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. ..... :	**6165570.50P V1.1**
Date of issue ..... :	**2023-10-26**
Total number of pages ..... :	19
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, Zhabei 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, JingAn District, Shanghai, P.R. China
Test specification:	
Standard ..... :	IEC TR 62778:2014 (Second Edition)
Test procedure ..... :	Type test
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

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.

The purpose of this report is only for export activities.

Test item description ..... :	LED package
Trade Mark ..... :	LUMILEDS
Manufacturer ..... :	Lumileds (Shanghai)Management Co., Ltd. Building 1-A, No.19&20, Lane 299, Wenshui Road, JingAn District, Shanghai, P.R. China
Model/Type reference ..... :	L150-AABB5006XXXSX; L150-AABB5030XXXSX; L150-NSC15030XXXSX; L150-NSC15006XXXSX; L150-AABB5006XXXNX
Ratings ..... :	For details see 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, Zhabei District, Shanghai, P.R.C 200436	
☐	~~Associated CB Testing Laboratory:~~		
~~Testing location/ address~~			
Tested by (name, function, signature).....		Nancy 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 6.1Based On IEC 62471:2006
- Appendix 5: Table 6.1 Based On EN62471:2008, Attachment To IEC 62471 European Group Differences And National Differences

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 L150-65705030000S0 (240mA) Have been tested according to the IEC/TR62778:2014 and been classified as **RG 2 for blue light hazard**. The tested sample of **L150-NSC15006000S0 (800mA)** Have been tested according to the IEC 62471(first edition, 2006-07) **at 200mm** and been classified as **RG 0.** Have been tested according to the EN 62471:2008 **at 200mm** and been classified as **RG 0.** Have been tested according to the IEC/TR62778:2014 and been classified as **RG 1 Unlimited for blue light hazard**.	DEKRA Testing and Certification (Shanghai) Ltd. 3/F, #250, Jiangchangsan Road building 16 Headquater Economy Park Shibei Hi-Tech Park, Zhabei District, Shanghai, P.R.C 200436

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

EN 62471:2008

☒ **The product fulfils 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) .....:	--
Rated current (mA) .....:	For details see Model list
Rated CCT (K).....:	--
Rated Luminance (Mcd/m²) .....:	--
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 .....:	2023-07-20
Date (s) of performance of tests.....:	2023-07-25

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

Decision rules applied Procedure 2 “Accuracy Method” as stated in the IEC Guide 115:2007.

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, JingAn District, Shanghai, P.R. China

General product information:

Full tests were performed on model L150-65705030000S0 and L150-NSC15006000S0.

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

The sample of L150-65705030000S0 was tested at 200mm from the light source. CCT of spectral irradiance was found at 6482 K.

The sample of L150-NSC15006000S0 was tested at 200mm from the light source. CCT of spectral irradiance was found at 1960 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 original test report 6054957.50P, dated 2019-07-08 was modified to include the following additions:

- New model L150-NSC15030000S0 and L150-NSC15006000S0 was added.

After review, full tests were performed on model **L150-NSC15006000S0**.

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	**L150-NSC15006000S0**	P
	- E_{thr}..... (lx) : - Distance to reach RG1..... (mm) ::	L150-65705030000S0 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:	☒ **LED package** ☐ **LED module** ☐ **Lamp** ☐ **Luminaire**	
	Model number.....	L150-65705030000S0 (240mA)	
	Test voltage (V)	--	—
	Test current (mA)	240 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	6482	
x/y colour coordinates			0,3126/0,3326	
Blue light hazard radiance	L_B	$W/(m^2 \cdot sr^1)$	2,18E+04	@11mrad
Blue light hazard irradiance	E_B	W/m^2	--	
Luminance	L	cd/m^2	2,52E+07	@11mrad
Illuminance	E	lx	8,38E+03	

Supplementary information:

Per IEC/TR 62778:2014
Ethr= 1154 lx

Dmin= 508 mm

IEC TR 62778			
Clause	Requirement + Test	Result - Remark	Verdict

	TABLE:Spectroradiometric measurement		
	Measurement performed on:	☒ **LED package** ☐ **LED module** ☐ **Lamp** ☐ **Luminaire**	
	Model number.....	L150-NSC15006000S0 (800mA)	
	Test voltage (V)	--	—
	Test current (mA)	800 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	1960	
x/y colour coordinates			0,5434/0,4286	
Blue light hazard radiance	L_B	$W/(m^2 \cdot sr^1)$	1,44E+03	@11mrad
Blue light hazard irradiance	E_B	W/m^2	--	
Luminance	L	cd/m^2	2,31E+07	@11mrad
Illuminance	E	lx	1,36E+03	

Supplementary information:
N/A

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	2023/2/25	2024/2/24
7	Irradiance measurements	CL6 Spectral irradiance standard (SH 350)	300-3000nm	2023/2/25	2024/2/24
7	Irradiance measurements	CL7 Spectral irradiance standard (SH 351)	200-400nm	2023/2/25	2024/2/24
7	Irradiance measurements	Photometric detector head (SH 359)	380nm-800nm	2023/2/26	2024/2/25
7	Irradiance measurements Radiance measurements	Wattmeter (SH030)	500V,40A	2022/10/10	2023/10/10

Appendix 1: Photo Documentation

L150-65705030000S0

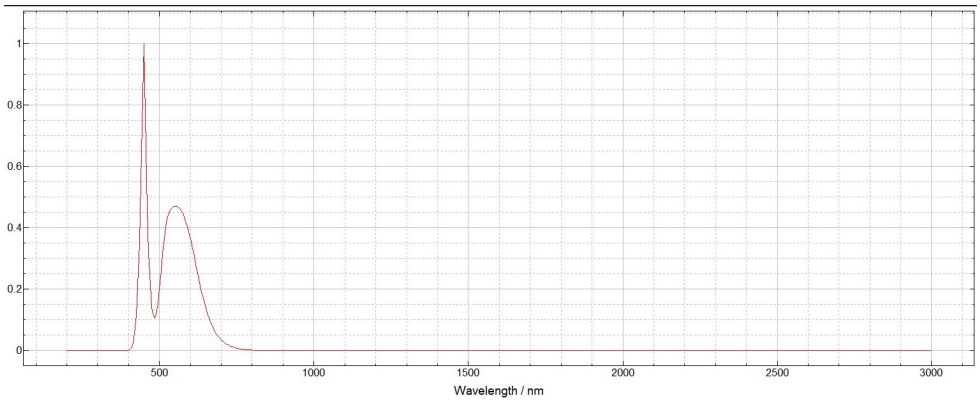
L150-NSC15006000S0

Appendix 2: Model List:

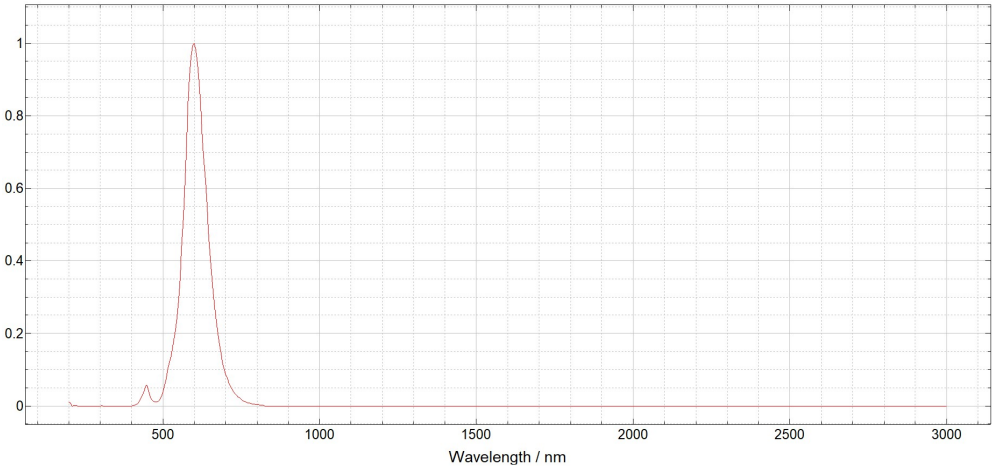
Commercial Part number	LES (mm)	Max Current (mA)	Max Voltage (V)	Nominal CCT (K)	Minimum CRI	Typical Flux (lm)	Typ Flux Density (lm/mm^2)	Forward Current (mA)	
L150-AABB5006XXXSX	4,5	1000	6,4	1800~6500	70	825	41	800	**RG2**
L150-AABB5030XXXSX	4,5	240	32	1800~6500	70	825	41	160	**RG2**
L150-NSC15030XXXSX	4,5	240	32	1800	50	695	35	160	**RG1**
L150-NSC15006XXXSX	4,5	1000	**6,4**	1800	50	695	35	800	**RG1**
L150-AABB5006XXXNX	4,5	800	6,4	1800~6500	70	700	35	640	**RG2**

Note:
AA–designates nominal ANSI CCT (18=1800K, 22=2200K, 27=2700K, 30=3000K, 35=3500K 40=4000K, 50=5000K, 57=5700K, 65=6500K);
BB–designates minimum CRI (70=70CRI, 80=80CRI, 90=90CRI 95=95CRI);
NSC1: designates Nightscape;
XXX— Design for customer;
X—Version

Appendix 3: Relative Spectrum Of Tested Sample(s)



L150-65705030000S0



L150-NSC15006000S0

Appendix 4: Table 6.1 Based On IEC 62471:2006
DUT: L150-65705030000S0, Evaluation Distance: 200mm, Test current: 240mA, Angular subtense of the apparent source α: 20.4 mrad

IEC 62471			
Clause	Requirement + Test	Result – Remark	Verdict

Table 6.1	Emission limits for risk groups of continuous wave lamps									
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	8,08E+02	10000	2,18E+04	4000000	7,02E+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	2,63E+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	0,02	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: L150-NSC15006000S0, Evaluation Distance: 200mm, Test current: 800mA, Angular subtense of the apparent source α: 20.4 mrad

IEC 62471			
Clause	Requirement + Test	Result – Remark	Verdict

Table 6.1	Emission limits for risk groups of continuous wave lamps									
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	9,80E+01	10000		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	7,37E+04	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	0,06	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: L150-65705030000S0, Evaluation Distance: 200mm, Test current: 240mA, Angular subtense of the apparent source α: 20.4mrad

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)									
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	8,08E+02	10000	2,18E+04	4000000	7,02E+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	2,63E+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	0,02	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: L150-NSC15006000S0, Evaluation Distance: 200mm, Test current: 800mA, Angular subtense of the apparent source α: 20.4mrad

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)									
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	9,80E+01	10000		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	7,37E+04	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	0,06	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.

----------End----------