Test Report issued under the responsibility of:

DEKRA

TEST REPORT
IEC TR 62778
Application of IEC 62471 for the assessment of blue light hazard to light sources and luminaires

Report Number..... :	6067217.50P
Date of issue ..... :	2020-05-12
Total number of pages	33
Name of Testing Laboratory preparing the Report ..... :	DEKRA Testing and Certification (Shanghai) Ltd. 3/F, #250, Jiangchangsan Road building 16 Headquater Economy Park Shibei Hi-Tech Park, Jing'an District, Shanghai, P.R.C 200436
Applicant's name ..... :	Lumileds (Shanghai) Management Co., Ltd.
Address..... :	Building 1-A, No. 19 & 20, Lane 299, Wenshui Road, Jinan District, Shanghai, P. R. China, 200072
Test specification:	
Standard ..... :	IEC TR 62778:2014 (Second Edition)
Test procedure..... :	CB Scheme
Non-standard test method ..... :	N/A
Test Report Form No. ..... :	IEC62778A
Test Report Form(s) Originator .... :	TÜV SÜD Product Service GmbH
Master TRF ..... :	Dated 2016-02

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.

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.

General disclaimer:

The test results presented in this report relate only to the object tested.
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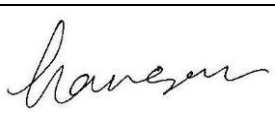
The purpose of this report is only for export activities.

Test item description	LED module
Trade Mark	LUMILEDS
Manufacturer	Lumileds (Shanghai) Management Co., Ltd. Building 1-A, No. 19 & 20, Lane 299,Wenshui Road, Jinan District, Shanghai, P. R. China, 200072
Model/Type reference	LUXEON CX Plus CoB - High Density series (Detailed lists refer to Appendix 2: Model List)
Ratings	Type reference / I_{rated} / I_{max} L2C4 - AABBCS01F04GG / 175mA / 350mA L2C4 - AABBCS01FH6GG / 175mA / 350mA L2C4 - AABBCS02F06GG / 350mA / 700mA L2C4 - AABBCS04F09GG / 700mA / 1400mA L2C4 - AABBCS02F04GG / 175mA / 350mA L2C4 - AABBCS02FH6GG / 175mA / 350mA Vmax:45Vdc (Detailed lists refer to Appendix 2: Model List)

Responsible Testing Laboratory (as applicable), testing procedure and testing location(s):			
☒	**CB Testing Laboratory:**	DEKRA Testing and Certification (Shanghai) Ltd.	
Testing location/ address		3/F, #250, Jiangchangsan Road building 16 Headquater Economy Park Shibei Hi-Tech Park, Jing'an District, Shanghai, P.R.C 200436	
☐	~~Associated CB Testing Laboratory:~~		
~~Testing location/ address~~			
Tested by (name, function, signature)		Zhijun Wang	
Approved by (name, function, signature)		Hanson Zhang	
☐	~~Testing procedure: CTF Stage 1:~~		
~~Testing location/ address~~			
~~Tested by (name, function, signature)~~			
~~Approved by (name, function, signature)~~			
☐	~~Testing procedure: CTF Stage~~		

	~~2:~~		
~~Testing location/ address .....~~			
~~Tested by (name + signature) .....~~			
~~Witnessed by (name, function, signature) .....~~			
~~Approved by (name, function, signature) .....~~			
☐	~~Testing procedure: CTF Stage 3:~~		
☐	~~Testing procedure: CTF Stage 4:~~		
~~Testing location/ address .....~~			
~~Tested by (name, function, signature)~~			
~~Witnessed by (name, function, signature) .....~~			
~~Approved by (name, function, signature) .....~~			
~~Supervised by (name, function, signature) .....~~			

List of Attachments (including a total number of pages in each attachment):

- Appendix 1: Photo Documentation
- Appendix 2: Model List
- Appendix 3: Relative Spectrum Of Tested Sample(s)
- Appendix 4: Table 6.1 Based On IEC 62471:2006
- Appendix 5: Table 6.1 Based On EN62471:2008, Attachment To IEC 62471 European Group Differences And National Differences
- Appendix 6: Blue Light Hazard-forward Current Relationship (Non-mandatory Information)

Summary of testing:

Tests performed (name of test and test clause):	**Testing location:**
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 L2C4-30802S02F0600 (350mA) has been tested according to the IEC/TR 62778:2014 and been classified as **RG 1 Unlimited for blue light hazard**. L2C4-57803S02F0600 has been tested according to the IEC/TR 62778:2014 and been classified as **RG 2 for blue light hazard**. The sample of L2C4-57803S02F0600 was tested at 175mA, 350mA, 525mA and 700mA. Current at RG1 to RG2 boundary was deducted to be 131mA. (See appendix 6 for detail).	DEKRA Testing and Certification (Shanghai) Ltd. 3/F, #250, Jiangchangsan Road building 16 Headquater Economy Park Shibei Hi-Tech Park, Jing'an District, Shanghai, P.R.C 200436

Summary of compliance with National Differences (List of countries addressed): EN Standards

EN 62471:2008

☒ **The product fulfills the requirements**

Copy of marking plate:

The artwork below may be only a draft. The use of certification marks on a product must be authorized by the respective NCBs that own these marks.

N/A

Test item particulars.....:	See below
Product evaluated.....:	☐ **LED package** ☒ **LED module** ☐ **Lamp** ☐ **Luminaire**
Rated voltage (V) .....:	34-45 Vdc
Rated current (mA) .....:	Type reference / I_{rated} / I_{max} L2C4 - AABBCS01F04GG / 175mA / 350mA L2C4 - AABBCS01FH6GG / 175mA / 350mA L2C4 - AABBCS02F06GG / 350mA / 700mA L2C4 - AABBCS04F09GG / 700mA / 1400mA L2C4 - AABBCS02F04GG / 175mA / 350mA L2C4 - AABBCS02FH6GG / 175mA / 350mA
Rated CCT (K).....:	--
Rated Luminance (Mcd/m^2) .....:	--
Component report data used .....:	☒ **Not applicable** ☐ **LED package** ☐ **LED module** ☐ **Lamp** Report number: --
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 .....:	2019-11-19
Date (s) of performance of tests.....:	2019-11-19 to 2020-05-11

General remarks:

"(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.

The product complied with the following standards:

☒IEC 62471:2006
☒EN 62471:2008
☐IEC/TR 62471-2:2009
☒IEC/TR 62778:2014

Manufacturer's Declaration per sub-clause 4.2.5 of IECEE 02:	
The application for obtaining a CB Test Certificate includes more than one factory location and a declaration from the Manufacturer stating that the sample(s) submitted for evaluation is (are) representative of the products from each factory has been provided ..... :	☐ **Yes** ☒**Not applicable**

When differences exist; they shall be identified in the General product information section.

Name and address of factory (ies) ..... : Lumileds (Shanghai) Management Co., Ltd.
Building 1-A, No. 19 & 20, Lane 299,
Wenshui Road, Jinan District,
Shanghai, P. R. China, 200072

General product information:

Full tests were performed on model L2C4-30802S02F0600 and L2C4-57803S02F0600 .

The samples were considered as typical case which should be evaluated at 200mm.

The sample of L2C4-30802S02F0600 (350mA) was tested at 200mm from the light source. The CCT of spectral irradiance was found at 2894 K.

The sample of L2C4-57803S02F0600 (175mA) was tested at 200mm from the light source. The CCT of spectral irradiance was found at 4941 K.

The sample of L2C4-57803S02F0600 (350mA) was tested at 200mm from the light source. The CCT of spectral irradiance was found at 4993 K.

The sample of L2C4-57803S02F0600 (525mA) was tested at 200mm from the light source. The CCT of spectral irradiance was found at 5057 K.

The sample of L2C4-57803S02F0600 (700mA) was tested at 200mm from the light source. The CCT of spectral irradiance was found at 5142 K.

Base on the Model list which listed on the appendix 2, The tested sample can be considered as
☐ typical product ☒ worst product
Which the results can be reference used for the other models.

Type test was performed according to IEC 62471:2006 procedure.

Amendment 1 report:

The report is issued to base on original test report No. 6049427.50P dated on 2019-03-06 ,including the following modification:

- Add new tests.

After review, full tests were performed on model L2C4-30802S02F0600.

IEC TR 62778			
Clause	Requirement + Test	Result - Remark	Verdict

7	**MEASUREMENT INFORMATION FLOW**		**P**
7.1	**Basic flow**		**P**
	'Law of conservation of luminance' applied		N/A
	Use of only true luminance/radiance values		P
	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 ..... :	☐RG0 unlimited ☐ 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	L2C4-30802S02F0600 (350mA)	P
	- E_{thr}..... (lx) : Distance to reach RG1 ..... (m) :	Refer to the Supplementary information of **TABLE:Spectroradiometric measurement** as following	P

	TABLE:Spectroradiometric measurement		
	Measurement performed on:	☐ **LED package** ☒ **LED module** ☐ **Lamp** ☐ **Luminaire**	
	Model number	L2C4-30802S02F0600 (350mA)	
	Test voltage (V)	37 Vdc	—
	Test current (mA)	350 mA	—
	Test frequency (Hz)	--	—
	Ambient, t(°C)	25**°C**	—
	Measurement distance	☒ 20 cm ☐ ... cm	—
	Source size	☒ Non-small ☐ Small :	—
	Field of view	☐ 100 mrad ☒ 11 mrad ☐ 1,7 mrad (for small sources)	—

Item	Symbol	Units	Result	Remark
Correlated colour temperature	CCT	K	2894	
x/y colour coordinates			0,4496/0,4163	
Blue light hazard radiance	L_B	$W/(m^2 \cdot sr^1)$	9,76E+03	@11mrad
Blue light hazard irradiance	E_B	W/m^2	--	
Luminance	L	cd/m^2	2,96E+07	@11mrad
Illuminance	E	lx	1,44E+04	

Supplementary information:
N/A

	TABLE:Spectroradiometric measurement		
	Measurement performed on:	☐ **LED package** ☒ **LED module** ☐ **Lamp** ☐ **Luminaire**	
	Model number	L2C4-57803S02F0600 (175mA)	
	Test voltage (V)	35 Vdc	—
	Test current (mA)	175 mA	—
	Test frequency (Hz)	--	—
	Ambient, t(°C)	25**°C**	—
	Measurement distance	☒ 20 cm ☐ ... cm	—
	Source size	☒ Non-small ☐ Small :	—
	Field of view	☐ 100 mrad ☒ 11 mrad ☐ 1,7 mrad (for small sources)	—

Item	Symbol	Units	Result	Remark
Correlated colour temperature	CCT	K	4941	
x/y colour coordinates			0,3485/0,3701	
Blue light hazard radiance	L_B	$W/(m^2 \cdot sr^1)$	1,33E+04	@11mrad
Blue light hazard irradiance	E_B	W/m^2	--	
Luminance	L	cd/m^2	1,59E+07	@11mrad
Illuminance	E	lx	9,71E+03	

Supplementary information:

Per IEC/TR 62778:2014
Ethr= 1191 lx

Dmin= 571 mm

	TABLE:Spectroradiometric measurement		
	Measurement performed on:	☐ **LED package** ☒ **LED module** ☐ **Lamp** ☐ **Luminaire**	
	Model number	L2C4-57803S02F0600 (350mA)	
	Test voltage (V)	37,8 Vdc	—
	Test current (mA)	350 mA	—
	Test frequency (Hz)	--	—
	Ambient, t(°C)	25**°C**	—
	Measurement distance	☒ 20 cm ☐ ... cm	—
	Source size	☒ Non-small ☐ Small :	—
	Field of view	☐ 100 mrad ☒ 11 mrad ☐ 1,7 mrad (for small sources)	—

Item	Symbol	Units	Result	Remark
Correlated colour temperature	CCT	K	4993	
x/y colour coordinates			0,3468/0,3684	
Blue light hazard radiance	L_B	$W/(m^2 \cdot sr^1)$	2,41E+04	@11mrad
Blue light hazard irradiance	E_B	W/m^2	--	
Luminance	L	cd/m^2	2,75E+07	@11mrad
Illuminance	E	lx	1,77E+04	

Supplementary information:

Per IEC/TR 62778:2014
Ethr= 1144 lx

Dmin= 787 mm

	TABLE:Spectroradiometric measurement		
	Measurement performed on:	☐ **LED package** ☒ **LED module** ☐ **Lamp** ☐ **Luminaire**	
	Model number	L2C4-57803S02F0600 (525mA)	
	Test voltage (V)	40,2 Vdc	—
	Test current (mA)	525mA	—
	Test frequency (Hz)	--	—
	Ambient, t(°C)	25**°C**	—
	Measurement distance	☒ 20 cm ☐ ... cm	—
	Source size	☒ Non-small ☐ Small :	—
	Field of view	☐ 100 mrad ☒ 11 mrad ☐ 1,7 mrad (for small sources)	—

Item	Symbol	Units	Result	Remark
Correlated colour temperature	CCT	K	5057	
x/y colour coordinates			0,3448/0,3657	
Blue light hazard radiance	L_B	$W/(m^2 \cdot sr^1)$	3,38E+04	@11mrad
Blue light hazard irradiance	E_B	W/m^2	--	
Luminance	L	cd/m^2	3,67E+07	@11mrad
Illuminance	E	lx	2,40E+04	

Supplementary information:

Per IEC/TR 62778:2014
Ethr= 1086 lx

Dmin= 941 mm

	TABLE:Spectroradiometric measurement		
	Measurement performed on:	☐ **LED package** ☒ **LED module** ☐ **Lamp** ☐ **Luminaire**	
	Model number.....	L2C4-57803S02F0600 (700mA)	
	Test voltage (V)	42,5 Vdc	—
	Test current (mA)	700mA	—
	Test frequency (Hz).....	--	—
	Ambient, t(°C)	25**°C**	—
	Measurement distance.....	☒ 20 cm ☐ ... cm	—
	Source size	☒ Non-small ☐ Small :	—
	Field of view	☐ 100 mrad ☒ 11 mrad ☐ 1,7 mrad (for small sources)	—

Item	Symbol	Units	Result	Remark
Correlated colour temperature	CCT	K	5142	
x/y colour coordinates			0,3421/0,3623	
Blue light hazard radiance	L_B	$W/(m^2 \cdot sr^1)$	4,02E+04	@11mrad
Blue light hazard irradiance	E_B	W/m^2	--	
Luminance	L	cd/m^2	4,16E+07	@11mrad
Illuminance	E	lx	2,84E+04	

Supplementary information:

Per IEC/TR 62778:2014
Ethr= 1036 lx

Dmin= 1047 mm

	TABLE: Angular light distribution	N/A

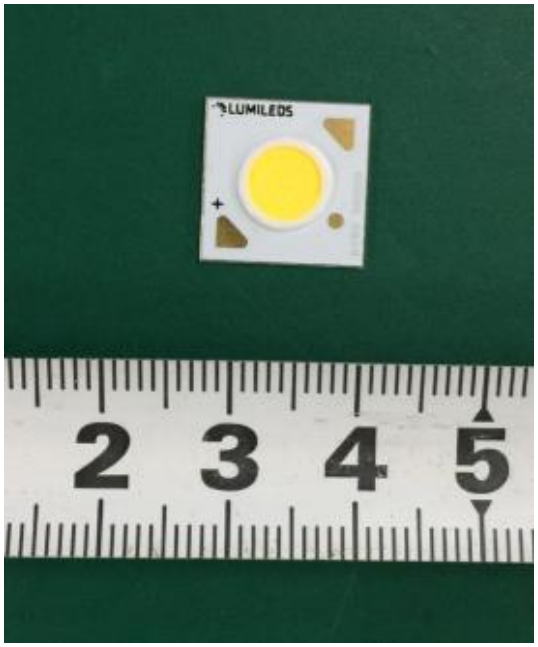
List of test equipment used:

A completed list of used test equipment shall be provided in the Test Reports when a Manufacturer Testing Laboratory according to CTF stage 1 or CTF stage 2 procedure has been used.
Note: This page may be removed when CTF stage 1 CTF stage 2 are not used. See also clause 4.8 in OD 2020 for more details.

Clause	Measurement / testing	Testing / measuring equipment / material used, (Equipment ID)	Range used	Last Calibration date	Calibration due date
7	Irradiance measurements Radiance measurements	IDR 300 Monochromator (SH 344)	200-3000nm	/	/
7	Radiance measurements	S009 Telescope (SH 345)	300-1400nm	/	/
7	Radiance measurements	SRS 12 Radiance Standard (SH 348)	300-1400nm	2019/2/27	2020/2/26
7	Irradiance measurements	CL6 Spectral irradiance standard (SH 350)	300-3000nm	2019/2/27	2020/2/26
7	Irradiance measurements	CL7 Spectral irradiance standard (SH 351)	200-400nm	2019/2/27	2020/2/26
7	Irradiance measurements	Photometric detector head (SH 359)	380nm-800nm	2019/2/26	2020/2/25
7	Irradiance measurements Radiance measurements	Wattmeter (SH030)	500V,40A	2019/10/10	2020/10/10

Appendix 1: Photo Documentation

L2C4-30802S02F0600



L2C4-57803S02F0600

Appendix 2: Model List

L2C4-57803S02F0600, and L2C4-30802S02F0600 are part of Lumileds LUXEON CX Plus CoB -High Density product line. The samples are 5700K, and 3000K CCT respectively, and we got different hazard classifications for them at different driven current. The tested sample of L2C4-57803S02F0600 is with the highest CCT in that product line, the classifications are thus valid (worst case) within the LUXEON CX Plus CoB -High Density product line with part number L2C4 - AABBCDDDEFFGG, where AA represents nominal ANSI CCT bins can be equal to or lower than the tested CCT values (see TR IEC62778), and BB represents CRI ranging from 80 and above, and C represents product configuration, and DDD represents options for product configuration, and FF represents for light emitting surface (LES) size, and GG represents for options for product specification. See the appendix below for an explanation of the type designation.

L 2 C 4 - A A B B C D D D E F F G G
Where
A A: designates nominal CCT (e.g. 27=2700K, 30=3000K, 35=3500K, 40=4000K, 50=5000K, 57=5700K or any nominal CCT less than 5700K)
B B: designates minimum CRI (e.g. 80=80CRI, 90=90CRI, 95=95CRI or any CRI greater than min 80)
C: designates SDCM (2=2-step MacAdam ellipse, 3=3-step MacAdam ellipse)
D D D: designates product configuration (e.g. S01, S02, S04)
E: designates options for product specification
F F: designates light emitting surface (LES) size (04=4.5mm, H6=6mm, 06=6mm, 09=9mm)
G G: designates options for product specification (00=standard, B0= Below Black Body Line)

Model No.	Drive current (mA)/% of max current	CCT					
		2700K	3000K	3500K	4000K	5000K	5700K
L2C4 - AABBCS01F04GG	350 / 100%	RG2	RG2	RG2	RG2	RG2	RG2
	175 / 50%	RG1 Unlimited	RG1 Unlimited	RG2	RG2	RG2	RG2
	66 / 19%	RG1 Unlimited	RG1 Unlimited	RG1 Unlimited	RG1 Unlimited	RG1 Unlimited	RG1 Unlimited
L2C4 - AABBCS01FH6GG	350 / 100%	RG2	RG2	RG2	RG2	RG2	RG2
	175 / 50%	RG1 Unlimited	RG1 Unlimited	RG2	RG2	RG2	RG2
	66 / 19%	RG1 Unlimited	RG1 Unlimited	RG1 Unlimited	RG1 Unlimited	RG1 Unlimited	RG1 Unlimited
L2C4 - AABBCS02F06GG	700 / 100%	RG2	RG2	RG2	RG2	RG2	RG2
	350 / 50%	RG1 Unlimited	RG1 Unlimited	RG2	RG2	RG2	RG2
	131 / 19%	RG1 Unlimited	RG1 Unlimited	RG1 Unlimited	RG1 Unlimited	RG1 Unlimited	RG1 Unlimited
L2C4 - AABBCS04F09GG	1400 / 100%	RG2	RG2	RG2	RG2	RG2	RG2
	700 / 50%	RG1 Unlimited	RG1 Unlimited	RG2	RG2	RG2	RG2
	262 / 19%	RG1 Unlimited	RG1 Unlimited	RG1 Unlimited	RG1 Unlimited	RG1 Unlimited	RG1 Unlimited

L2C4 - AABBCS02F04GG	350 / 100%	RG2	RG2	RG2	RG2	-	-
	175 / 50%	RG1 Unlimited	RG1 Unlimited	RG2	RG2	-	-
	66 / 19%	RG1 Unlimited	RG1 Unlimited	RG1 Unlimited	RG1 Unlimited	-	-
L2C4 - AABBCS02FH6GG	350 / 100%	RG2	RG2	RG2	RG2	-	-
	175 / 50%	RG1 Unlimited	RG1 Unlimited	RG2	RG2	-	-
	66 / 19%	RG1 Unlimited	RG1 Unlimited	RG1 Unlimited	RG1 Unlimited	-	-

Note:"-" means no such products

Supplementary information:
Per IEC/TR 62778:2014, the estimated Ethr and Dmin values for different part numbers are listed below:
These values are very conservative in regards to margin of safety.
Ethr (lx):

Model No.	**Drive current (mA)/% of max current**	**CCT**					
		2700K	**3000K**	**3500K**	**4000K**	**5000K**	**5700K**
L2C4 - AABBCS01F 04GG	350 / 100%	1036	1036	1036	1036	1036	1036
	175 / 50%	N/A	N/A	1144	1144	1144	1144
	88 / 25%	N/A	N/A	1191	1191	1191	1191
L2C4 - AABBCS01FH6GG	350 / 100%	1036	1036	1036	1036	1036	1036
	175 / 50%	N/A	N/A	1144	1144	1144	1144
	88 / 25%	N/A	N/A	1191	1191	1191	1191
L2C4 - AABBCS02F06GG	700 / 100%	1036	1036	1036	1036	1036	1036
	350 / 50%	N/A	N/A	1144	1144	1144	1144
	175 / 25%	N/A	N/A	1191	1191	1191	1191
L2C4 - AABBCS04F09GG	1400 / 100%	1036	1036	1036	1036	1036	1036
	700 / 50%	N/A	N/A	1144	1144	1144	1144
	350 / 25%	N/A	N/A	1191	1191	1191	1191
L2C4 - AABBCS02F04GG	350 / 100%	1036	1036	1036	1036	-	-
	175 / 50%	N/A	N/A	1144	1144	-	-
	88 / 25%	N/A	N/A	1191	1191	-	-
L2C4 - AABBCS02FH6GG	350 / 100%	1036	1036	1036	1036	-	-
	175 / 50%	N/A	N/A	1144	1144	-	-
	88 / 25%	N/A	N/A	1191	1191	-	-

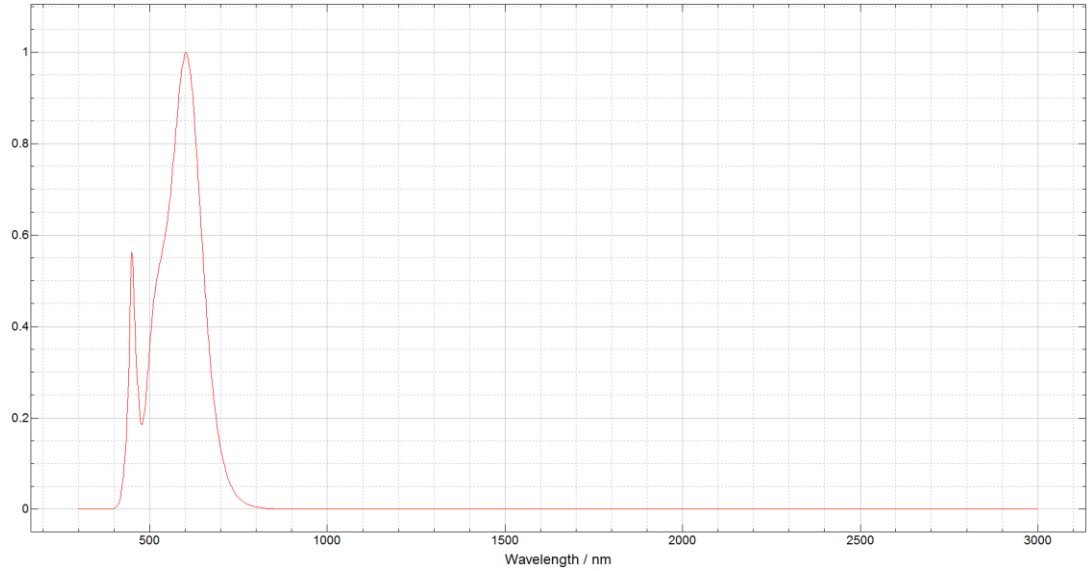
Note:"-" means no such products.

Dmin (mm):

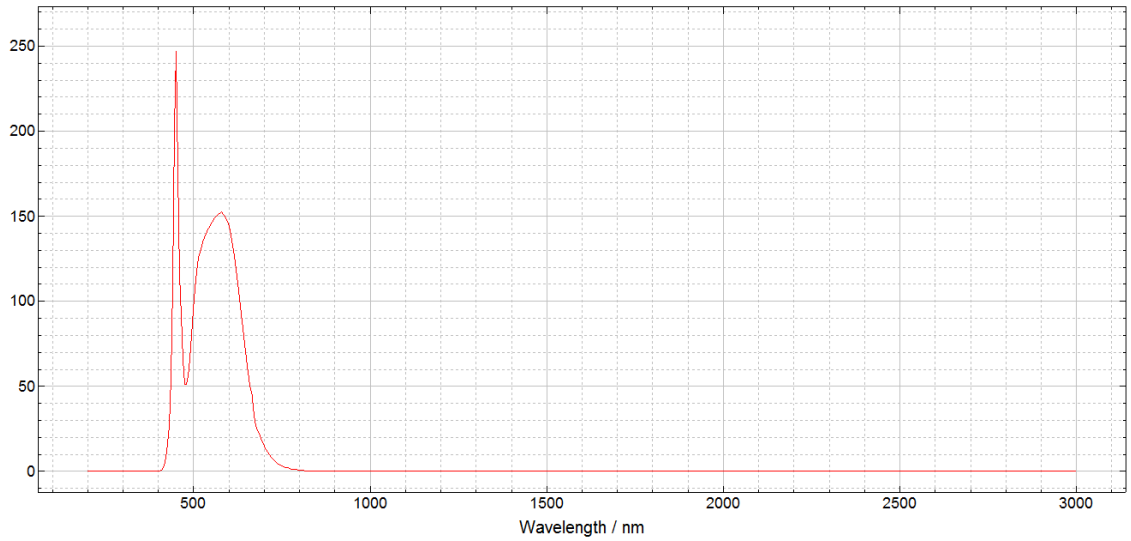
Model No.	Drive current (mA)/% of max current	CCT					
		2700K	3000K	3500K	4000K	5000K	5700K
L2C4 - AABBCS01F04GG	350 / 100%	736	736	736	736	736	736
	175 / 50%	N/A	N/A	553	553	553	553
	88 / 25%	N/A	N/A	401	401	401	401
L2C4 - AABBCS01FH6GG	350 / 100%	740	740	740	740	740	740
	175 / 50%	N/A	N/A	556	556	556	556
	88 / 25%	N/A	N/A	404	404	404	404
L2C4 - AABBCS02F06GG	700 / 100%	1047	1047	1047	1047	1047	1047
	350 / 50%	N/A	N/A	787	787	787	787
	175 / 25%	N/A	N/A	571	571	571	571
L2C4 - AABBCS04F09GG	1400 / 100%	1506	1506	1506	1506	1506	1506
	700 / 50%	N/A	N/A	1132	1132	1132	1132
	350 / 25%	N/A	N/A	822	822	822	822
L2C4 - AABBCS02F04GG	350 / 100%	648	648	648	648	-	-
	175 / 50%	N/A	N/A	486	486	-	-
	88 / 25%	N/A	N/A	352	352	-	-
L2C4 - AABBCS02FH6GG	350 / 100%	665	665	665	665	-	-
	175 / 50%	N/A	N/A	498	498	-	-
	88 / 25%	N/A	N/A	361	361	-	-

Note:"-" means no such products.

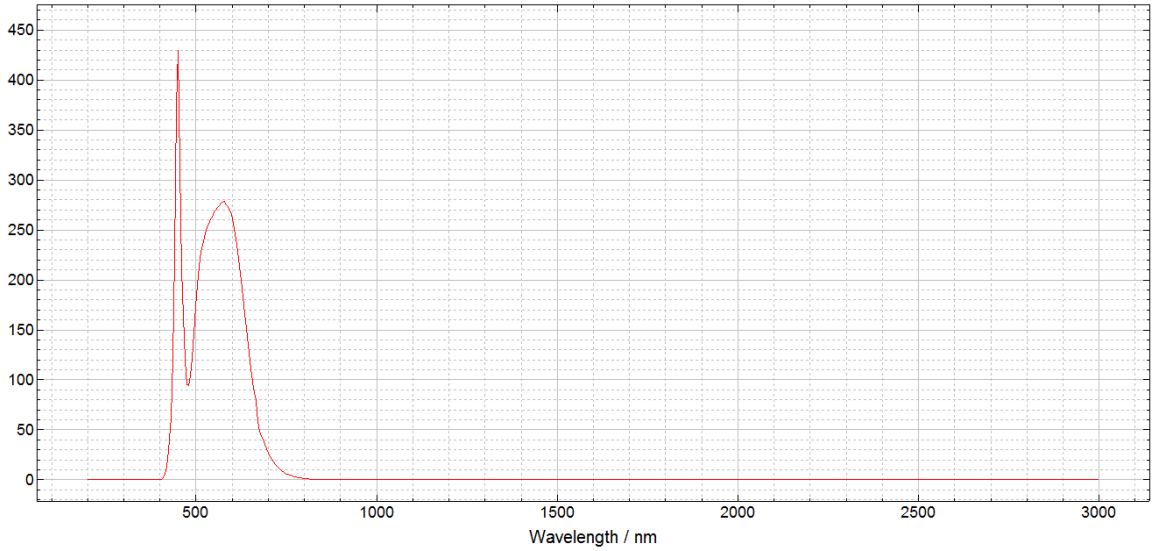
Appendix 3: Relative Spectrum Of Tested Sample(s)



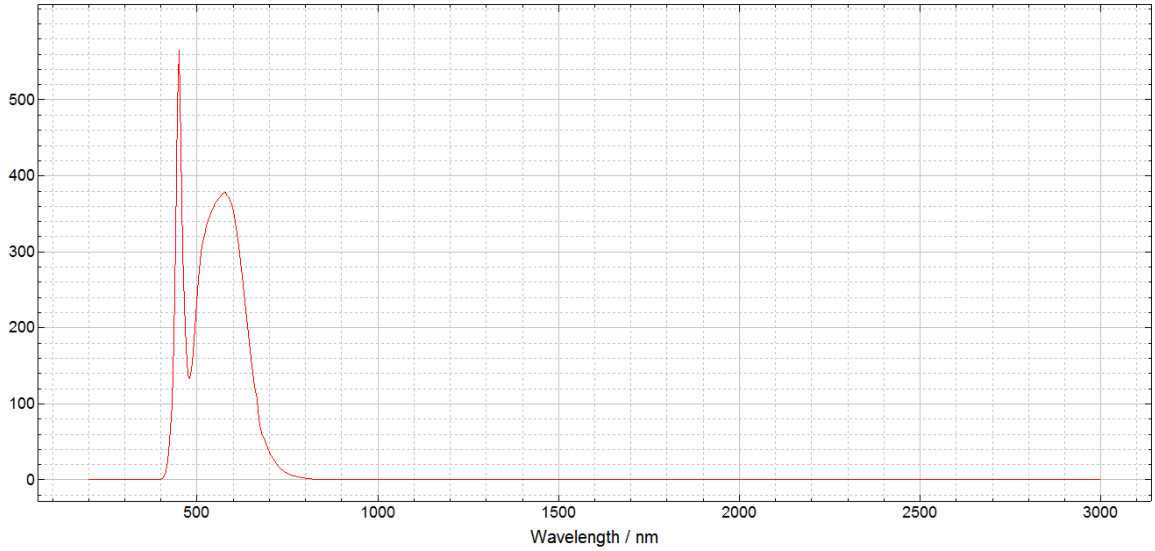
L2C4-30802S02F0600 (350mA)



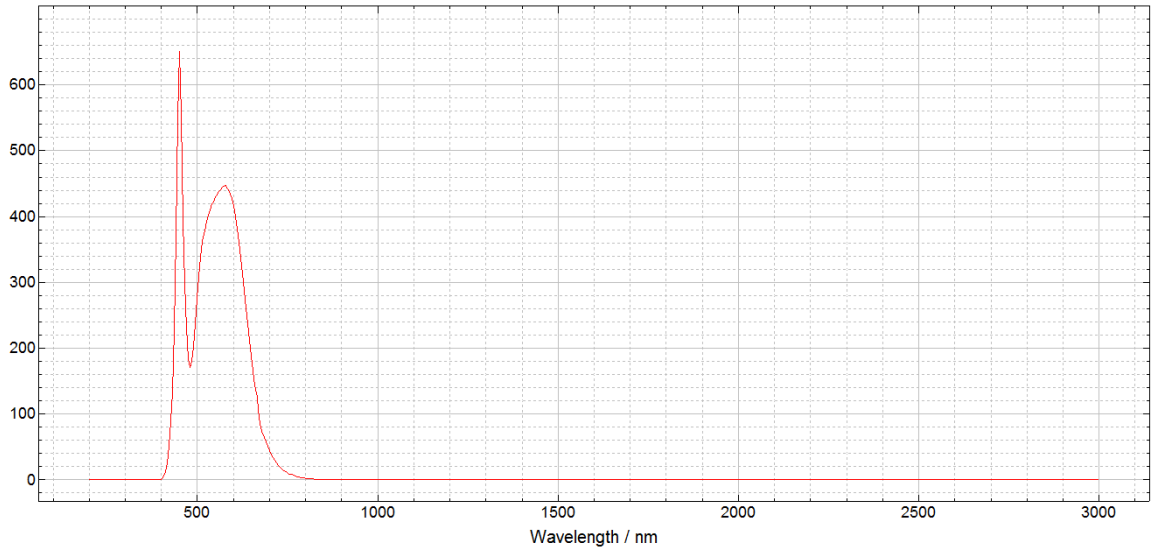
L2C4-57803S02F0600 (175mA)



L2C4-57803S02F0600 (350mA)



L2C4-57803S02F0600 (525mA)



L2C4-57803S02F0600 (700mA)

Appendix 4: Table 6.1 Based On IEC 62471:2006

DUT: L2C4-30802S02F0600 (350mA) Evaluation Distance: 200mm, Angular subtense of the apparent source α: 30 mrad

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	$S_{UV}(\lambda)$	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	4,25E+02	10000	9,76E+03	4000000		
Blue light, small source	B(λ)	E_B	$W \cdot m^{-2}$	1,0*	--	1,0		400		
Retinal thermal	R(λ)	L_R	$W \cdot m^{-2} \cdot sr^{-1}$	28000/α	1,66E+05	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	0,13	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

DUT: L2C4-57803S02F0600 (175mA) Evaluation Distance: 200mm, Angular subtense of the apparent source α: 30 mrad

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	$S_{UV}(\lambda)$	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	7,33E+02	10000	1,33E+04	4000000	1,38E+04	
Blue light, small source	B(λ)	E_B	$W \cdot m^{-2}$	1,0*****	--	1,0		400		
Retinal thermal	R(λ)	L_R	$W \cdot m^{-2} \cdot sr^{-1}$	28000/α	1,63E+05	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	0,09	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

DUT: L2C4-57803S02F0600 (350mA) Evaluation Distance: 200mm, Angular subtense of the apparent source α: 30 mrad

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	$S_{UV}(\lambda)$	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	1,37E+03	10000	2,41E+04	4000000	2,56E+04	
Blue light, small source	B(λ)	E_B	$W \cdot m^{-2}$	1,0*	--	1,0		400		
Retinal thermal	R(λ)	L_R	$W \cdot m^{-2} \cdot sr^{-1}$	28000/α	2,92E+05	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	0,11	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

DUT: L2C4-57803S02F0600 (525mA) Evaluation Distance: 200mm, Angular subtense of the apparent source α: 30 mrad

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	$S_{UV}(\lambda)$	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	1,91E+03	10000	3,38E+04	4000000	4,20E+04	
Blue light, small source	B(λ)	E_B	$W \cdot m^{-2}$	1,0*	--	1,0		400		
Retinal thermal	R(λ)	L_R	$W \cdot m^{-2} \cdot sr^{-1}$	28000/α	4,06E+05	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	0,15	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

DUT: L2C4-57803S02F0600 (700mA) Evaluation Distance: 200mm, Angular subtense of the apparent source α: 30 mrad

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	$S_{UV}(\lambda)$	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	2,33E+03	10000	4,02E+04	4000000	4,75E+04	
Blue light, small source	B(λ)	E_B	$W \cdot m^{-2}$	1,0*****	--	1,0		400		
Retinal thermal	R(λ)	L_R	$W \cdot m^{-2} \cdot sr^{-1}$	28000/α	4,79E+05	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	0,18	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

Appendix 5: Table 6.1 Based On EN62471:2008, Attachment To IEC 62471 European Group Differences And National Differences

DUT: L2C4-30802S02F0600 (350mA), Evaluation Distance: 200mm, Angular subtense of the apparent source α: 30 mrad

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)									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	--	--	--	--
Near UV		E_{UVA}	$W \cdot m^{-2}$	0,33	0,0000	--	--	--	--
Blue light	B(λ)	L_B	$W \cdot m^{-2} \cdot sr^{-1}$	100	4,25E+02	10000	9,76E+03	4000000	
Blue light, small source	B(λ)	E_B	$W \cdot m^{-2}$	0,01*	--	1,0		400	
Retinal thermal	R(λ)	L_R	$W \cdot m^{-2} \cdot sr^{-1}$	28000/α	1,66E+05	28000/α		71000/α	
Retinal thermal, weak visual stimulus**	R(λ)	L_{IR}	$W \cdot m^{-2} \cdot sr^{-1}$	545000 0,0017≤ α ≤ 0,011	--				
				6000/α 0,011≤ α ≤ 0,1	--				
IR radiation, eye		E_{IR}	$W \cdot m^{-2}$	100	0,13	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

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.

DUT: L2C4-57803S02F0600 (175mA), Evaluation Distance: 200mm, Angular subtense of the apparent source α: 30 mrad

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)									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	--	--	--	--	
Near UV		E_{UVA}	$W \cdot m^{-2}$	0,33	0,0000	--	--	--	--	
Blue light	B(λ)	L_B	$W \cdot m^{-2} \cdot sr^{-1}$	100	7,33E+02	10000	1,33E+04	4000000	1,38E+04	
Blue light, small source	B(λ)	E_B	$W \cdot m^{-2}$	0,01*	--	1,0		400		
Retinal thermal	R(λ)	L_R	$W \cdot m^{-2} \cdot sr^{-1}$	28000/α	1,63E+05	28000/α		71000/α		
Retinal thermal, weak visual stimulus**	R(λ)	L_{IR}	$W \cdot m^{-2} \cdot sr^{-1}$	545000 0,0017≤ α ≤ 0,011	--					
				6000/α 0,011≤ α ≤ 0,1	--					
IR radiation, eye		E_{IR}	$W \cdot m^{-2}$	100	0,09	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

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.

DUT: L2C4-57803S02F0600 (350mA), Evaluation Distance: 200mm, Angular subtense of the apparent source α: 30 mrad

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)								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	--	--	--	--
Near UV		E_{UVA}	$W \cdot m^{-2}$	0,33	0,0000	--	--	--	--
Blue light	B(λ)	L_B	$W \cdot m^{-2} \cdot sr^{-1}$	100	1,37E+03	10000	2,41E+04	4000000	2,56E+04
Blue light, small source	B(λ)	E_B	$W \cdot m^{-2}$	0,01*	--	1,0		400	
Retinal thermal	R(λ)	L_R	$W \cdot m^{-2} \cdot sr^{-1}$	28000/α	2,92E+05	28000/α		71000/α	
Retinal thermal, weak visual stimulus**	R(λ)	L_{IR}	$W \cdot m^{-2} \cdot sr^{-1}$	545000 0,0017≤ α ≤ 0,011	--				
				6000/α 0,011≤ α ≤ 0,1	--				
IR radiation, eye		E_{IR}	$W \cdot m^{-2}$	100	0,11	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

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.

DUT: L2C4-57803S02F0600 (525mA), Evaluation Distance: 200mm, Angular subtense of the apparent source α: 30 mrad

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)									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	--	--	--	--	
Near UV		E_{UVA}	$W \cdot m^{-2}$	0,33	0,0000	--	--	--	--	
Blue light	B(λ)	L_B	$W \cdot m^{-2} \cdot sr^{-1}$	100	1,91E+03	10000	3,38E+04	4000000	4,20E+04	
Blue light, small source	B(λ)	E_B	$W \cdot m^{-2}$	0,01*	--	1,0		400		
Retinal thermal	R(λ)	L_R	$W \cdot m^{-2} \cdot sr^{-1}$	28000/α	4,06E+05	28000/α		71000/α		
Retinal thermal, weak visual stimulus**	R(λ)	L_{IR}	$W \cdot m^{-2} \cdot sr^{-1}$	545000 0,0017≤ α ≤ 0,011	--					
				6000/α 0,011≤ α ≤ 0,1	--					
IR radiation, eye		E_{IR}	$W \cdot m^{-2}$	100	0,15	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

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.

DUT: L2C4-57803S02F0600 (700mA), Evaluation Distance: 200mm, Angular subtense of the apparent source α: 30 mrad

EN 62471			
Clause	Requirement + Test	Result – Remark	Verdict

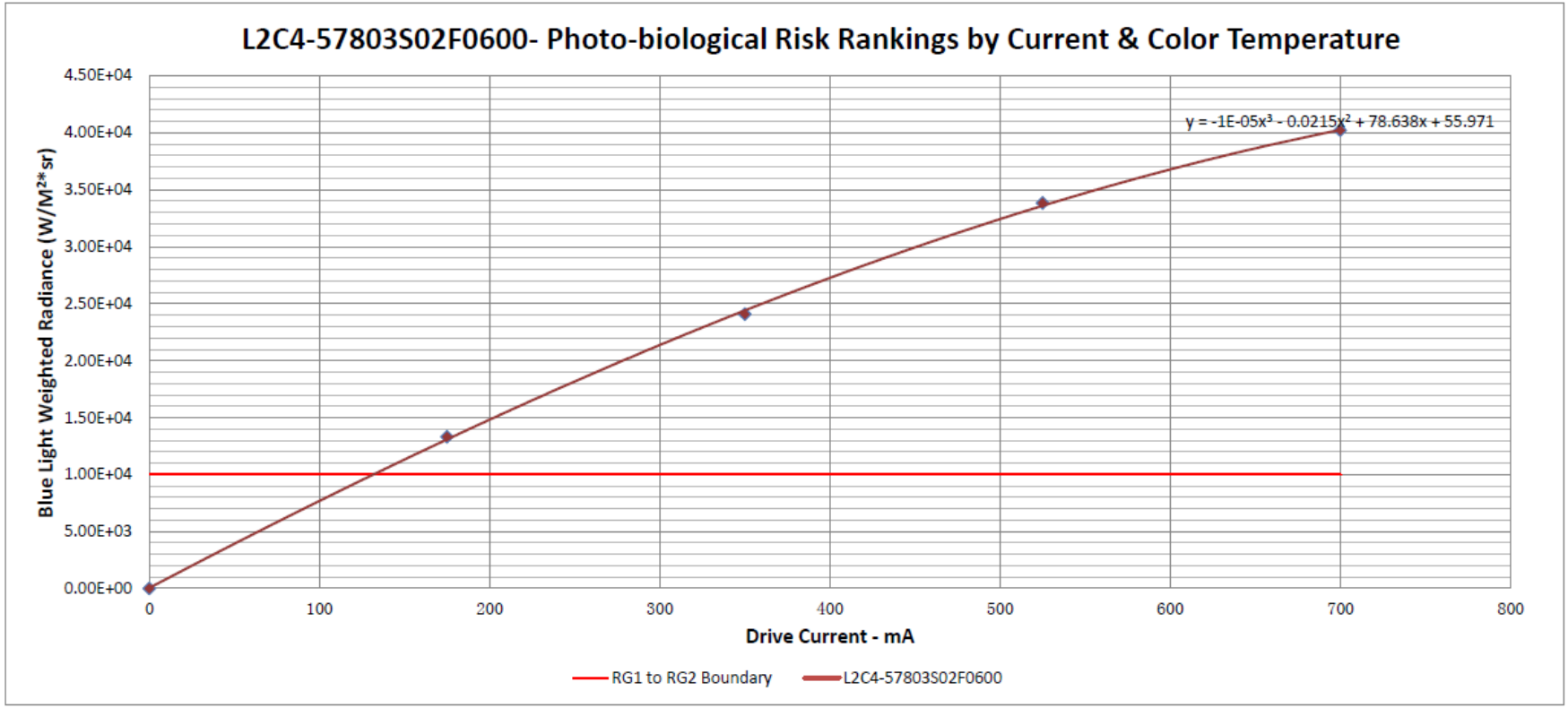
Table 6.1	Emission limits for risk groups of continuous wave lamps (based on EU Directive 2006/25/EC)									P
Risk	Action spectrum	Symbol	Units	Emission Measurement					
				Exempt		Low risk		Mod risk	
				Limit	Result	Limit	Result	Limit	Result
Actinic UV	$S_{UV}(\lambda)$	E_s	$W \cdot m^{-2}$	0,001	0,0000	--	--	--	--
Near UV		E_{UVA}	$W \cdot m^{-2}$	0,33	0,0000	--	--	--	--
Blue light	B(λ)	L_B	$W \cdot m^{-2} \cdot sr^{-1}$	100	2,33E+03	10000	4,02E+04	4000000	4,75E+04
Blue light, small source	B(λ)	E_B	$W \cdot m^{-2}$	0,01*	--	1,0		400	
Retinal thermal	R(λ)	L_R	$W \cdot m^{-2} \cdot sr^{-1}$	28000/α	4,79E+05	28000/α		71000/α	
Retinal thermal, weak visual stimulus**	R(λ)	L_{IR}	$W \cdot m^{-2} \cdot sr^{-1}$	545000 0,0017≤ α ≤ 0,011	--				
				6000/α 0,011≤ α ≤ 0,1	--				
IR radiation, eye		E_{IR}	$W \cdot m^{-2}$	100	0,18	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

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.

Appendix 6: Blue Light Hazard-Forward Current Relationship (Non-mandatory Information)

The diagram below shows the different blue light hazards against different forward currents. It is additional information for reference only.



		Drive Currents (mA)							
Product ID:	Measured CCT:	0	175	350	525	700	Regression Formula:	Fit to RG2 Line:	Current @ RG-1 to RG-2 Boundary, mA:
L2C4-57803S02F0600	5142	0	13315	24068	33814	40190	y =-1E-05x3 - 0.0215x2 + 78.638x +55.971	10000	131

-----The End-----