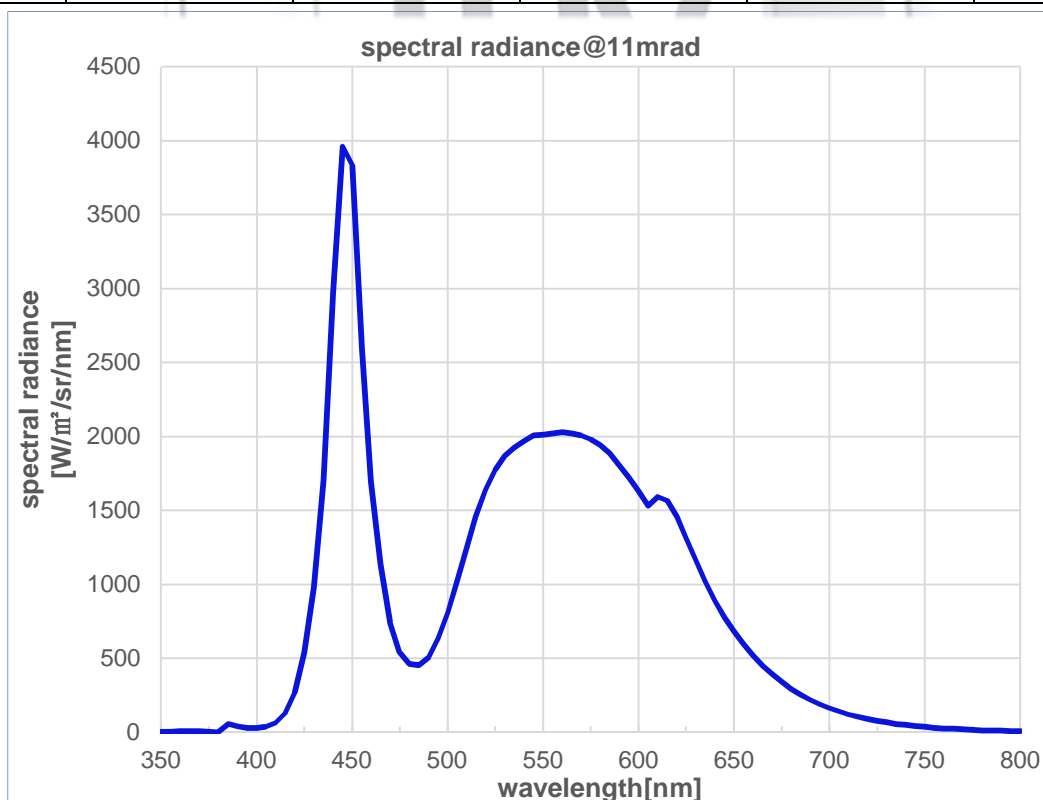
Appendix IV
Additional information

Measured LED voltage (VDC)			22.1					
Test current (mA)			45					
Measured system power (W)			1					
Ambient temperature (°C)			25 (thermally stabilized)					
Burning position			Refer to test setup on Appendix III					
Peak wavelength			450					
Risk	Symbol	Units	Limit	Result	Limit	Result	Limit	Result
Blue light	L _B	W•m ⁻² •sr ⁻¹	100	182.3	10000	3271	4000000	6006
Risk group classification.....:			RG0		RG1		RG2	
			<input type="checkbox"/>		<input checked="" type="checkbox"/>		<input type="checkbox"/>	
Field of view (mrad)	Distance (mm)	Diameter (mm)	Luminance (cd/m ²)		Blue light, L _B (W•m ⁻² •sr ⁻¹)		Exposure limit, t _{max} (mins)	
1.7	200	0.34	7846000		6006		2.8	
11	200	2.2	4273000		3271		5.1	
100	200	20	238200		182.3		91.4	



Appendix IV – Cont'd
Additional information

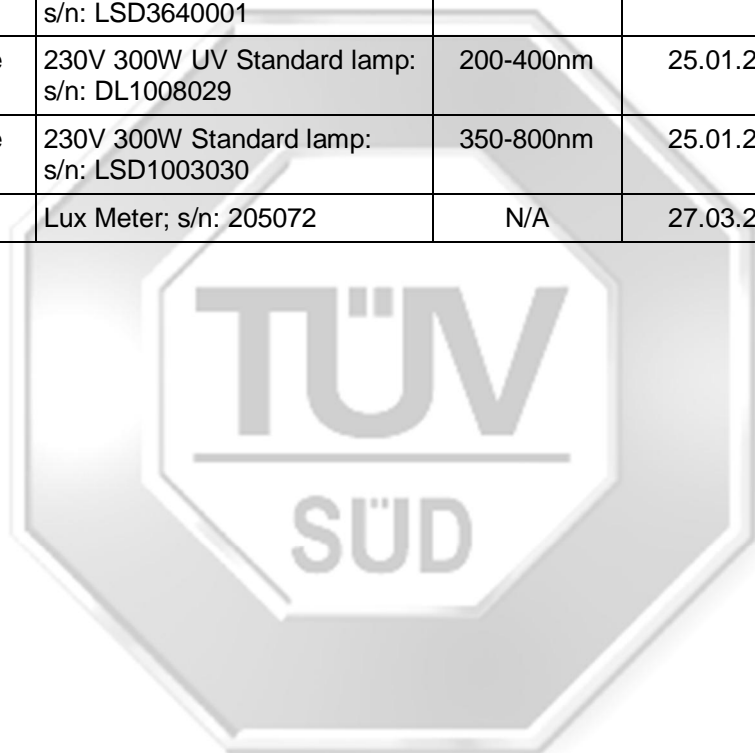
Measured LED voltage (VDC)			26.3					
Test current (mA)			300					
Measured system power (W)			7.9					
Ambient temperature (°C)			25 (thermally stabilized)					
Burning position			Refer to test setup on Appendix III					
Peak wavelength			445					
Risk	Symbol	Units	Limit	Result	Limit	Result	Limit	Result
Blue light	L _B	W•m ⁻² •sr ⁻¹	100	1164	10000	20510	4000000	39340
Risk group classification.....:			RG0		RG1		RG2	
			<input type="checkbox"/>		<input type="checkbox"/>		<input checked="" type="checkbox"/>	
Field of view (mrad)	Distance (mm)	Diameter (mm)	Luminance (cd/m ²)		Blue light, L _B (W•m ⁻² •sr ⁻¹)		Exposure limit, t _{max} (mins)	
1.7	200	0.34	47310000		39340		0.4	
11	200	2.2	24660000		20510		0.8	
100	200	20	1400000		1164		14.3	





Appendix V
List of test equipment used

Measurement / testing	Testing / measuring equipment / material used, (Equipment ID)	Range used	Last Calibration date	Calibration due date
Electrical values	Digital Power Meter; s/n: 91G634627	N/A	07.06.2017	07.06.2018
Electrical values	Programmable DC Power Supply; s/n: 62150EF00283	N/A	23.05.2017	23.05.2018
Spectral radiance and irradiance	CCD camera and lens, and spectroradiometer; ID: SUV50100906xx	N/A	Cal before use	Cal before use
Spectral radiance	36V 400W Standard lamp; s/n: LSD3640001	350-800nm	25.01.2018	25.01.2019
Spectral irradiance	230V 300W UV Standard lamp: s/n: DL1008029	200-400nm	25.01.2018	25.01.2019
Spectral irradiance	230V 300W Standard lamp: s/n: LSD1003030	350-800nm	25.01.2018	25.01.2019
Illuminance	Lux Meter; s/n: 205072	N/A	27.03.2018	27.03.2019



Test Report No. 7191184236-EEC18-CMF
dated 27 Apr 2018



PSB Singapore

Please note that this Report is issued under the following terms :

1. This report applies to the sample of the specific product/equipment given at the time of its testing/calibration. The results are not used to indicate or imply that they are applicable to other similar items. In addition, such results must not be used to indicate or imply that TÜV SÜD PSB approves, recommends or endorses the manufacturer, supplier or user of such product/equipment, or that TÜV SÜD PSB in any way "guarantees" the later performance of the product/equipment. Unless otherwise stated in this report, no tests were conducted to determine long term effects of using the specific product/equipment.
2. The sample/s mentioned in this report is/are submitted/supplied/manufactured by the Client. TÜV SÜD PSB therefore assumes no responsibility for the accuracy of information on the brand name, model number, origin of manufacture, consignment or any information supplied.
3. Nothing in this report shall be interpreted to mean that TÜV SÜD PSB has verified or ascertained any endorsement or marks from any other testing authority or bodies that may be found on that sample.
4. This report shall not be reproduced wholly or in parts and no reference shall be made by the Client to TÜV SÜD PSB or to the report or results furnished by TÜV SÜD PSB in any advertisements or sales promotion.
5. Unless otherwise stated, the tests were carried out in TÜV SÜD PSB Pte Ltd, No.1 Science Park Drive Singapore 118221.

July 2011



LED Family:

DURIS® S 8

Corresponding photo biological safety report:

7191184236-EEC18-CMF

LED	Test Status	Test Current	IEC 62471:2006	IEC 62778:2014
GW P9LR34.PM	Tested Device	45mA	RG1	RG1 unlimited
		300mA	RG2	RG2
		Est. equivalent to		
GW P9LR34.EM	Covered device	45mA	RG1	RG1 unlimited
		300mA	RG2	RG2
		Est. equivalent to		
GW P9LR35.PM	Covered Device	180mA	RG1	RG1 unlimited
		1200mA	RG2	RG2

This Risk group assessment shall only be used in combination with the eye safety report according to IEC 62471:2006 & IEC 62778:2014.

END OF DOCUMENT