Test Report issued under the responsibility of:

TEST REPORT
IEC 62471
Photobiological safety of lamps and lamp systems

Report Reference No. ..... :	3175390.50A
Date of issue ..... :	2015-12-11
Total number of pages ..... :	22
CB Testing Laboratory ..... :	DEKRA Testing and Certification (Shanghai) Ltd.
Address ..... :	3/F, #250, Jiangchangsan Road building 16 Headquater Economy Park Shibei Hi-Tech Park, Zhabei District, Shanghai, P.R.C 200436
Applicant's name ..... :	Lumileds Malaysia Sdn. Bhd.
Address ..... :	No. 3 , Lintang Bayan Lepas 8, Phase 4, Bayan Lepas Industrial Park, 11900 Penang, Malaysia
Test specification:	
Standard ..... :	IEC 62471:2006 (First Edition)
Test procedure ..... :	CB
Non-standard test method…….. :	N/A
Test Report Form No. ..... :	IEC62471A
TRF Originator ..... :	VDE Testing and Certification Institute
Master TRF ..... :	Dated 2009-05

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.

Test item description ..... :	LUXEON 3535L HE part number MXA7-PW65-H001
Trade Mark ..... :	LUMILEDS
Manufacturer ..... :	Lumileds Malaysia Sdn. Bhd. No. 3 , Lintang Bayan Lepas 8, Phase 4, Bayan Lepas Industrial Park, 11900 Penang, Malaysia
Model/Type reference ..... :	MXA7-PW65-H001/LUXEON 3535L group
Ratings ..... :	I_f = 300 mA, 3,2 V

Testing procedure and testing location:	
☒ **CB Testing Laboratory:**	DEKRA Testing and Certification (Shanghai) Ltd.
Testing location/ address .....:	3F, #250 Jiangchangsan Road, Building 16, Headquarter Economy Park Shibei Hi-Tech Park, Zhabei District, Shanghai, 200436, China
☐ ~~**Associated CB Laboratory:**~~	
~~Testing location/ address .....:~~	
Tested by (name + signature) .....:	Zhijun Wang
Approved by (+ signature) .....:	Hanson Zhang
☐ ~~Testing procedure: TMP~~	
~~Tested by (name + signature) .....:~~	
~~Approved by (+ signature).....:~~	
~~Testing location/ address .....:~~	
☐ ~~Testing procedure: WMT~~	
~~Tested by (name + signature) .....:~~	
~~Witnessed by (+ signature) .....:~~	
~~Approved by (+ signature).....:~~	
~~Testing location/ address .....:~~	
☐ ~~Testing procedure: SMT~~	
~~Tested by (name + signature) .....:~~	
~~Approved by (+ signature).....:~~	
~~Supervised by (+ signature) .....:~~	
~~Testing location/ address .....:~~	
☐ ~~Testing procedure: RMT~~	
~~Tested by (name + signature) .....:~~	
~~Approved by (+ signature).....:~~	
~~Supervised by (+ signature) .....:~~	
~~Testing location/ address .....:~~	

Summary of testing:	
Tests performed (name of test and test clause): These tests fulfil the requirements of standard ISO/IEC 17025. When determining the test conclusion, the Measurement Uncertainty of test has been considered. The tested sample of LED chip list as below MXA7-PW65-H001/LUXEON 3535L group Have been tested according to the IEC 62471(first edition, 2006-07) and been classified as **Exempt Group** Have been tested according to the EN 62471:2008 and been classified as **Risk Group 1 for blue light hazard.**	**Testing location:** DEKRA Testing and Certification (Shanghai) Ltd. 3F, #250 Jiangchangsan Road, Building 16, Headquarter Economy Park Shibei Hi-Tech Park, Zhabei District, Shanghai, 200436, China
Summary of compliance with National Differences: Pass	
Copy of marking plate: N/A	

Test item particulars ..... :	
Tested lamp ..... :	☒ continuous wave lamps ☐ pulsed lamps
Tested lamp system ..... :	N/A
Lamp classification group ..... :	☒ exempt ☐ risk 1 ☐ risk 2 ☐ risk 3
Lamp cap ..... :	N/A
Bulb ..... :	LEDs
Rated of the lamp ..... :	I_f = 300 mA, 3,2 V
Furthermore marking on the lamp ..... :	N/A
Seasoning of lamps according IEC standard ..... :	N/A
Used measurement instrument ..... :	spectroradiometer
Temperature by measurement ..... :	23-28 °C
Information for safety use ..... :	--

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 ..... : 2015-10

Date (s) of performance of tests ..... : 2015-10

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 comma (point) is used as the decimal separator.
List of test equipment must be kept on file and available for review.

The product complied with the following standards:
IEC 62471:2006
IEC/TR 62471-2:2009
EN 62471:2008
IEC/TR 62778:2014

This report should be read in conjunction with the attached pages concerned with the European group differences and national differences of the standards EN 62471:2008 with the reference number of 3175395.50B. (2 pages)

Factory Location:
Lumileds Malaysia Sdn. Bhd.
No. 3 , Lintang Bayan Lepas 8, Phase 4, Bayan Lepas Industrial Park, 11900 Penang, Malaysia

General product information:

The sample tested MXA7-PW65-H001 with ANSI bin 6500K is part of the larger LUXEON 3535L Line series which include LUXEON 3535L HE, LUXEON 3535L and LUXEON 3535LS group. The sample measured, MXA7-PW65-H001 has the highest typical flux and therfore the highest typical device luminance level within the complete LUXEON LUXEON 3535L Line (consists of LUXEON 3535L HE, LUXEON 3535L and LUXEON 3535LS, see appendix 5 for the datasheet from customer). The present classification is thus valid for all LUXEON product MXAn-PWnn-nnnn from ANSI bins equal to 6500K or lower CCT (see IEC/TR 62778)..

Detailed spec can be checked and download from the following website:

http://www.lumileds.com/

The product is considered as no GLS product which should be evaluated at 200mm.

The sample of MXA7-PW65-H001/LUXEON 3535L group was tested at 200mm from the light source. CCT of the spectral irradiance was found at 7943 K.

The angular substance of the product is less than 11 mrad. It should belong to blue light small source considering the blue light hazard.

From the Appendix 6 (Provided by client) also can double confirm the sample belong to blue light small source considering the blue light hazard.

Type test was performed both according to IEC 62471:2006 procedure and IEC/TR 62778 :2014 procedure,

For details evaluation according to IEC/TR 62778 :2014, Please refer to Appendix 4 mentioned in this report

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 cd·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 J·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
	$E_s \cdot t = \sum_{200}^{400} \sum_{t} E_\lambda(\lambda,t) \cdot S_{UV}(\lambda) \cdot \Delta t \cdot \Delta\lambda \le 30$ J·m^{-2}		P
	The permissible time for exposure to ultraviolet radiation incident upon the unprotected eye or skin shall be computed by:		P
	$t_{max} = \frac{30}{E_s}$ 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 J·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 W·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
	$t_{max} \le \frac{10\,000}{E_{UVA}}$ s		P
4.3.3	Retinal blue light hazard exposure limit		N/A
	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(λ), i.e., the blue-light weighted radiance , L_B, shall not exceed the levels defined by:		N/A
	$L_B \cdot t = \sum_{300}^{700} \sum_{t} L_\lambda(\lambda,t) \cdot B(\lambda) \cdot \Delta t \cdot \Delta\lambda \le 10^6$ J · m^{-2} · sr^{-1}	for t ≤ 10^4 s $t_{max} = \frac{10^6}{L_B}$	N/A

IEC 62471			
Clause	Requirement + Test	Result – Remark	Verdict
	$L_B = \sum_{300}^{700} L_\lambda \cdot B(\lambda) \cdot \Delta\lambda \le 100$ $W \cdot m^{-2} \cdot sr^{-1}$	for t > 10^4 s	N/A
4.3.4	Retinal blue light hazard exposure limit - small source		P
	Thus the spectral irradiance at the eye E_λ, weighted against the blue-light hazard function B(λ) shall not exceed the levels defined by:	see table 4.2	P
	$E_B \cdot t = \sum_{300}^{700} \sum_{t} E_\lambda(\lambda,t) \cdot B(\lambda) \cdot \Delta t \cdot \Delta\lambda \le 100$ $J \cdot m^{-2}$	for t ≤ 100 s	P
	$E_B = \sum_{300}^{700} E_\lambda \cdot B(\lambda) \cdot \Delta\lambda \le 1$ $W \cdot m^{-2}$	for t > 100 s	P
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
	$L_R = \sum_{380}^{1400} L_\lambda \cdot R(\lambda) \cdot \Delta\lambda \le \frac{50\,000}{\alpha \cdot t^{0,25}}$ $W \cdot m^{-2} \cdot sr^{-1}$	(10 µs ≤ t ≤ 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
	$L_{IR} = \sum_{780}^{1400} L_\lambda \cdot R(\lambda) \cdot \Delta\lambda \le \frac{6\,000}{\alpha}$ $W \cdot m^{-2} \cdot sr^{-1}$	t > 10 s	N/A
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, E_{IR}, over the wavelength range 780 nm to 3000 nm, for times less than 1000 s, shall not exceed:		P
	$E_{IR} = \sum_{780}^{3\,000} E_\lambda \cdot \Delta\lambda \le 18\,000 \cdot t^{-0,75}$ $W \cdot m^{-2}$	t ≤ 1000 s	P
	For times greater than 1000 s the limit becomes:		P
	$E_{IR} = \sum_{780}^{3\,000} E_\lambda \cdot \Delta\lambda \le 100$ $W \cdot m^{-2}$	t > 1000 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

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Clause	Requirement + Test	Result – Remark	Verdict
	$E_H \cdot t = \sum_{380}^{3\,000} \sum_{t} E_\lambda(\lambda,t) \cdot \Delta t \cdot \Delta\lambda \le 20\,000 \cdot t^{0,25}$ $J \cdot m^{-2}$		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:		N/A
	– the appropriate IEC lamp standard, or		N/A
	– 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

IEC 62471			
Clause	Requirement + Test	Result – Remark	Verdict
	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		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 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
	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		P

IEC 62471			
Clause	Requirement + Test	Result – Remark	Verdict
	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		P
6.1.2	Risk Group 1 (Low-Risk)		N/A
	In this group are lamps, which exceeds the limits for the except group but that does not pose:		N/A
	– an actinic ultraviolet hazard (E_S) within 10000 s, nor		N/A
	– a near ultraviolet hazard (E_{UVA}) within 300 s, nor		N/A
	– a retinal blue-light hazard (L_B) within 100 s, 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 100 s		N/A
	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/A
6.1.3	Risk Group 2 (Moderate-Risk)		N/A
	This requirement is met by any lamp that exceeds the limits for Risk Group 1, but that does not pose:		N/A
	– an actinic ultraviolet hazard (E_S) within 1000 s exposure, nor		N/A
	– a near ultraviolet hazard (E_{UVA}) within 100 s, nor		N/A
	– a retinal blue-light hazard (L_B) within 0,25 s (aversion response), nor		N/A
	– a retinal thermal hazard (L_R) within 0,25 s (aversion response), nor		N/A
	– an infrared radiation hazard for the eye (E_{IR}) within 10 s		N/A
	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/A
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

IEC 62471			
Clause	Requirement + Test	Result – Remark	Verdict
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
	– 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

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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.

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
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)				
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)				
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

IEC 62471			
Clause	Requirement + Test	Result – Remark	Verdict

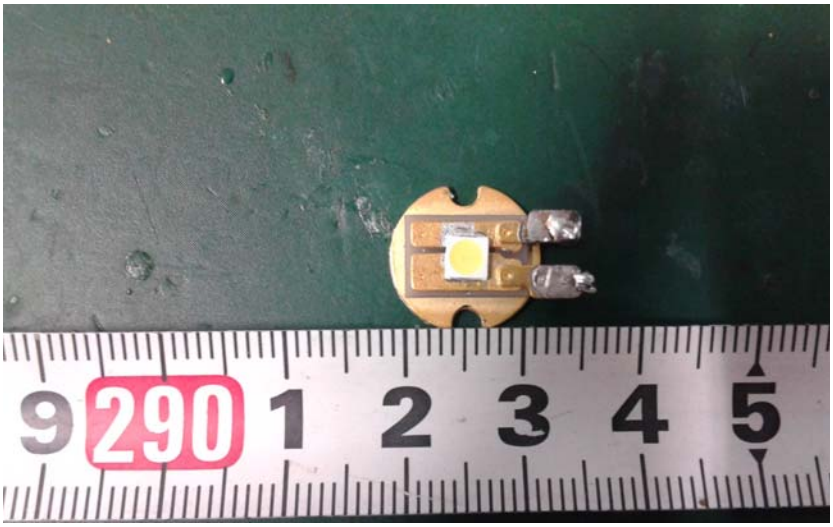
Table 6.1	Emission limits for risk groups of continuous wave lamps (MXA7-PW65-H001/LUXEON 3535L group, α=11 mrad)								P
Risk	Action spectrum	Symbol	Units	Emission Measurement					
				Exempt		Low risk		Mod risk	
				Limit	Result	Limit	Result	Limit	Result
Actinic UV	$S_{UV}(\lambda)$	E_s	$W \cdot m^{-2}$	0,001	0,0000	0,003		0,03	
Near UV		E_{UVA}	$W \cdot m^{-2}$	10	0,0000	33		100	
Blue light	B(λ)	L_B	$W \cdot m^{-2} \cdot sr^{-1}$	100		10000		4000000	
Blue light, small source	B(λ)	E_B	$W \cdot m^{-2}$	1,0*	0,96	1,0		400	
Retinal thermal	R(λ)	L_R	$W \cdot m^{-2} \cdot sr^{-1}$	28000/α	234968,01	28000/α		71000/α	
Retinal thermal, weak visual stimulus**	R(λ)	L_{IR}	$W \cdot m^{-2} \cdot sr^{-1}$	6000/α	--	6000/α		6000/α	
IR radiation, eye		E_{IR}	$W \cdot m^{-2}$	100	0,01	570		3200	
* 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									

Furthermore remarks:

Appenix 1: List of test equipment used:

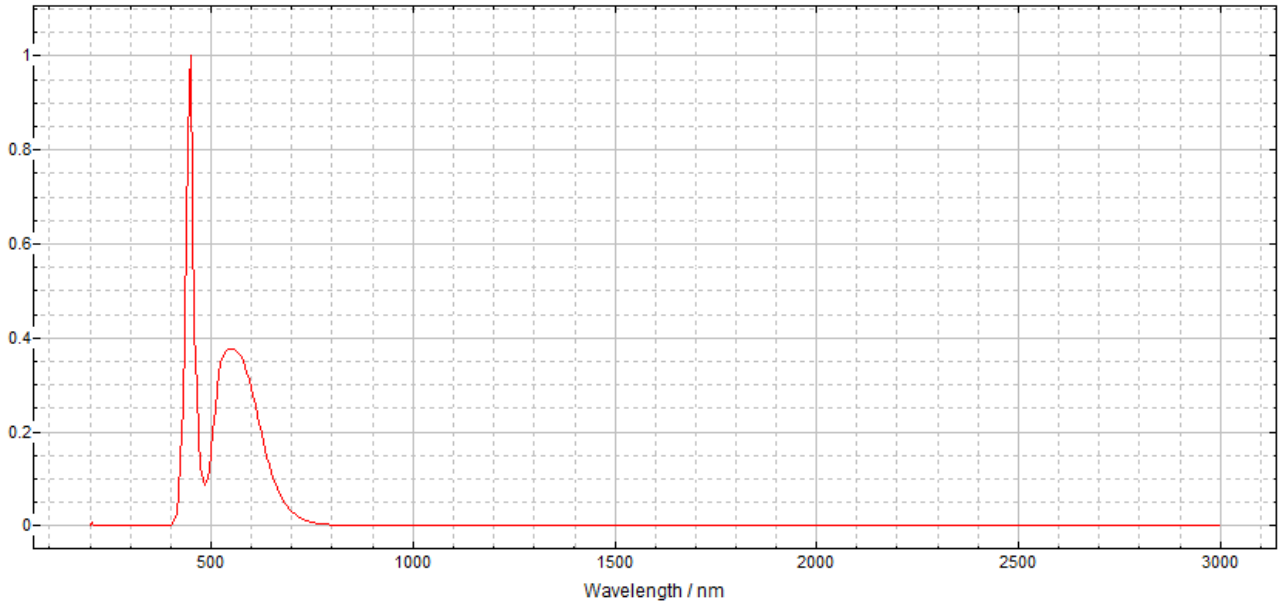
Clause	Measurement/ testing	Registration Number	Testing/measuring equipment/material used	Range used
5	Irradiance measurements Radiance measurements	SH 344	MONOCHROMATOR	200-3000nm
5	Radiance measurements	SH 345	S009 TELESCOPE	300-1400nm
5	Irradiance measurements	SH 346	S400_417 DETECTION ELECTRONIC	--
5	Irradiance measurements Radiance measurements	SH 347	608 CONSTANT CURRENT	--
5	Radiance measurements	SH 348	SRS12 RADIANCE	300-1400nm
5	Irradiance measurements	SH 349	705 DEUTERIUM SUPPLY	200-400nm
5	Irradiance measurements	SH 350	CL6 STANDARD	300-3000nm
5	Irradiance measurements	SH 351	CL7 STANDARD	200-400nm
5	Irradiance measurements Radiance measurements	SH 352	PHOTOMULTIPLIER	200-850nm
5	Irradiance measurements Radiance measurements	SH 353	INGAAS DETECTOR	800-1700nm
5	Irradiance measurements Radiance measurements	SH 354	SILICON DETECTOR	200-1100nm
5	Irradiance measurements	SH 355	PBS-TE DETECTOR	1000-3000nm
5	Irradiance measurements	SH 356	RELAY OPTIC	--
5	Irradiance measurements Radiance measurements	SH 357	D8 INTEGRATING SPHER	1000-3000nm
5	Irradiance measurements	SH 358	D7 COSINE DIFFUSER	200-1100nm
5	Irradiance measurements	SH 359	PHOTOMETRIC DETECTOR	380nm-800nm
5	Irradiance measurements Radiance measurements	SH070	WATTMETER	500 V, 40 A

Appendix 2: Photo documentation

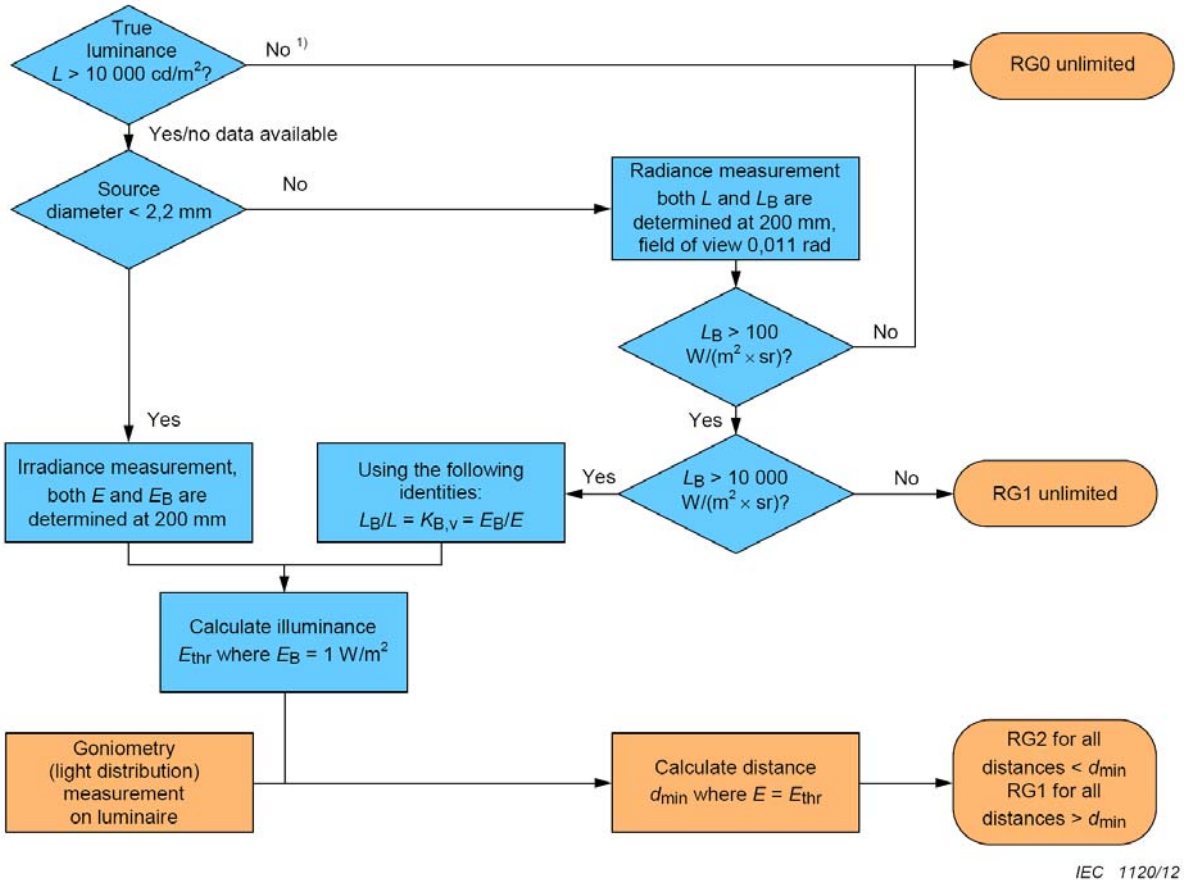


Overview

Appendix 3: Relative spectrum of tested sample



Appendix 4: Evaluation procedure according to IEC 62778: 2014



Evaluation of MXA7-PW65-H001/LUXEON 3535L group

True Luminance Judgment or Measurement:
☒ L>10000cd/m^2 ☐ L⩽10000cd/m2

Source Diameter:
☒ D<2,2mm ☐ D⩾2,2mm

Irradiance Measurement Results at 200mm: ☐ Not applicable
Value E= 880 lux
Value E_B= 0,96 W m^{-2}
$K_{B,V}$= 1,09 x 10^{-3} W/lm

Radiance Measurement Results at 200mm & 11mrad: ☒ Not applicable
Value L=
Value L_B=
$K_{B,V}$=

$L_B/L=K_{B,V}=E_B/E$
Calculate illuminance E_{thr} where E_B=1W/m^2: ☒ Not applicable
E_{thr}=

Calculate distance d_{min} where E=E_{thr}: ☒ Not applicable
d_{min}=

Classification Result:
☒ RG0 ☐ RG1 ☐ RG2

Appendix 5 Products Data sheet (Provided by clients as product information)

Product Selection Guide

Table 1. Product performance of LUXEON 3535L Line at 100mA and 65mA, T_j=25°C.

PRODUCT	NOMINAL CCT [1]	MINIMUM CRI [2]	LUMINOUS FLUX [3] (lm)		TYPICAL LUMINOUS EFFICACY (lm/W)	TYPICAL LUMINOUS FLUX (lm)	TYPICAL LUMINOUS EFFICACY (lm/W)	PART NUMBER
			MINIMUM	TYPICAL				
			100mA			65mA		
LUXEON 3535LS	4000K	70	38	44	147	30	158	MXA7-PW40-S001
	5000K	70	38	44	147	30	158	MXA7-PW50-S001
	5700K	70	38	44	147	30	158	MXA7-PW57-S001
	6500K	70	38	46	154	31	166	MXA7-PW65-S001
	2200K	80	26	30	100	20	108	MXA8-PW22-S001
	2500K	80	26	32	107	22	116	MXA8-PW25-S001
	2700K	80	30	38	127	26	137	MXA8-PW27-S001
	3000K	80	30	39	130	26	141	MXA8-PW30-S001
	3500K	80	30	41	137	28	148	MXA8-PW35-S001
	4000K	80	34	43	144	29	155	MXA8-PW40-S001
	5000K	80	34	43	144	29	155	MXA8-PW50-S001
	5700K	80	30	42	140	28	151	MXA8-PW57-S001
	6500K	80	30	42	140	28	151	MXA8-PW65-S001
	2700K	85	30	33	110	22	119	MXA9-PW27-S111
	4000K	85	24	32	107	22	116	MXA9-PW40-S111
	2700K	90	26	32	107	22	116	MXA9-PW27-S001
	3000K	90	26	32	107	22	116	MXA9-PW30-S001
LUXEON 3535L	4000K	70	40	49	161	33	176	MXA7-PW40-0000
	5000K	70	40	49	161	33	176	MXA7-PW50-0000
	5700K	70	40	49	161	33	176	MXA7-PW57-0000
	6500K	70	40	47	155	32	168	MXA7-PW65-0000
	2200K	80	28	33	109	22	117	MXA8-PW22-0000
	2500K	80	28	34	112	23	121	MXA8-PW25-0000
	2700K	80	36	44	145	30	156	MXA8-PW27-0000
	3000K	80	34	44	145	30	156	MXA8-PW30-0000
	3500K	80	34	44	145	30	156	MXA8-PW35-0000
	4000K	80	36	46	151	31	163	MXA8-PW40-0000
	5000K	80	36	47	155	32	167	MXA8-PW50-0000
	5700K	80	36	45	148	30	160	MXA8-PW57-0000
	6500K	80	36	45	148	30	160	MXA8-PW65-0000
	2700K	85	32	36	119	24	128	MXA9-PW27-0000
	4000K	85	34	40	132	27	142	MXA9-PW40-0000
	2700K	90	31	36	119	24	128	MXA9-PW27-9000
	3000K	90	31	36	119	24	128	MXA9-PW30-0000
LUXEON 3535L HE	4000K	70	42	51	176	34	186	MXA7-PW40-H001
	5000K	70	42	51	176	34	186	MXA7-PW50-H001
	5700K	70	42	51	176	34	186	MXA7-PW57-H001
	6500K	70	42	51	176	34	186	MXA7-PW65-H001
	2200K	80	30	35	121	23	128	MXA8-PW22-H001
	2500K	80	30	36	125	24	132	MXA8-PW25-H001
	2700K	80	38	46	159	31	168	MXA8-PW27-H001
	3000K	80	38	46	159	31	168	MXA8-PW30-H001
	3500K	80	40	46	159	31	168	MXA8-PW35-H001
	4000K	80	42	48	166	32	175	MXA8-PW40-H001
	5000K	80	42	48	166	32	175	MXA8-PW50-H001
	5700K	80	42	48	166	32	175	MXA8-PW57-H001
	6500K	80	42	48	166	32	175	MXA8-PW65-H001
	2700K	90	32	37	128	25	135	MXA9-PW27-H001
	3000K	90	32	37	128	25	135	MXA9-PW30-H001
	3500K	90	32	40	138	27	146	MXA9-PW35-H001
	4000K	90	32	41	142	27	150	MXA9-PW40-H001
	5000K	90	32	41	142	27	150	MXA9-PW50-H001
	5700K	90	32	40	138	27	146	MXA9-PW57-H001
	6500K	90	32	40	138	27	146	MXA9-PW65-H001

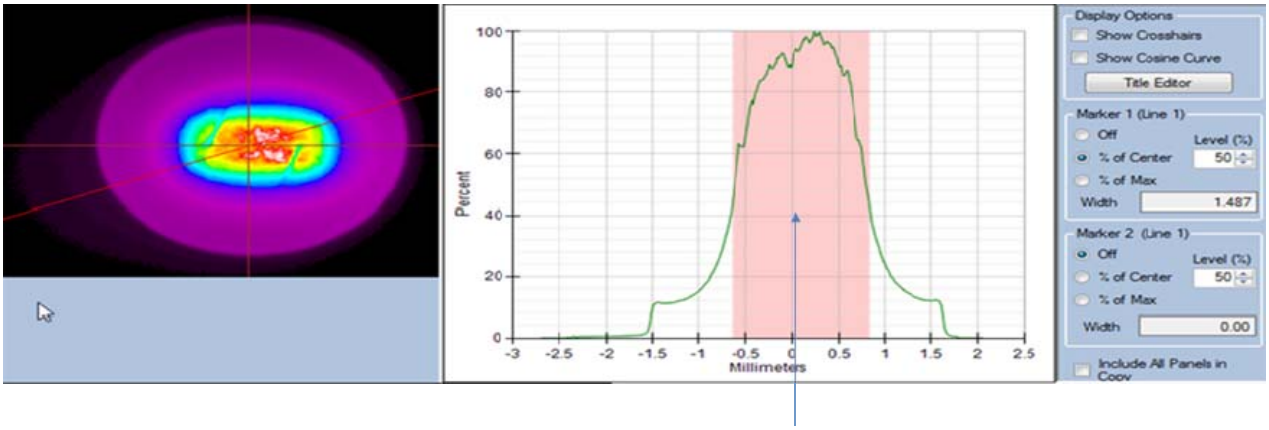
Note: All products in LUXEON 3535L, 3535LS and 3535L HE share the same package construction and outline but has different die size. LUXEON 3535L HE (MXAx-PWxx-H001) uses the largest die and driven at the highest drive current (at 300mA max. See below). Also all the three models share the same spectra shape. See figure 1a, 1b and 1c of the datasheet.

Absolute Maximum Ratings

Table 4. Absolute maximum ratings for LUXEON 3535L Line.

PARAMETER	MAXIMUM PERFORMANCE
DC Forward Current [1,2]	200mA for MXAx-PWxx-S001 and MXAx-PWxx-0000 300mA for MXAx-PWxx-H001
Peak Pulsed Forward Current [1,3]	240mA for MXAx-PWxx-S001 and MXAx-PWxx-0000 350mA for MXAx-PWxx-H001

Appendix 6 Product source size determination (Provided by clients as product information)



Note: The pink shaded area is the 50% of the max emission point. The diameter for the source size is therefor 1.487mm and therefore the sample MXA7-PW65-H001 is considered small source