
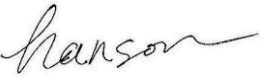




<p>TEST REPORT IEC TR 62778 Application of IEC 62471 for the assessment of blue light hazard to light sources and luminaires</p>	
Report Number.....	: 6045325.50P
Date of issue	: 2018-12-13
Total number of pages	: 19
<p>Name of Testing Laboratory preparing the Report : DEKRA Testing and Certification (Shanghai) Ltd. 3/F, #250, Jiangchangsan Road building 16 Headquater Economy Park Shibe Hi-Tech Park, Zhabei District, Shanghai, P.R.C 200436</p>	
<p>Applicant's name : Lumileds Malaysia Sdn. Bhd Address..... : No. 3 , Lintang Bayan Lepas 8, Phase 4, Bayan Lepas Industrial Park, 11900 Penang, Malaysia</p>	
<p>Test specification: Standard : IEC TR 62778:2014 (Second Edition) Test procedure : Type test Non-standard test method : N/A</p>	
<p>Test Report Form No. : IEC62778A Test Report Form(s) Originator : TÜV SÜD Product Service GmbH Master TRF : Dated 2016-02</p>	
<p>Copyright © 2016 IEC System of Conformity Assessment Schemes for Electrotechnical Equipment and Components (IECEE System). All rights reserved. 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. 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.</p>	
<p>General disclaimer: 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 CB Testing Laboratory. The authenticity of this Test Report and its contents can be verified by contacting the NCB, responsible for this Test Report.</p>	

Test item description	LED package	
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	Royal Blue, Green	
Ratings	Max I _F : 200mA	
Responsible Testing Laboratory (as applicable), testing procedure and testing location(s):		
<input checked="" type="checkbox"/>	CB Testing Laboratory:	DEKRA Testing and Certification (Shanghai) Ltd.
	Testing location/ address	3/F, #250, Jiangchangsan Road building 16 Headquarter Economy Park Shibe Hi-Tech Park, Zhabei District, Shanghai, P.R.C 200436
<input type="checkbox"/>	Associated CB Testing Laboratory:	
	Testing location/ address	
	Tested by (name, function, signature)	Yuelie Wu 
	Approved by (name, function, signature)	Hanson Zhang 
<input type="checkbox"/>	Testing procedure: CTF Stage 1:	
	Testing location/ address	
	Tested by (name, function, signature)	
	Approved by (name, function, signature)	
<input type="checkbox"/>	Testing procedure: CTF Stage 2:	
	Testing location/ address	
	Tested by (name + signature)	
	Witnessed by (name, function, signature)	
	Approved by (name, function, signature)	
<input type="checkbox"/>	Testing procedure: CTF Stage 3:	
<input type="checkbox"/>	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):		

<p>List of Attachments (including a total number of pages in each attachment):</p> <ul style="list-style-type: none"> ● 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 	
<p>Summary of testing:</p>	
<p>Tests performed (name of test and test clause):</p> <p>These tests fulfil the requirements of standard ISO/IEC 17025. When determining the test conclusion, the Measurement Uncertainty of test has been considered.</p> <p>The tested sample of Green Have been tested according to the IEC/TR62778:2014 and been classified as RG 1 Unlimited for blue light hazard Royal Blue Have been tested according to the IEC/TR62778:2014 and been classified as RG 2 for blue light hazard</p>	<p>Testing location:</p> <p>DEKRA Testing and Certification (Shanghai) Ltd. 3/F, #250, Jiangchangsan Road building 16 Headquater Economy Park Shibe Hi-Tech Park, Zhabei District, Shanghai, P.R.C 200436</p>
<p>Summary of compliance with National Differences (List of countries addressed):EN Standards</p> <p>EN 62471:2008</p> <p><input checked="" type="checkbox"/> The product fulfils the requirements</p>	

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.....:	<input checked="" type="checkbox"/> LED package <input type="checkbox"/> LED module <input type="checkbox"/> Lamp <input type="checkbox"/> Luminaire
Rated voltage (V)	--
Rated current (mA)	Max I _F : 200mA
Rated CCT (K).....	--
Rated Luminance (Mcd/m²)	--
Component report data used	<input checked="" type="checkbox"/> Not applicable <input type="checkbox"/> LED package <input type="checkbox"/> LED module <input type="checkbox"/> 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	2018-12-11
Date (s) of performance of tests	2018-12-11 to 2018-12-12
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 <input checked="" type="checkbox"/> comma / <input type="checkbox"/> point is used as the decimal separator. The product complied with the following standards: <input checked="" type="checkbox"/> IEC 62471:2006 <input checked="" type="checkbox"/> EN 62471:2008 <input type="checkbox"/> IEC/TR 62471-2:2009 <input checked="" type="checkbox"/> IEC/TR 62778:2014	
Manufacturer's Declaration per sub-clause 4.2.5 of IEC60730-2:	
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:	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> Not applicable

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

Name and address of factory (ies) : Lumileds Malaysia Sdn. Bhd.
No. 3 , Lintang Bayan Lepas 8, Phase 4, Bayan
Lepas Industrial Park, 11900 Penang, Malaysia

General product information:

Full tests were performed on model Royal Blue and Green Part

The products considered as worst case which should be evaluated at 200mm.

The sample of Royal Blue and Green were tested at 200mm from the light source, and the test current was 200 mA.

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.

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 : <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	Green	P
	- E _{thr} (lx) : - Distance to reach RG1..... (mm) ::	Royal Blue Refer to the Supplementary information of TABLE: Spectroradiometric measurement as following	P

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.....	Green		
	Test voltage (V)	3,26 Vdc		—
	Test current (mA)	200 mA		—
	Test frequency (Hz).....	--		—
	Ambient, t(°C)	25°C		—
	Measurement distance	<input checked="" type="checkbox"/> 20 cm <input type="checkbox"/> ... cm		—
	Source size	<input type="checkbox"/> Non-small <input checked="" type="checkbox"/> Small		—
	Field of view	<input type="checkbox"/> 100 mrad <input checked="" type="checkbox"/> 11 mrad <input type="checkbox"/> 1,7 mrad (for small sources)		—
Item	Symb ol	Units	Result	Remark
Correlated colour temperature	CCT	K	--	
x/y colour coordinates			--	
Blue light hazard radiance	L _B	W/(m ² •sr ¹)	--	@11mrad
Blue light hazard irradiance	E _B	W/m ²	0,05E+00	
Luminance	L	cd/m ²	6,03E+06	@11mrad
Illuminance	E	lx	3,94E+02	
Supplementary information: N/A				

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.....	Royal Blue		
	Test voltage (V)	3,13 Vdc		—
	Test current (mA)	200 mA		—
	Test frequency (Hz).....	--		—
	Ambient, t(°C)	25°C		—
	Measurement distance	<input checked="" type="checkbox"/> 20 cm <input type="checkbox"/> ... cm		—
	Source size	<input type="checkbox"/> Non-small <input checked="" type="checkbox"/> Small		—
	Field of view	<input type="checkbox"/> 100 mrad <input checked="" type="checkbox"/> 11 mrad <input type="checkbox"/> 1,7 mrad (for small sources)		—
Item	Symb ol	Units	Result	Remark
Correlated colour temperature	CCT	K	--	
x/y colour coordinates			--	
Blue light hazard radiance	L _B	W/(m ² •sr ¹)	--	@11mrad
Blue light hazard irradiance	E _B	W/m ²	1,75E+00	
Luminance	L	cd/m ²	8,75E+05	@11mrad
Illuminance	E	lx	7,90E+01	
Supplementary information: Per IEC/TR 62778:2014 E _{thr} = 43 lx D _{min} = 271 mm				

IEC TR 62778			
Clause	Requirement + Test	Result - Remark	Verdict

	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.

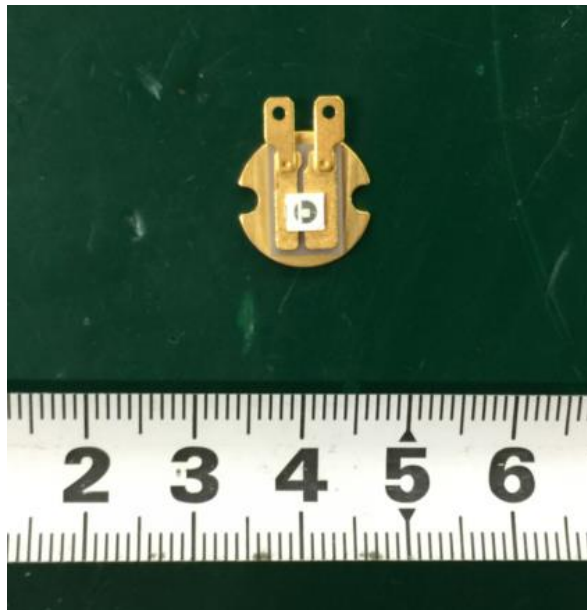
Note: This page may be removed when CTF stage 1 CTF stage 2 are not used. See also clause 4.8 in OD 2020 for more details.

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	2018/3/19	2019/3/19
7	Irradiance measurements	CL6 Spectral irradiance standard (SH 350)	300-3000nm	2018/3/19	2019/3/19
7	Irradiance measurements	CL7 Spectral irradiance standard (SH 351)	200-400nm	2018/3/19	2019/3/19
7	Irradiance measurements	Photometric detector head (SH 359)	380nm-800nm	2018/3/19	2019/3/19
7	Irradiance measurements Radiance measurements	Wattmeter (SH070)	500V,40A	2018/10/09	2019/10/09

Appendix 1: Photo Documentation



Green



Royal Blue
Overview (tested)

Appendix 2: Model List:

L 1 3 5 – A A A A 0 0 3 5 0 0 0 0 B

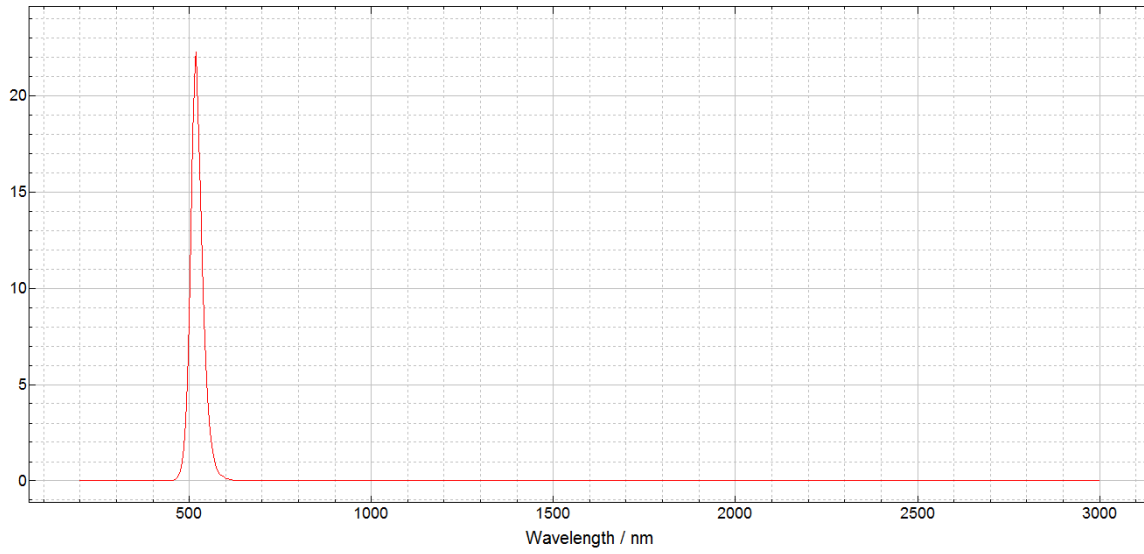
Where:

A A A A: designates color (R625=Red, O615=Red Orange, A589=PC Amber, L567=Lime, G525=Green, B475=Blue, U450=Royal Blue)

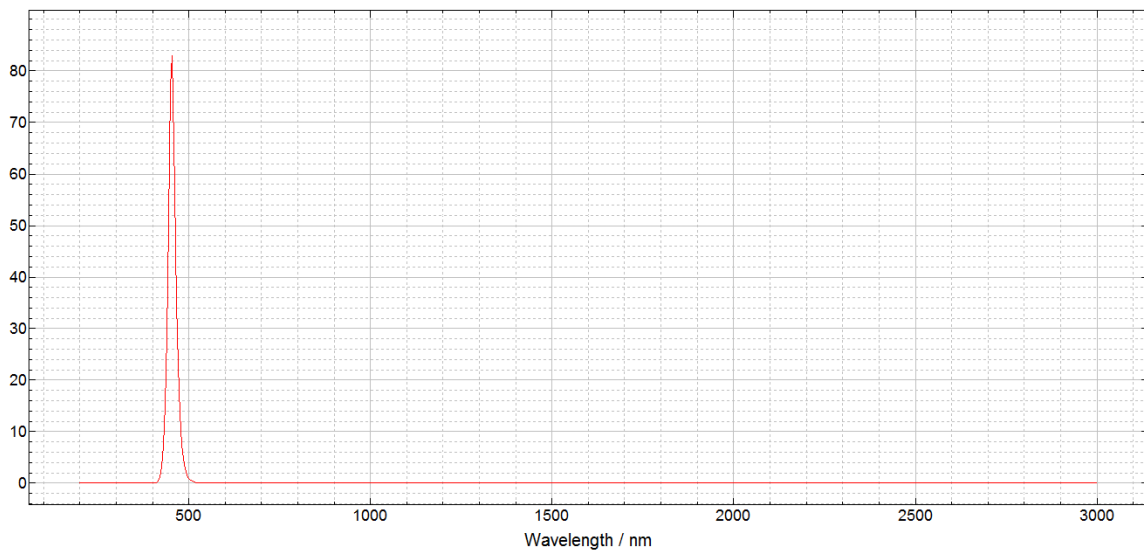
B: designates a Lumileds internal code (either 0 or 1)

Color	Commercial Part Number	PBS rating
Royal Blue	L135-U450003500000	RG2
Blue	L135-B475003500000	RG2
Green	L135-G525003500000	RG1
Lime	L135-L567003500000	RG1
PC Amber	L135-A589003500000	RG1
Red-Orange	L135-O615003500000	RG1
Red	L135-R625003500000	RG1

Appendix 3: Relative Spectrum Of Tested Sample(s)



Green



Royal Blue

Appendix 4: Table 6.1 Based On IEC 62471:2006

DUT: Green, Evaluation Distance: 200mm, Test current: 200mA, Angular subtense of the apparent source α : 10,25mrad

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	$B(\lambda)$	L_B	$W \cdot m^{-2} \cdot sr^{-1}$	100	--	10000	--	4000000	--
Blue light, small source	$B(\lambda)$	E_B	$W \cdot m^{-2}$	1,0*	0,05E+00	1,0		400	
Retinal thermal	$R(\lambda)$	L_R	$W \cdot m^{-2} \cdot sr^{-1}$	28000/ α	1,49E+04	28000/ α		71000/ α	
Retinal thermal, weak visual stimulus**	$R(\lambda)$	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	0,06	570		3200	
* Small source defined as one with $\alpha < 0,011$ radian. Averaging field of view at 10000 s is 0,1 radian.									
** Involves evaluation of non-GLS source									

DUT: Royal Blue, Evaluation Distance: 200mm, Test current: 200mA, Angular subtense of the apparent source α : 10.25mrad

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	$B(\lambda)$	L_B	$W \cdot m^{-2} \cdot sr^{-1}$	100	--	10000	--	4000000	--
Blue light, small source	$B(\lambda)$	E_B	$W \cdot m^{-2}$	1,0*	1,75E+00	1,0	1,75E+00	400	1,75E+00
Retinal thermal	$R(\lambda)$	L_R	$W \cdot m^{-2} \cdot sr^{-1}$	28000/ α	2,03E+05	28000/ α		71000/ α	
Retinal thermal, weak visual stimulus**	$R(\lambda)$	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	0,07	570		3200	
* Small source defined as one with $\alpha < 0,011$ 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: Green, Evaluation Distance: 200mm, Test current: 200mA, Angular subtense of the apparent source α : 10,25mrad

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	$B(\lambda)$	L_B	$W \cdot m^{-2} \cdot sr^{-1}$	100	--	10000	--	4000000	--	
Blue light, small source	$B(\lambda)$	E_B	$W \cdot m^{-2}$	0,01*	0,05E+00	1,0	--	400	--	
Retinal thermal	$R(\lambda)$	L_R	$W \cdot m^{-2} \cdot sr^{-1}$	28000/ α	1,49E+04	28000/ α		71000/ α		
Retinal thermal, weak visual stimulus**	$R(\lambda)$	L_{IR}	$W \cdot m^{-2} \cdot sr^{-1}$	545000 0,0017 $\leq \alpha \leq$ 0,011	--					
				6000/ α 0,011 $\leq \alpha \leq$ 0,1	--					
IR radiation, eye		E_{IR}	$W \cdot m^{-2}$	100	0,06	570		3200		
<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>										

DUT: Royal Blue, Evaluation Distance: 200mm, Test current: 200mA, Angular subtense of the apparent source α : 10,25mrad

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	$B(\lambda)$	L_B	$W \cdot m^{-2} \cdot sr^{-1}$	100	--	10000	--	4000000	--	
Blue light, small source	$B(\lambda)$	E_B	$W \cdot m^{-2}$	0,01*	1,75E+00	1,0	1,75E+00	400	1,75E+00	
Retinal thermal	$R(\lambda)$	L_R	$W \cdot m^{-2} \cdot sr^{-1}$	28000/ α	2,03E+05	28000/ α		71000/ α		
Retinal thermal, weak visual stimulus**	$R(\lambda)$	L_{IR}	$W \cdot m^{-2} \cdot sr^{-1}$	545000 0,0017 $\leq \alpha \leq$ 0,011	--					
				6000/ α 0,011 $\leq \alpha \leq$ 0,1	--					
IR radiation, eye		E_{IR}	$W \cdot m^{-2}$	100	0,07	570		3200		
<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>										