

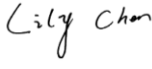




Test Report issued under the responsibility of:



TEST REPORT IEC TR 62778 Application of IEC 62471 for the assessment of blue light hazard to light sources and luminaires	
Report Number..... :	4791335733_1
Date of issue	2024-06-19
Total number of pages	31 including attachments
Name of Testing Laboratory preparing the Report UL-CCIC Company Limited	
Applicant's name Lumileds (Shanghai) Management Co., Ltd.	
Address..... : Building 1-A, No. 19 & 20, Lane 299, Wenshui Road, Jingan District, Shanghai, 200072, China	
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	
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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. 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.	

Test item description	Built-in LED Package	
Trade Mark		
Manufacturer	Same as Applicant	
Model/Type reference	L130-6570003000Y21, L130-4070003000Y21, L130-AABB003000C2D (see GPI for type designation)	
Ratings	Imax 240 mA \equiv Vmax 6,0 V (see GPI for further ratings)	
Responsible Testing Laboratory (as applicable), testing procedure and testing location(s):		
<input checked="" type="checkbox"/>	CB Testing Laboratory:	UL-CCIC Company Limited
Testing location/ address.....		No.2, Chengwan Road, Suzhou Industrial Park Suzhou 215122, China
<input type="checkbox"/>	Associated Testing Laboratory:	
Testing location/ address.....		
Tested by (name, function, signature)		Chris Yi Project handler 
Approved by (name, function, signature)....		Lily Chen Reviewer 
<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) :		

List of Attachments (including a total number of pages in each attachment):	
Components List	(Attachment No.1):1 pages
Photographs	(Attachment No.2): 2 pages
Technical reference for IEC 62471:2006	(Attachment No.3): 17 pages
Summary of testing:	
Tests performed (name of test and test clause): IEC TR 62778 Edition2.0 2014-06 7.2 Conditions for the radiance measurement	Testing location: UL-CCIC Company Limited No.2, Chengwan Road, Suzhou Industrial Park Suzhou 215122, China
The measurement uncertainties stated in this Test Report are estimated according to the Quality Procedure 00-LC-S0278.	
If requested, UL-CCIC Company Limited will be able to estimate the uncertainty contribution for all the quantities stated in this Test Report.	
Summary of compliance with National Differences (List of countries addressed): N/A	

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.



Note: Due to the limited amount of Built-in LED Package surface, the required markings and ratings may be provided on the smallest package.

Test item particulars : -	
Product evaluated..... : <input checked="" type="checkbox"/> LED package <input type="checkbox"/> LED module <input type="checkbox"/> Lamp <input type="checkbox"/> Luminaire Rated voltage (V) : see GPI for further ratings Rated current (mA) : see GPI for further ratings Rated CCT (K)..... : see GPI for further ratings 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 : 2024-05-28 Date (s) of performance of tests : 2024-05-30 to 2024-06-06	
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.	
Manufacturer's Declaration per sub-clause 4.2.5 of IEC62778A:	
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 (Shanghai) Management Co., Ltd. Building 1-A, No. 19 & 20, Lane 299, Wenshui Road, Jingan District, Shanghai, 200072, China	

General product information:

The product under test is a Built-in LED package for lighting applications (indoor and outdoor use).

L130-6570003000Y21, with ANSI bin 6500K, is part of Lumileds LUXOEN 3030 2D Round Plus product line. The tested sample of L130-6570003000X21 is with the highest CCT in that product line. The present classification is thus valid (worst case) within the LUXEON 3030 2D Round Plus product line with part number L130-AABB003000C2D, where AA represents nominal ANSI CCT bins can be equal to 6500K or lower (see TR IEC62778), and BB represents CRI ranging from 70 and above, and C represents package type, and D represents Lumileds internal code. See the appendix below for an explanation of the type designation.

Type designation:

L 1 3 0 – A A B B 0 0 3 0 0 0 C 2 D

Where

A A: designates nominal CCT (e.g. 22=2200K, 27=2700K, 30=3000K, 35=3500K, 40=4000K, 50=5000K, 57=5700K, 65=6500K or any nominal CCT less than 6500K)

B B: designates minimum CRI (e.g. 70=70CRI, 80=80CRI, 90=90CRI or any CRI greater than min 70)

C: designates package type (Y=Round)

D: designates Lumileds internal code (1 = base part and can be any alphanumeric for marketing use but share same base part configuration)

Model/type	Drive current (mA)	CCT						
		2200/2700K	3000K	3500K	4000K	5000K	5700K	6500K
L130–AABB003000C2D	135	RG1	RG1	RG1	RG1	RG1	RG1	RG1
	210	RG1	RG1	RG1	RG1	RG2	RG2	RG2
	240	RG2	RG2	RG2	RG2	RG2	RG2	RG2

Note: this table is provided by the manufacturer.

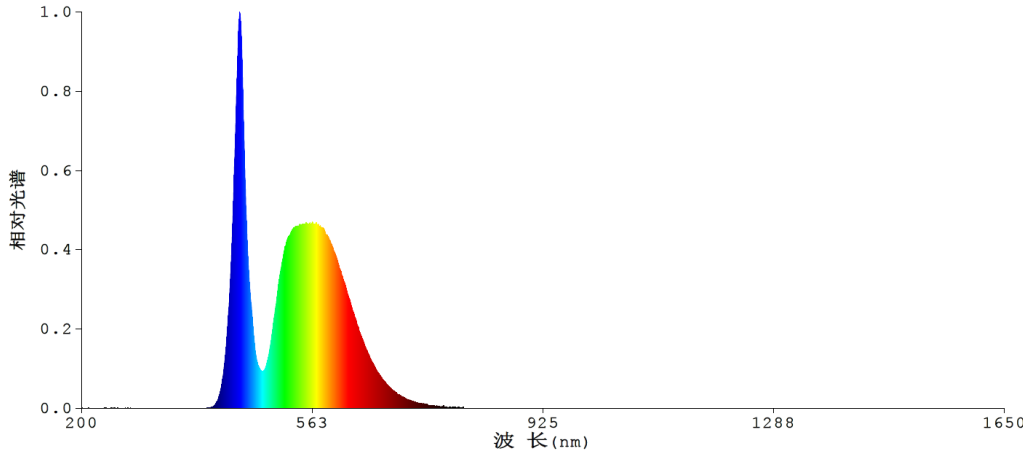
Models used for the tests:

Model	Maximum ratings and characteristics	Risk Group Classification	
L130-6570003000Y21	Vmax 6,0V, Imax 240mA CRI 70, CCT 6500K	For 240mA	Risk Group 2 Ethr = 1037 lx
		For 135mA	Risk Group 1 Unlimited
L130-4070003000Y21	Vmax 6,0V, Imax 240mA CRI 70, CCT 4000K	For 210mA	Risk Group 1 Unlimited

NOTE:

1. The Radiance measure was carried out at the distance of 200 mm from detector, in the direction of maximum light output, in place in order to determinate (according to IEC TR 62778) the highest LB value of the product.
2. The accuracy method decision rule is applied when the compliance or verdict is made to the results of this report.
3. Install the sample into the holder, with the back close to the heat sink for testing.

IEC TR 62778			
Clause	Requirement + Test		Verdict
7	MEASUREMENT INFORMATION FLOW		P
7.1	Basic flow		P
	'Law of conservation of luminance' applied		P
	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		P
7.2	Conditions for the radiance measurement		P
	Standard condition applied (200mm distance, 0,011rad field of view)	200mm	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		N/A
	- E_{thr} (lx) : Distance to reach RG1 (m) :	See detail measurements in Table: Spectroradiometric measurement	P

TABLE: Spectroradiometric measurement				P
Measurement performed on:		<input checked="" type="checkbox"/> LED package <input type="checkbox"/> LED module <input type="checkbox"/> Lamp <input type="checkbox"/> Luminaire		
Model number.....:		L130-6570003000Y21		
Test voltage (V)		6,61 VDC		—
Test current (mA)		240 mA		—
Test frequency (Hz).....:		-		—
Ambient, t (°C)		24,5 °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 : 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	6500	Rated
x/y colour coordinates	-	-	x=0,3175, y=0,3343	For reference only
Blue light hazard radiance	L _B	W/(m ² •sr ¹)	-	-
Blue light hazard irradiance	E _B	W/m ²	1,850e+000	-
Luminance	L	cd/m ²	-	-
Illuminance	E	lx	1919	-
Distance	dmin	mm	270	-
Risk Group Classification: Risk Group 2 for 240 mA, Ethr = 1037 lx Risk Group 1 Unlimited for 135 mA				
				

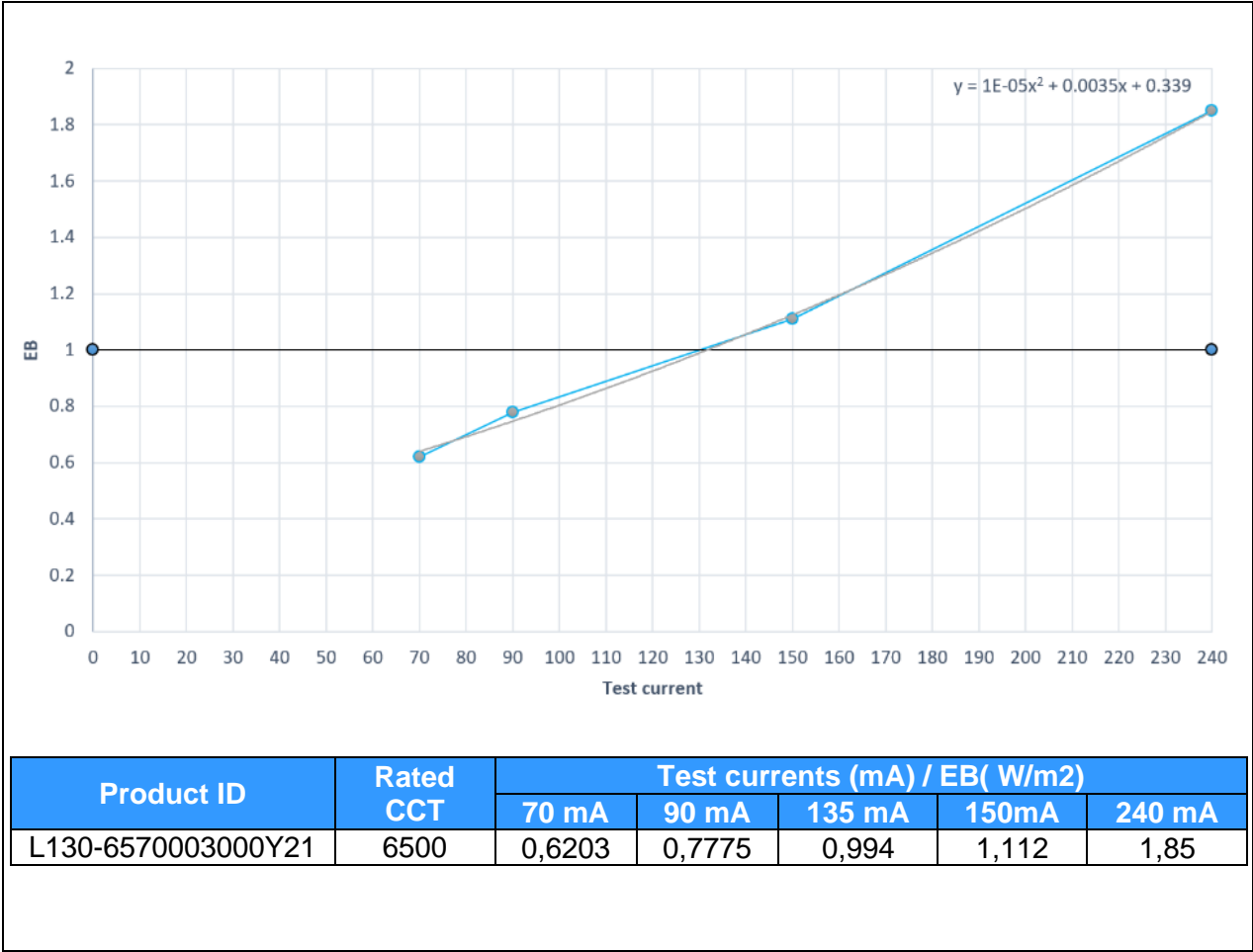


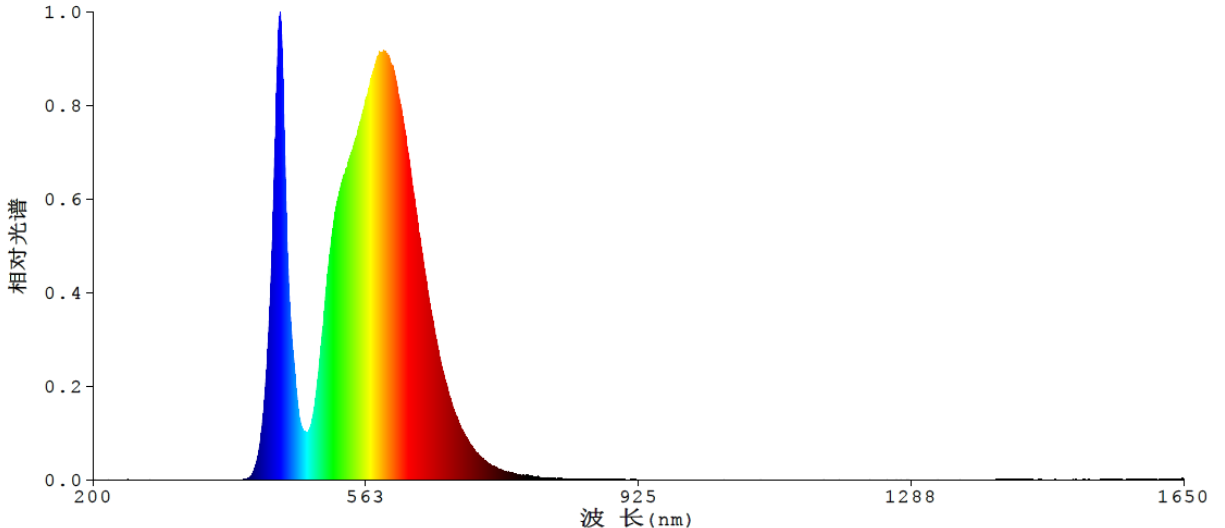
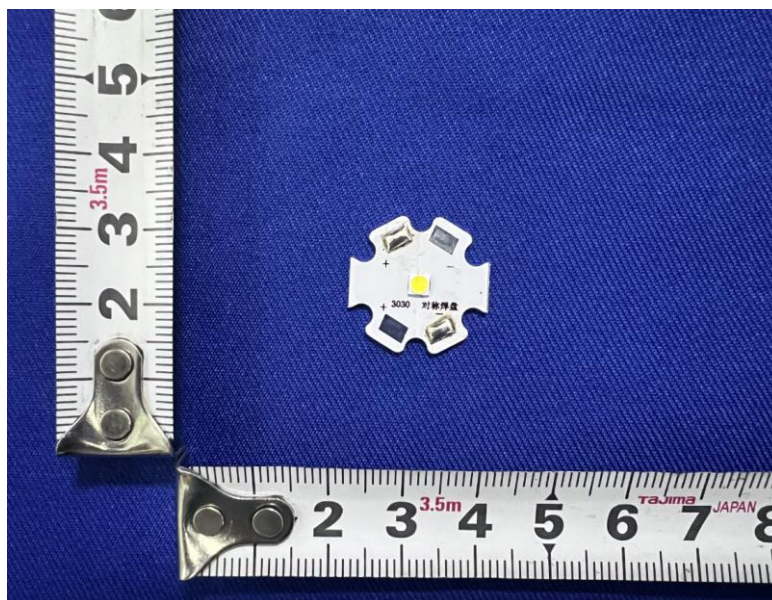
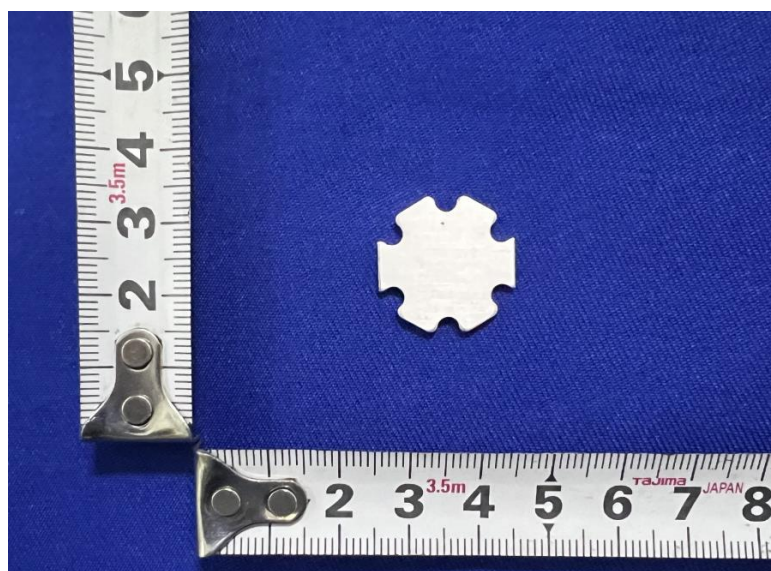
TABLE: Spectroradiometric measurement					P
Measurement performed on:		<input checked="" type="checkbox"/> LED package <input type="checkbox"/> LED module <input type="checkbox"/> Lamp <input type="checkbox"/> Luminaire			
Model number.....:		L130-4070003000Y21			
Test voltage (V)		6,43VDC			—
Test current (mA)		210 mA			—
Test frequency (Hz).....:		-			—
Ambient, t (°C)		24,5 °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 : 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	4000	Rated	
x/y colour coordinates	-	-	x=0,3864, y=0,3836	For reference only	
Blue light hazard radiance	L _B	W/(m ² •sr ¹)	-	-	
Blue light hazard irradiance	E _B	W/m ²	8,856e-001	-	
Luminance	L	cd/m ²	-	-	
Illuminance	E	lx	1832	-	
Risk Group Classification: Risk Group 1 Unlimited for 210 mA					
					

	TABLE: Angular light distribution	N/A

	Attachment No. 1: Components List	
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Object / part No.	Manufacturer/ trademark	Type / model	Technical data
LED Chip	Lumileds	L130-6570003000Y21	Vmax 6,0V, Imax 240mA CRI 70, CCT 6500K
LED Chip	Lumileds	L130-4070003000Y21	Vmax 6,0V, Imax 240mA CRI 70, CCT 4000K

Attachment No. 2: Photographs

Photograph No. 1 – Front view of the model L130-6570003000Y21**Photograph No. 2 – Rear view of the model L130-6570003000Y21**

Attachment No. 2: Photographs

Photograph No. 3– Front view of the model L130-4070003000Y21**Photograph No. 4** – Rear view of the model L130-4070003000Y21

Attachment No. 3

Attachment No.3


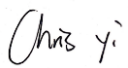

Technical reference for IEC 62471:2006
(Total 17 pages including this cover page)

Attachment No. 3

Test Report issued under the responsibility of:



TEST REPORT IEC 62471 Photobiological safety of lamps and lamp systems	
Report Reference No.:	4791335733_1
Date of issue	2024-06-19
Total number of pages	16
Name of Testing Laboratory preparing the Report	UL-CCIC Company Limited
Applicant's name	Lumileds (Shanghai) Management Co., Ltd.
Address	Building 1-A, No. 19 & 20, Lane 299, Wenshui Road, Jingan District, Shanghai, 200072, China
Test specification: Standard: IEC 62471:2006 Test procedure.....: Informative Report Non-standard test method.....: N/A	
Test Report Form No.:	IEC62471B
TRF Originator	VDE Testing and Certification Institute
Master TRF	Dated 2018-08-16
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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.	

Test item description	Built-in LED Package	
Trade Mark		
Manufacturer	Same as Applicant	
Model/Type reference	L130-6570003000Y21, L130-4070003000Y21, L130-AABB003000C2D (see GPI for type designation)	
Ratings	Imax 240 mA --- Vmax 6,0 V (see GPI for further ratings)	
Responsible Testing Laboratory (as applicable), testing procedure and testing location(s):		
<input checked="" type="checkbox"/>	Testing Laboratory:	UL-CCIC Company Limited
Testing location/ address		No.2, Chengwan Road, Suzhou Industrial Park Suzhou 215122, China
Tested by (name, function, signature)		Chris Yi Project handler 
Approved by (name, function, signature) ..		Lily Chen Reviewer 
<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) :		

List of Attachments (including a total number of pages in each attachment): <ul style="list-style-type: none">• Photographs – See Attachment No.2 in test report No. 4791335733_1 of IEC62778A	
Summary of testing:	
Tests performed (name of test and test clause): Clause 5.2.1 and Clause 5.2.2 in IEC 62471:2006 (First Edition) The accuracy method decision rule is applied when the compliance or verdict is made to the results of this report.	Testing location: UL-CCIC Company Limited No.2 Chengwan Road, Suzhou Industrial Park Suzhou 215122, China
Summary of compliance with National Differences (List of countries addressed): N/A	

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.



Note: Due to the limited amount of Built-in LED Package surface, the required markings and ratings may be provided on the smallest package

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	see GPI for further ratings
Furthermore marking on the lamp	N/A
Seasoning of lamps according IEC standard	N/A
Used measurement instrument	OST-500
Temperature by measurement	22.1 °C
Information for safety use	N/A
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	2024-05-28
Date (s) of performance of tests	2024-05-30 to 2024-06-06
General remarks:	
<p>"(See Enclosure #)" refers to additional information appended to the report.</p> <p>"(See appended table)" refers to a table appended to the report.</p> <p>Throughout this report a <input checked="" type="checkbox"/> comma / <input type="checkbox"/> point is used as the decimal separator.</p>	
Manufacturer's Declaration per sub-clause 4.2.5 of IEC60060-02:	
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	<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 (Shanghai) Management Co., Ltd. Building 1-A, No. 19 & 20, Lane 299, Wenshui Road, Jingan District, Shanghai, 200072, China	

General product information and other remarks:

The product under test is a Built-in LED package for lighting applications (indoor and outdoor use).

L130-6570003000Y21, with ANSI bin 6500K, is part of Lumileds LUXOEN 3030 2D Round Plus product line. The tested sample of L130-6570003000X21 is with the highest CCT in that product line. The present classification is thus valid (worst case) within the LUXEON 3030 2D Round Plus product line with part number L130-AABB003000C2D, where AA represents nominal ANSI CCT bins can be equal to 6500K or lower (see TR IEC62778), and BB represents CRI ranging from 70 and above, and C represents package type, and D represents Lumileds internal code. See the appendix below for an explanation of the type designation.

Type designation:

L 1 3 0 – A A B B 0 0 3 0 0 0 C 2 D

Where

A A: designates nominal CCT (e.g. 22=2200K, 27=2700K, 30=3000K, 35=3500K, 40=4000K, 50=5000K, 57=5700K, 65=6500K or any nominal CCT less than 6500K)

B B: designates minimum CRI (e.g. 70=70CRI, 80=80CRI, 90=90CRI or any CRI greater than min 70)

C: designates package type (Y=Round)

D: designates Lumileds internal code (1 = base part and can be any alphanumeric for marketing use but share same base part configuration)

Model/type	Drive current (mA)	CCT						
		2200/2700K	3000K	3500K	4000K	5000K	5700K	6500K
L130-AABB003000C2D	135	RG1	RG1	RG1	RG1	RG1	RG1	RG1
	210	RG1	RG1	RG1	RG1	RG2	RG2	RG2
	240	RG2	RG2	RG2	RG2	RG2	RG2	RG2

Note: this table is provided by the manufacturer.

Models used for the tests:

Model	Maximum ratings and characteristics	Risk Group Classification	
L130-6570003000Y21	Vmax 6,0V, Imax 240mA CRI 70, CCT 6500K	For 240mA	Risk Group 2 E _{thr} = 1037 lx
		For 135mA	Risk Group 1 Unlimited
L130-4070003000Y21	Vmax 6,0V, Imax 240mA CRI 70, CCT 4000K	For 210mA	Risk Group 1 Unlimited

NOTE:

4. The measure was carried out at a distance of 200 mm (non-GLS) without any secondary optics in place, in the direction of maximum light output according to IEC 62471.
5. The accuracy method decision rule is applied when the compliance or verdict is made to the results of this report.
6. When the optical characteristic of the LED or any optical components are changed, re-measurement or further consideration should be necessary.
7. Install the sample into the holder, with the back close to the heat sink for testing.
8. Only photobiological hazards have been addressed.

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		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, $B(\lambda)$, i.e., the blue-light weighted radiance, L_B , shall not exceed the levels defined by:		N/A
	$L_B \cdot t = \sum_{300}^{700} \sum_t L_\lambda(\lambda, t) \cdot B(\lambda) \cdot \Delta t \cdot \Delta \lambda \leq 10^6 \quad \text{J} \cdot \text{m}^{-2} \cdot \text{sr}^{-1}$	for $t \leq 10^4 \text{ s}$ $t_{\max} = \frac{10^6}{L_B}$	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 $t > 10^4 \text{ s}$	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 $B(\lambda)$ shall not exceed the levels defined by:	see table 4.2	P

IEC 62471			
Clause	Requirement + Test	Result – Remark	Verdict
	$E_B \cdot t = \sum_{300}^{700} \sum_t E_\lambda(\lambda, t) \cdot B(\lambda) \cdot \Delta\lambda \leq 100 \quad \text{J} \cdot \text{m}^{-2}$	for $t \leq 100$ s	P
	$E_B = \sum_{300}^{700} E_\lambda \cdot B(\lambda) \cdot \Delta\lambda \leq 1 \quad \text{W} \cdot \text{m}^{-2}$	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
	$L_R = \sum_{380}^{1400} L_\lambda \cdot R(\lambda) \cdot \Delta\lambda \leq \frac{50\,000}{\alpha \cdot t^{0.25}} \quad \text{W} \cdot \text{m}^{-2} \cdot \text{sr}^{-1}$	$(10 \mu\text{s} \leq t \leq 10 \text{ s})$	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
	$L_{IR} = \sum_{780}^{1400} L_\lambda \cdot R(\lambda) \cdot \Delta\lambda \leq \frac{6\,000}{\alpha} \quad \text{W} \cdot \text{m}^{-2} \cdot \text{sr}^{-1}$	$t > 10 \text{ s}$	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
	$E_{IR} = \sum_{780}^{3000} E_\lambda \cdot \Delta\lambda \leq 18\,000 \cdot t^{-0.75} \quad \text{W} \cdot \text{m}^{-2}$	$t \leq 1000 \text{ s}$	N/A
	For times greater than 1000 s the limit becomes:		P
	$E_{IR} = \sum_{780}^{3000} E_\lambda \cdot \Delta\lambda \leq 100 \quad \text{W} \cdot \text{m}^{-2}$	$t > 1000 \text{ s}$	P
4.3.8	Thermal hazard exposure limit for the skin		N/A
	Visible and infrared radiant exposure (380 nm to 3000 nm) of the skin shall be limited to:		N/A
	$E_H \cdot t = \sum_{380}^{3000} \sum_t E_\lambda(\lambda, t) \cdot \Delta\lambda \leq 20\,000 \cdot t^{0.25} \quad \text{J} \cdot \text{m}^{-2}$		N/A
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)	LED source	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

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	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
	– 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.	For model: L130-6570003000Y21 Angular subtense = 0,0076rad For model: L130-4070003000Y21 Angular subtense = 0,0073rad	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		P

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	weighted energy.		
5.3.3	Measurement uncertainty		P
	The quality of all measurement results must be quantified by an analysis of the uncertainty.	The measurement uncertainties stated in this Test Report are estimated according to the Quality Procedure 00-LC-S0278.	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	200 mm	P
6.1	Continuous wave lamps		P
6.1.1	Except Group		N/A
	In the except 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)		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)		P
	This requirement is met by any lamp that exceeds the limits for Risk Group 1, but that does not pose:		P
	– an actinic ultraviolet hazard (E_S) within 1000 s		N/A

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	exposure, nor		
	– 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		P
	– 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
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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Table 4.1		Spectral weighting function for assessing ultraviolet hazards for skin and eye		P
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.				

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Table 4.2	Spectral weighting functions for assessing retinal hazards from broadband optical sources		P
Wavelength nm	Blue-light hazard function B (λ)	Burn hazard function R (λ)	
300	0,01		
305	0,01		
310	0,01		
315	0,01		
320	0,01		
325	0,01		
330	0,01		
335	0,01		
340	0,01		
345	0,01		
350	0,01		
355	0,01		
360	0,01		
365	0,01		
370	0,01		
375	0,01		
380	0,01	0,1	
385	0,013	0,13	
390	0,025	0,25	
395	0,05	0,5	
400	0,10	1,0	
405	0,20	2,0	
410	0,40	4,0	
415	0,80	8,0	
420	0,90	9,0	
425	0,95	9,5	
430	0,98	9,8	
435	1,00	10,0	
440	1,00	10,0	
445	0,97	9,7	
450	0,94	9,4	
455	0,90	9,0	
460	0,80	8,0	
465	0,70	7,0	
470	0,62	6,2	
475	0,55	5,5	
480	0,45	4,5	
485	0,40	4,0	
490	0,22	2,2	
495	0,16	1,6	
500-600	$10^{[(450-\lambda)/50]}$	1,0	
600-700	0,001	1,0	
700-1050		$10^{[(700-\lambda)/500]}$	
1050-1150		0,2	
1150-1200		$0,2 \cdot 10^{0,02(1150-\lambda)}$	
1200-1400		0,02	

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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

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Table 6.1 Emission limits for risk groups of continuous wave lamps(model: L130-6570003000Y21)									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	2,65e-04	0.003	-	0.03	-
Near UV		E_{UVA}	$W \cdot m^{-2}$	10	2,26e-04	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*	-	1,0	-	400	1,850e+00
Retinal thermal	$R(\lambda)$	L_R	$W \cdot m^{-2} \cdot sr^{-1}$	28000/ α	1,42e+05	28000/ α	-	28000/ 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	5,67e-01	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 Risk Group 2 for 240 mA, $E_v = 1037$ lx Risk Group 1 Unlimited for 135 mA Input Voltage: 6,61 VDC, Input Current: 240mA, Power: 1,5885 W, Alpha = 0,0076rad									

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Table 6.1		Emission limits for risk groups of continuous wave lamps(model: L130-4070003000Y21)							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	4,45e-04	0.003	-	0.03	-
Near UV		E_{UVA}	$W \cdot m^{-2}$	10	2,56e-04	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*	-	1,0	8,856e-01	400	-
Retinal thermal	$R(\lambda)$	L_R	$W \cdot m^{-2} \cdot sr^{-1}$	28000/ α	9,00e+04	28000/ α	-	28000/ 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	8,94e-01	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>Risk Group 1 Unlimited for 210 mA</p> <p>Input Voltage: 6,43VDC, Input Current: 210mA, Power: 1,35W, Alpha = 0,0073rad</p>									