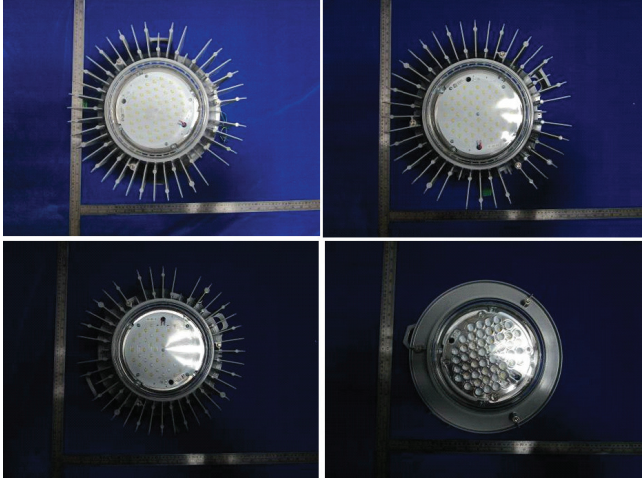




Prüfbericht-Nr.: <i>Test Report No.:</i>	50200535 001	Auftrags-Nr.: <i>Order No.:</i>	154367357	Seite 1 von 23 <i>Page 1 of 23</i>	
Kunden-Referenz-Nr.: <i>Client Reference No.:</i>	Quotation No. 52257895	Auftragsdatum: <i>Order date:</i>	17.10.2018		
Auftraggeber: <i>Client:</i>	EMERSON INNOVATION CENTER PUNE, APPLETON GROUP Plot No 23 Rajiv Gandhi Infotech Park Hinjewadi, Phase II, Pune 411057, India				
Prüfgegenstand: <i>Test item:</i>	LED Luminaire				
Bezeichnung / Typ-Nr.: <i>Identification / Type No.:</i>	See models list on page 6				
Auftrags-Inhalt: <i>Order content:</i>	Photobiological safety test				
Prüfgrundlage: <i>Test specification:</i>	IEC 62471:2006				
Wareneingangsdatum: <i>Date of receipt:</i>	02.11.2018				
Prüfmuster-Nr.: <i>Test sample No.:</i>	A000831842-001 to 006				
Prüfzeitraum: <i>Testing period:</i>	15.11.2018-19.11.2018				
Ort der Prüfung: <i>Place of testing:</i>	TÜV Rheinland (Shanghai) Co., Ltd.				
Prüflaboratorium: <i>Testing laboratory:</i>	TÜV Rheinland (Shanghai) Co., Ltd.				
Prüfergebnis*: <i>Test result*:</i>	Pass				
geprüft von / tested by: 12.12.2018 Tory Wang/ PE		kontrolliert von / reviewed by: 12.12.2018 Alex Yan / Reviewer			
Datum <i>Date</i>	Name / Stellung <i>Name / Position</i>	Unterschrift <i>Signature</i>	Datum <i>Date</i>	Name / Stellung <i>Name / Position</i>	Unterschrift <i>Signature</i>
Sonstiges / Other The LED luminaires were evaluated as Exempt Group according to IEC 62471. Attachment 1: Equipment list, 1 page					
Zustand des Prüfgegenstandes bei Anlieferung: <i>Condition of the test item at delivery:</i>			Prüfmuster vollständig und unbeschädigt <i>Test item complete and undamaged</i>		
* Legende:	1 = sehr gut P(ass) = entspricht o.g. Prüfgrundlage(n)	2 = gut F(ail) = entspricht nicht o.g. Prüfgrundlage(n)	3 = befriedigend N/A = nicht anwendbar	4 = ausreichend N/A = nicht anwendbar	5 = mangelhaft N/T = nicht getestet
Legend:	1 = very good P(ass) = passed a.m. test specification(s)	2 = good F(ail) = failed a.m. test specification(s)	3 = satisfactory N/A = not applicable	4 = sufficient N/A = not applicable	5 = poor N/T = not tested
Dieser Prüfbericht bezieht sich nur auf das o.g. Prüfmuster und darf ohne Genehmigung der Prüfstelle nicht auszugsweise vervielfältigt werden. Dieser Bericht berechtigt nicht zur Verwendung eines Prüfzeichens. <i>This test report only relates to the a. m. test sample. Without permission of the test center this test report is not permitted to be duplicated in extracts. This test report does not entitle to carry any test mark.</i>					



TEST REPORT IEC 62471 Photobiological safety of lamps and lamp systems	
Report Reference No. :	50200535 001
Date of issue	See cover page
Total number of pages	See cover page
Applicant's name	EMERSON INNOVATION CENTER PUNE, APPLETON GROUP
Address	Plot No 23 Rajiv Gandhi Infotech Park Hinjewadi, Phase II, Pune 411057, India
Test specification:	
Standard	IEC 62471:2006 (First Edition)
Test procedure	Acceptance test
Non-standard test method.....	N/A
Test Report Form No. :	IEC62471A
TRF Originator	VDE Testing and Certification Institute
Master TRF	Dated 2009-05
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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.	
Test item description	LED Luminaire
Trade Mark.....	N/A
Manufacturer.....	EGS MEXICO S DE R L DE C V
Address	VIA MONTERREY MATAMOROS 598 PARQUE INDUSTRIAL APODACA 66600, MEXICO
Model/Type reference	See model list on page 6
Ratings	AC 120-277V, 50/60Hz
Details See "General product information"	

Testing procedure and testing location:	
<input checked="" type="checkbox"/> Testing Laboratory:	TÜV Rheinland (Shanghai) Co., Ltd.
Testing location/ address.....:	No. 177, 178 Lane 777 West Guangzhong Road Jing'an District Shanghai CHINA
<input type="checkbox"/> Associated Laboratory:	
Testing location/ address.....:	
Tested by (name + signature)	See cover page
Approved by (+ signature)	See cover page
<input type="checkbox"/> Testing procedure: TMP	
Tested by (name + signature)	N/A
Approved by (+ signature)	N/A
Testing location/ address.....:	N/A
<input type="checkbox"/> Testing procedure: WMT	
Tested by (name + signature)	N/A
Witnessed by (+ signature).....:	N/A
Approved by (+ signature)	N/A
Testing location/ address.....:	N/A
<input type="checkbox"/> Testing procedure: SMT	
Tested by (name + signature)	N/A
Approved by (+ signature)	N/A
Supervised by (+ signature)	N/A
Testing location/ address..... :	N/A
<input type="checkbox"/> Testing procedure: RMT	
Tested by (name + signature)	N/A
Approved by (+ signature)	N/A
Supervised by (+ signature)	N/A
Testing location/ address.....:	N/A

Summary of testing:

Tests performed (name of test and test clause): 5.2.1 Irradiance measurements 5.2.2 Radiance measurements	Testing location: TÜV Rheinland (Guangdong) Ltd. No.199 Kezhu Road, Guangzhou Science City, Guangzhou, China
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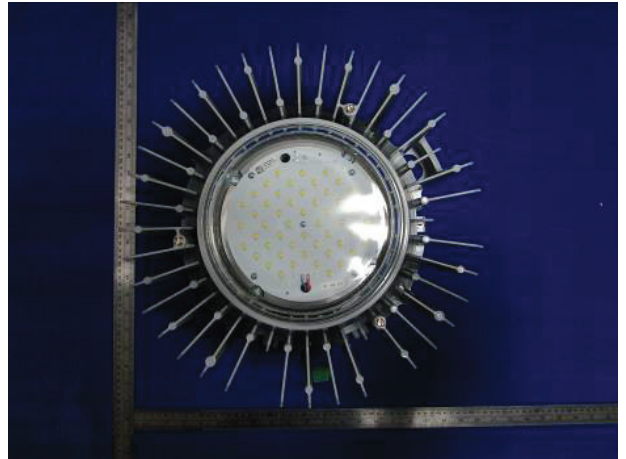
Summary of compliance with National Differences:
N/A

Copy of marking plate:
N/A

Photo of product:



MLGH6CG5BU



MLGH1CG5BU



MLGL5CG5BU



MLLED4CG5BU

Test item particulars		LED Luminaire
Tested lamp	<input checked="" type="checkbox"/> continuous wave lamps	<input type="checkbox"/> pulsed lamps
Tested lamp system		
Lamp classification group	<input checked="" type="checkbox"/> exempt <input type="checkbox"/> risk 1 <input type="checkbox"/> risk 2 <input type="checkbox"/> risk 3 (Details See "General product information")	
Lamp cap	--	
Bulb	--	
Rated of the lamp	See 'General Product Information'	
Furthermore marking on the lamp.....	--	
Seasoning of lamps according IEC standard	--	
Used measurement instrument.....	SPR-5000B Spectroradiometer, MPR-16 Retinal ra- diance meter	
Temperature by measurement.....	22,9°C	
Information for safety use	--	
Possible test case verdicts:		
– test case does not apply to the test object : N/A		
– test object does meet the requirement..... : P (Pass)		
– test object does not meet the requirement..... : F (Fail)		
Testing:		
Date of receipt of test item..... : 02.11.2018		
Date (s) of performance of tests..... : 15.11.2018-19.11.2018		
General remarks:		
The test results presented in this report relate only to the object tested. This report shall not be reproduced, except in full, without the written approval of the Issuing testing laboratory. "(See Enclosure #)" refers to additional information appended to the report. "(See appended table)" refers to a table appended to the report. Throughout this report a comma (point) is used as the decimal separator. List of test equipment must be kept on file and available for review.		

General product information:

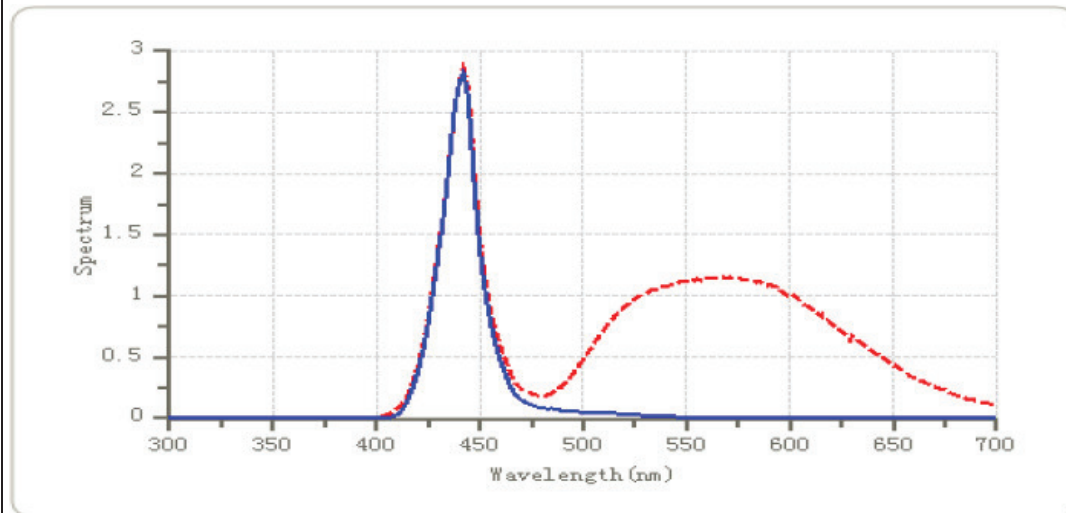
All products were LED fixed Luminaire, with AC 120-277V, 50/60Hz, details see following table:

Model name	Testing voltage	Rated wattage	Rated Lumen	LED Type Name	No of LEDs	Forward Current, If	Forward Voltage, Vf	Driver
MLGH6CG5BU	AC 230V, 50Hz	145W	16000lm	CREE - XP-L2	51	900mA	3V	APMS150C105XX
MLGH6*****		145W	16000lm	CREE - XP-L2	51	900mA	3V	APMS150C105XX
MLGH3*****		115W	13500lm	CREE - XP-L2	51	720mA	2.9V	APMS150C105XX
MLGH1CG5BU		93W	11500lm	CREE - XP-L2	51	595mA	2.84V	APMS100C105XX
MLGH1*****		93W	11500lm	CREE - XP-L2	51	595mA	2.84V	APMS100C105XX
MLGH9*****		75W	9500lm	CREE - XP-L2	51	480mA	2.8V	APMS100C105XX
MLG*L9*****		75W	9500lm	CREE - XP-L2	51	480mA	2.8V	APMS100C105XX
MLG*L7*****		57W	7500lm	CREE - XP-L2	51	360mA	2.8V	APMS100C105XX
MLGL5CG5BU		46W	5500lm	CREE - XP-G3	36	390mA	2.78V	APMS050C135XX
MLG*L5*****		46W	5500lm	CREE - XP-G3	36	390mA	2.78V	APMS050C135XX
MLG*L3*****		30W	3500lm	CREE - XP-G3	36	250mA	2.72V	APMS050C135XX
MLLED4CG5BU		48W	5000lm	CREE - XTE	22	650mA	2.91V	APMS050C135XX
MLLED*4*****		48W	5000lm	CREE - XTE	22	650mA	2.91V	APMS050C135XX
MLLED*3*****		38W	4000lm	CREE - XTE	22	500mA	2.86V	APMS050C135XX
MLLED*2*****		28W	3000lm	CREE - XTE	22	360mA	2.82V	APMS050C135XX

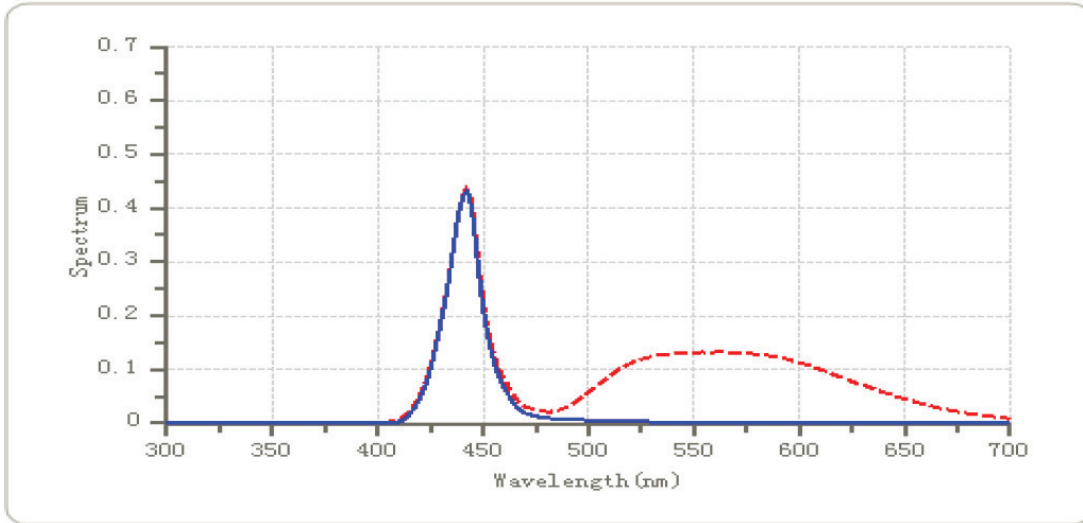
Model MLGH6CG5BU, MLGH1CG5BU, MLGL5CG5BU and MLLED4CG5BU were selected to do the type test according to IEC 62471 and all models were evaluated as Exempt Group

Spectral Distribution:

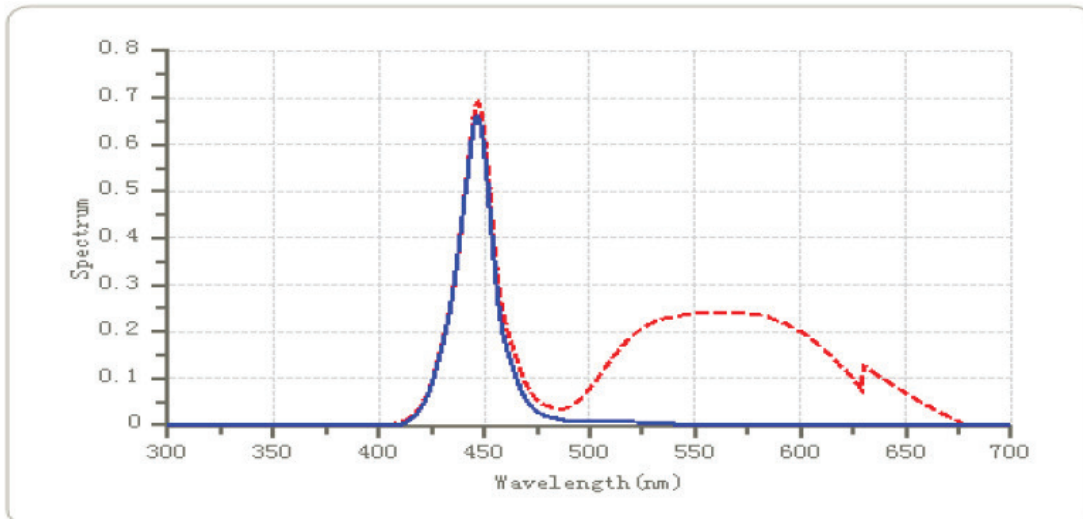
MLGH6CG5BU



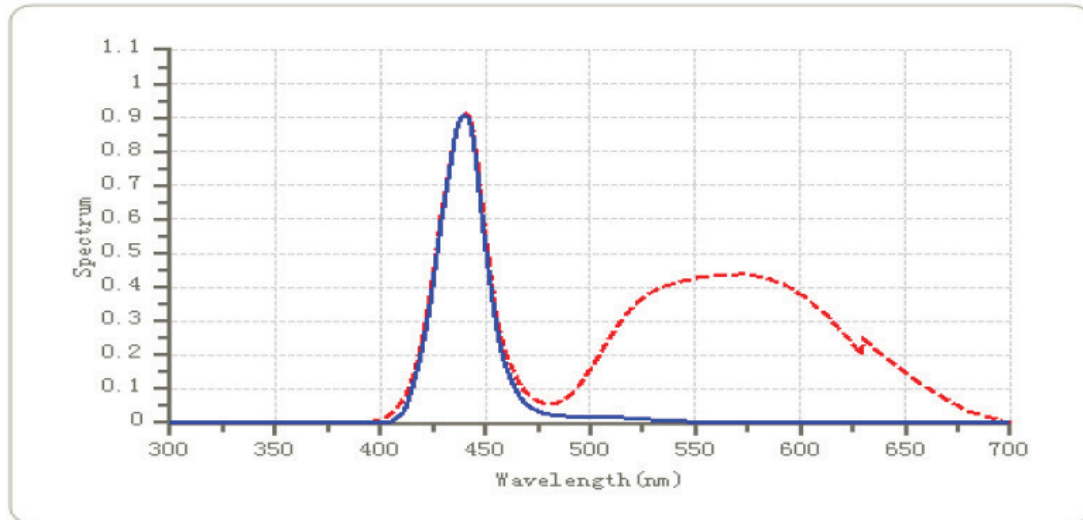
MLGH1CG5BU



MLGL5CG5BU



MLLED4CG5BU



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
	$E_s \cdot t = \sum_{200}^{400} \sum_t E_\lambda(\lambda, t) \cdot S_{UV}(\lambda) \cdot \Delta t \cdot \Delta \lambda \leq 30 \quad \text{J}\cdot\text{m}^{-2}$		—
	The permissible time for exposure to ultraviolet radiation incident upon the unprotected eye or skin shall be computed by:		P
	$t_{\max} = \frac{30}{E_s} \quad \text{s}$		—
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
	$t_{\max} \leq \frac{10\,000}{E_{UVA}} \quad \text{s}$		—
4.3.3	Retinal blue light hazard exposure limit		P

IEC 62471			
Clause	Requirement + Test	Result – Remark	Verdict
	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:		P
	$L_B \cdot t = \sum_{300}^{700} \sum_t L_\lambda(\lambda, t) \cdot B(\lambda) \cdot \Delta\lambda \cdot \Delta t \leq 10^6 \quad \text{J} \cdot \text{m}^{-2} \cdot \text{sr}^{-1}$	for $t \leq 10^4$ s $t_{\max} = \frac{10^6}{L_B}$	—
	$L_B = \sum_{300}^{700} L_\lambda \cdot B(\lambda) \cdot \Delta\lambda \leq 100 \quad \text{W} \cdot \text{m}^{-2} \cdot \text{sr}^{-1}$	for $t > 10^4$ s	—
4.3.4	Retinal blue light hazard exposure limit - small source		N/A
	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	N/A
	$E_B \cdot t = \sum_{300}^{700} \sum_t E_\lambda(\lambda, t) \cdot B(\lambda) \cdot \Delta\lambda \cdot \Delta t \leq 100 \quad \text{J} \cdot \text{m}^{-2}$	for $t \leq 100$ s	—
	$E_B = \sum_{300}^{700} E_\lambda \cdot B(\lambda) \cdot \Delta\lambda \leq 1 \quad \text{W} \cdot \text{m}^{-2}$	for $t > 100$ s	—
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
	$L_R = \sum_{380}^{1400} L_\lambda \cdot R(\lambda) \cdot \Delta\lambda \leq \frac{50\,000}{\alpha \cdot t^{0,25}} \quad \text{W} \cdot \text{m}^{-2} \cdot \text{sr}^{-1}$	($10 \mu\text{s} \leq t \leq 10$ s)	—
4.3.6	Retinal thermal hazard exposure limit – weak visual stimulus		P
	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:		P
	$L_{IR} = \sum_{780}^{1400} L_\lambda \cdot R(\lambda) \cdot \Delta\lambda \leq \frac{6\,000}{\alpha} \quad \text{W} \cdot \text{m}^{-2} \cdot \text{sr}^{-1}$	$t > 10$ s	—
4.3.7	Infrared radiation hazard exposure limits for the eye		P

IEC 62471			
Clause	Requirement + Test	Result – Remark	Verdict
	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
	$E_{IR} = \sum_{780}^{3000} E_{\lambda} \cdot \Delta\lambda \leq 18\,000 \cdot t^{-0,75} \quad W \cdot m^{-2}$	$t \leq 1000 \text{ s}$	—
	For times greater than 1000 s the limit becomes:		N/A
	$E_{IR} = \sum_{780}^{3000} E_{\lambda} \cdot \Delta\lambda \leq 100 \quad W \cdot m^{-2}$	$t > 1000 \text{ s}$	—
4.3.8	Thermal hazard exposure limit for the skin		P
	Visible and infrared radiant exposure (380 nm to 3000 nm) of the skin shall be limited to:		P
	$E_H \cdot t = \sum_{380}^{3000} \sum_t E_{\lambda}(\lambda, t) \cdot \Delta\lambda \leq 20\,000 \cdot t^{0,25} \quad J \cdot m^{-2}$		—
5	MEASUREMENT OF LAMPS AND LAMP SYSTEMS		P
5.1	Measurement conditions		P
	Measurement conditions shall be reported as part of the evaluation against the exposure limits and the assignment of risk classification.		P
5.1.1	Lamp ageing (seasoning)		N/A
	Seasoning of lamps shall be done as stated in the appropriate IEC lamp standard.		N/A
5.1.2	Test environment		P
	For specific test conditions, see the appropriate IEC lamp standard or in absence of such standards, the appropriate national standards or manufacturer's recommendations.		P
5.1.3	Extraneous radiation		P
	Careful checks should be made to ensure that extraneous sources of radiation and reflections do not add significantly to the measurement results.		P
5.1.4	Lamp operation		P
	Operation of the test lamp shall be provided in accordance with:		P
	– the appropriate IEC lamp standard, or		N/A
	– the manufacturer's recommendation		P

IEC 62471			
Clause	Requirement + Test	Result – Remark	Verdict
5.1.5	Lamp system operation		P
	The power source for operation of the test lamp shall be provided in accordance with:		P
	– the appropriate IEC standard, or		N/A
	– the manufacturer' s recommendation		P
5.2	Measurement procedure		P
5.2.1	Irradiance measurements		P
	Minimum aperture diameter 7mm.	aperture diameter: 7mm	—
	Maximum aperture diameter 50 mm.		—
	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.		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

IEC 62471			
Clause	Requirement + Test	Result – Remark	Verdict
	The calculation of source hazard values shall be performed by weighting the spectral scan by the appropriate function and calculating the total weighted energy.		P
5.3.3	Measurement uncertainty		P
	The quality of all measurement results must be quantified by an analysis of the uncertainty.	see Annex C in the norm	P
6	LAMP CLASSIFICATION		P
	For the purposes of this standard it was decided that the values shall be reported as follows:		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	MLGH6CG5BU: 450mm MLGH1CG5BU: 340mm MLGL5CG5BU: 239,5mm MLLED4CG5BU: 218mm	P
	– for all other light sources, including pulsed lamp sources, the hazard values shall be reported at a distance of 200 mm		N/A
6.1	Continuous wave lamps		P
6.1.1	Exempt Group		P
	In the exempt group are lamps, which does not pose any photobiological hazard. The requirement is met by any lamp that does not pose:		P
	– an actinic ultraviolet hazard (E_S) within 8-hours exposure (30000 s), nor		P
	– a near-UV hazard (E_{UVA}) within 1000 s, (about 16 min), nor		P
	– a retinal blue-light hazard (L_B) within 10000 s (about 2,8 h), nor		P
	– a retinal thermal hazard (L_R) within 10 s, nor		P
	– an infrared radiation hazard for the eye (E_{IR}) within 1000 s		P
6.1.2	Risk Group 1 (Low-Risk)		N/A
	In this group are lamps, which exceeds the limits for the exempt 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

IEC 62471			
Clause	Requirement + Test	Result – Remark	Verdict
	– an infrared radiation hazard for the eye (E_{IR}) within 100 s		N/A
	Lamps that emit infrared radiation without a strong visual stimulus and do not pose a near-infrared retinal hazard (L_{IR}), within 100 s are in Risk Group 1.		N/A
6.1.3	Risk Group 2 (Moderate-Risk)		N/A
	This requirement is met by any lamp that exceeds the limits for Risk Group 1, but that does not pose:		N/A
	– an actinic ultraviolet hazard (E_S) within 1000 s exposure, nor		N/A
	– a near ultraviolet hazard (E_{UVA}) within 100 s, nor		N/A
	– a retinal blue-light hazard (L_B) within 0,25 s (aversion response), nor		N/A
	– a retinal thermal hazard (L_R) within 0,25 s (aversion response), nor		N/A
	– an infrared radiation hazard for the eye (E_{IR}) within 10 s		N/A
	Lamps that emit infrared radiation without a strong visual stimulus and do not pose a near-infrared retinal hazard (L_{IR}), within 10 s are in Risk Group 2.		N/A
6.1.4	Risk Group 3 (High-Risk)		N/A
	Lamps which exceed the limits for Risk Group 2 are in Group 3.		N/A
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

IEC 62471			
Clause	Requirement + Test	Result – Remark	Verdict
	– 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

IEC 62471			
Clause	Requirement + Test	Result – Remark	Verdict

Table 4.1		Spectral weighting function for assessing ultraviolet hazards for skin and eye		—
Wavelength ¹ λ , nm	UV hazard function $S_{uv}(\lambda)$	Wavelength λ , nm	UV hazard function $S_{uv}(\lambda)$	
200	0,030	313*	0,006	
205	0,051	315	0,003	
210	0,075	316	0,0024	
215	0,095	317	0,0020	
220	0,120	318	0,0016	
225	0,150	319	0,0012	
230	0,190	320	0,0010	
235	0,240	322	0,00067	
240	0,300	323	0,00054	
245	0,360	325	0,00050	
250	0,430	328	0,00044	
254*	0,500	330	0,00041	
255	0,520	333*	0,00037	
260	0,650	335	0,00034	
265	0,810	340	0,00028	
270	1,000	345	0,00024	
275	0,960	350	0,00020	
280*	0,880	355	0,00016	
285	0,770	360	0,00013	
290	0,640	365*	0,00011	
295	0,540	370	0,000093	
297*	0,460	375	0,000077	
300	0,300	380	0,000064	
303*	0,120	385	0,000053	
305	0,060	390	0,000044	
308	0,026	395	0,000036	
310	0,015	400	0,000030	

¹ Wavelengths chosen are representative: other values should be obtained by logarithmic interpolation at intermediate wavelengths.
 * Emission lines of a mercury discharge spectrum.

IEC 62471			
Clause	Requirement + Test	Result – Remark	Verdict

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

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Clause	Requirement + Test	Result – Remark	Verdict

Table 4.2	Spectral weighting functions for assessing retinal hazards from broadband optical sources	—
	1150-1200	$0,2 \cdot 10^{0,02(1150-\lambda)}$
	1200-1400	0,02

IEC 62471			
Clause	Requirement + Test	Result – Remark	Verdict

Table 5.4		Summary of the ELs for the surface of the skin or cornea (irradiance based values)				—
Hazard Name	Relevant equation	Wavelength range nm	Exposure duration sec	Limiting aperture rad (deg)	EL in terms of constant irradiance $W \cdot m^{-2}$	
Actinic UV skin & eye	$E_S = \sum E_\lambda \cdot S(\lambda) \cdot \Delta\lambda$	200 – 400	< 30000	1,4 (80)	30/t	
Eye UV-A	$E_{UVA} = \sum E_\lambda \cdot \Delta\lambda$	315 – 400	≤ 1000 >1000	1,4 (80)	10000/t 10	
Blue-light small source	$E_B = \sum E_\lambda \cdot B(\lambda) \cdot \Delta\lambda$	300 – 700	≤ 100 >100	< 0,011	100/t 1,0	
Eye IR	$E_{IR} = \sum E_\lambda \cdot \Delta\lambda$	780 – 3000	≤ 1000 >1000	1,4 (80)	18000/t ^{0,75} 100	
Skin thermal	$E_H = \sum E_\lambda \cdot \Delta\lambda$	380 – 3000	< 10	2π sr	20000/t ^{0,75}	

Table 5.5		Summary of the ELs for the retina (radiance based values)				—
Hazard Name	Relevant equation	Wavelength range nm	Exposure duration sec	Field of view radians	EL in terms of constant radiance $W \cdot m^{-2} \cdot sr^{-1}$	
Blue light	$L_B = \sum L_\lambda \cdot B(\lambda) \cdot \Delta\lambda$	300 – 700	0,25 – 10	$0,011 \cdot \sqrt{(t/10)}$	10 ⁶ /t	
			10-100	0,011	10 ⁶ /t	
			100-10000	$0,0011 \cdot \sqrt{t}$	10 ⁶ /t	
			≥ 10000	0,1	100	
Retinal thermal	$L_R = \sum L_\lambda \cdot R(\lambda) \cdot \Delta\lambda$	380 – 1400	< 0,25	0,0017	50000/($\alpha \cdot t^{0,25}$)	
			0,25 – 10	$0,011 \cdot \sqrt{(t/10)}$	50000/($\alpha \cdot t^{0,25}$)	
Retinal thermal (weak visual stimulus)	$L_{IR} = \sum L_\lambda \cdot R(\lambda) \cdot \Delta\lambda$	780 – 1400	> 10	0,011	6000/α	

IEC 62471			
Clause	Requirement + Test	Result – Remark	Verdict

Table 6.12		Emission limits for risk groups of continuous wave lamps for MLGH6CG5BU							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	$9,880 \times 10^{-5}$	0,003	--	0,03	--	
Near UV		E_{UVA}	$W \cdot m^{-2}$	10	$6,345 \times 10^{-4}$	33	--	100	--	
Blue light	$B(\lambda)$	L_B	$W \cdot m^{-2} \cdot sr^{-1}$	100	$6,125 \times 10$	10000	--	4000000	--	
Blue light, small source	$B(\lambda)$	E_B	$W \cdot m^{-2}$	1,0*	--	1,0	--	400	--	
Retinal thermal	$R(\lambda)$	L_R	$W \cdot m^{-2} \cdot sr^{-1}$	$28000/\alpha$	$\alpha=0,03068,$ $6,057 \times 10^3 <$ $9,127 \times 10^5$	$28000/\alpha$	--	$71000/\alpha$	--	
Retinal thermal, weak visual stimulus**	$R(\lambda)$	L_{IR}	$W \cdot m^{-2} \cdot sr^{-1}$	$6000/\alpha$	$\alpha=0,03068,$ $0,000 <$ $1,956 \times 10^5$	$6000/\alpha$	--	$6000/\alpha$	--	
IR radiation, eye		E_{IR}	$W \cdot m^{-2}$	100	0,000	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
 $E_h = 1,620 W \cdot m^{-2} < 3556,56 W \cdot m^{-2}$

IEC 62471			
Clause	Requirement + Test	Result – Remark	Verdict

Table 6.12		Emission limits for risk groups of continuous wave lamps for MLGH1CG5BU							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	$8,898 \times 10^{-5}$	0,003	--	0,03	--	
Near UV		E_{UVA}	$W \cdot m^{-2}$	10	$7,285 \times 10^{-4}$	33	--	100	--	
Blue light	$B(\lambda)$	L_B	$W \cdot m^{-2} \cdot sr^{-1}$	100	$8,902 \times 10$	10000	--	4000000	--	
Blue light, small source	$B(\lambda)$	E_B	$W \cdot m^{-2}$	1,0*	--	1,0	--	400	--	
Retinal thermal	$R(\lambda)$	L_R	$W \cdot m^{-2} \cdot sr^{-1}$	$28000/\alpha$	$\alpha=0,03658,$ $4,905 \times 10^2 <$ $7,654 \times 10^5$	$28000/\alpha$	--	$71000/\alpha$	--	
Retinal thermal, weak visual stimulus**	$R(\lambda)$	L_{IR}	$W \cdot m^{-2} \cdot sr^{-1}$	$6000/\alpha$	$\alpha=0,03658,$ $0,000 <$ $1,640 \times 10^5$	$6000/\alpha$	--	$6000/\alpha$	--	
IR radiation, eye		E_{IR}	$W \cdot m^{-2}$	100	0,000	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
 $E_h = 1,649 W \cdot m^{-2} < 3556,56 W \cdot m^{-2}$

IEC 62471			
Clause	Requirement + Test	Result – Remark	Verdict

Table 6.12		Emission limits for risk groups of continuous wave lamps for MLGL5CG5BU							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	$7,890 \times 10^{-5}$	0,003	--	0,03	--	
Near UV		E_{UVA}	$W \cdot m^{-2}$	10	$5,790 \times 10^{-4}$	33	--	100	--	
Blue light	$B(\lambda)$	L_B	$W \cdot m^{-2} \cdot sr^{-1}$	100	$1,388 \times 10$	10000	--	4000000	--	
Blue light, small source	$B(\lambda)$	E_B	$W \cdot m^{-2}$	1,0*	--	1,0	--	400	--	
Retinal thermal	$R(\lambda)$	L_R	$W \cdot m^{-2} \cdot sr^{-1}$	$28000/\alpha$	$\alpha=0,05084,$ $4,567 \times 10^2 <$ $5,508 \times 10^5$	$28000/\alpha$	--	$71000/\alpha$	--	
Retinal thermal, weak visual stimulus**	$R(\lambda)$	L_{IR}	$W \cdot m^{-2} \cdot sr^{-1}$	$6000/\alpha$	$\alpha=0,05084,$ $0,000 <$ $1,180 \times 10^5$	$6000/\alpha$	--	$6000/\alpha$	--	
IR radiation, eye		E_{IR}	$W \cdot m^{-2}$	100	0,000	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
 $E_h = 1,643 W \cdot m^{-2} < 3556,56 W \cdot m^{-2}$

IEC 62471			
Clause	Requirement + Test	Result – Remark	Verdict

Table 6.12		Emission limits for risk groups of continuous wave lamps for MLLED4CG5BU							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	$6,056 \times 10^{-5}$	0,003	--	0,03	--
Near UV		E_{UVA}	$W \cdot m^{-2}$	10	$1,271 \times 10^{-3}$	33	--	100	--
Blue light	$B(\lambda)$	L_B	$W \cdot m^{-2} \cdot sr^{-1}$	100	$2,354 \times 10$	10000	--	4000000	--
Blue light, small source	$B(\lambda)$	E_B	$W \cdot m^{-2}$	1,0*	--	1,0	--	400	--
Retinal thermal	$R(\lambda)$	L_R	$W \cdot m^{-2} \cdot sr^{-1}$	$28000/\alpha$	$\alpha=0,04643,$ $1,006 \times 10^3 <$ $6,031 \times 10^5$	$28000/\alpha$	--	$71000/\alpha$	--
Retinal thermal, weak visual stimulus**	$R(\lambda)$	L_{IR}	$W \cdot m^{-2} \cdot sr^{-1}$	$6000/\alpha$	$\alpha=0,04643,$ $0,000 <$ $1,292 \times 10^5$	$6000/\alpha$	--	$6000/\alpha$	--
IR radiation, eye		E_{IR}	$W \cdot m^{-2}$	100	0,000	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
 $E_h = 1,650 W \cdot m^{-2} < 3556,56 W \cdot m^{-2}$

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Report No.: 50200535 001

Furthermore remarks:

N/A

Measurement Equipment List

Testing Start Date 15.11.2018
 Testing end date 19.11.2018

Project Manager Xu Boat
 Cost Center 40
 Test Report Number 50200535 001
 Order Item Number 0154367357A00040

Customer TUV Rheinland (India) Pvt. Ltd.
 Product Name LED LAMP
 Comment

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Old ID	Equip.	Description	Model	Manufacturer	Inte. (mon)	Due Date
E180	1812197	AC Digital Power Meter	3332	HIOKI E.E.	12	07.09.2019
O027	1812488	Spectroradiometer	SUV-3000	SENSING	12	26.03.2019
O035	1812492	Three-dimensional Photometric System	GMS-109H	SENSING	12	16.03.2019
O040	1812495	Irradiance & Radiance Standard Lamp	LSD-400	SENSING	24	04.01.2019

* No entry for devices that are not subject to regular calibration
 or require initial verification/calibration only.

Signature: _____ *Jacky*