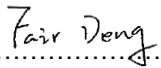
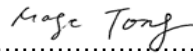


Test Report issued under the responsibility of:



TEST REPORT IEC 62471 Photobiological safety of lamps and lamp systems	
Report Reference No.	4903216.51
Date of issue	2023-05-12
Total number of pages	26 pages
Name of Testing Laboratory preparing the Report	DEKRA Testing and Certification (Shanghai) Ltd., Guangzhou Branch
Applicant's name	AOK Industrial Company Limited
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Test specification:	
Standard	IEC 62471:2006
Test procedure	Type test
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:	
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Test item description	LED Streetlights	
Trade Mark		
Manufacturer	Same as applicant	
Model/Type reference	Refer to Attachment 6 for detailed model list	
Ratings	220-240 VAC, 50/60 Hz, Class I, IP66, ta: 55 °C; non-user replaceable LEDs; Other information refers to Attachment 6 for detailed model list	
Responsible Testing Laboratory (as applicable), testing procedure and testing location(s):		
☒	Testing Laboratory:	DEKRA Testing and Certification (Shanghai) Ltd., Guangzhou Branch
Testing location/ address		Block 5, No.3, Qiyun Road, Huangpu District, Guangzhou, Guangdong, China
Tested by (name, function, signature)		Fair Deng (Project Handler) 
Approved by (name, function, signature) ..		Magic Tong (Reviewer) 

List of Attachments (including a total number of pages in each attachment): Attachment 1: List of test equipment used (1 page) Attachment 2: Photos (4 pages) Attachment 3: Test Result (2 pages) Attachment 4: LED chip specification (1 page) Attachment 5: The difference between IEC 62471: 2006 and EN 62471: 2008 (1 page) Attachment 6: Detailed model list (1 page)	
Summary of testing:	
Tests performed (name of test and test clause): AOK-300WiL02-NV-S3-PH-6570-T2-P (with Seoul 3535, 6500 K LEDs) and AOK-100WiLA-NV-S5-PH-6570-T2-P (with Seoul 5050, 6500 K LEDs) were subjected to full test. All models were subjected to construction check.	Testing location: DEKRA Testing and Certification (Shanghai) Ltd., Guangzhou Branch Block 5, No.3, Qiyun Road, Huangpu District, Guangzhou, Guangdong, China
Summary of compliance with National Differences (List of countries addressed): ☒ EU Group Differences and National Differences	
Copy of marking plate: N/A	

Test item particulars		LED Streetlights	
Tested lamp		☒ continuous wave lamps	☐ pulsed lamps
Tested lamp system		N/A	
Lamp classification group		☒ exempt	☒ risk 1 ☐ risk 2 ☐ risk 3
Lamp cap		--	
Bulb		--	
Rated of the lamp		See ratings	
Furthermore marking on the lamp		N/A	
Seasoning of lamps according IEC standard		N/A	
Used measurement instrument		Spectroradiometer	
Temperature by measurement		25 °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		2023-05-08	
Date (s) of performance of tests		2023-05-08 to 2023-05-10	
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 measurement result is considered in conformance with the requirement if it is within the prescribed limit, it is not necessary to calculate the uncertainty associated with the measurement result. This report will not be used for social proof function in China market.			
Manufacturer's Declaration per sub-clause 4.2.5 of IEC60598-2:			
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:		☐ Yes ☒ Not applicable	
When differences exist; they shall be identified in the General product information section.			
Name and address of factory (ies) : Same as applicant			

General product information and other remarks:

The products in this report were tested and compliant with following standards:

-IEC 62471: 2006

-EN 62471: 2008

-IEC/TR 62471-2: 2009

The products covered in this report are class I streetlights, equipped with non-user replaceable LEDs.

The requirement of photobiological safety of LED required by IEC 62471: 2006 and EN 62471: 2008, AOK-300WiL02-NV-S3-PH-6570-T2-P (with Seoul 3535, 6500 K LEDs) had been tested and was classified as Risk Group 1. AOK-100WiLA-NV-S5-PH-6570-T2-P (with Seoul 5050, 6500 K LEDs) had been tested and was classified as Exempt Group. According to these test result, the products with Seoul 3535 LEDs in this report were classified as Risk Group 1 and the products with Seoul 5050 LEDs in this report were classified as Exempt Group. All models in this report do not pose any photobiological hazard according to IEC/EN 62471. No labelling is required.

IEC 62471			
Clause	Requirement + Test	Result – Remark	Verdict
4	EXPOSURE LIMITS		
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 broad-band 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		P
	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

IEC 62471			
Clause	Requirement + Test	Result – Remark	Verdict
	$L_B \cdot t = \sum_{300}^{700} \sum_t L_\lambda(\lambda, t) \cdot B(\lambda) \cdot \Delta\lambda \cdot \Delta t \leq 10^6 \quad \text{J} \cdot \text{m}^{-2} \cdot \text{sr}^{-1}$	for $t \leq 10^4 \text{ s}$ $t_{\max} = \frac{10^6}{L_B}$	P
	$L_B = \sum_{300}^{700} L_\lambda \cdot B(\lambda) \cdot \Delta\lambda \leq 100 \quad \text{W} \cdot \text{m}^{-2} \cdot \text{sr}^{-1}$	for $t > 10^4 \text{ s}$	P
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 $t \leq 100 \text{ s}$	N/A
	$E_B = \sum_{300}^{700} E_\lambda \cdot B(\lambda) \cdot \Delta\lambda \leq 1 \quad \text{W} \cdot \text{m}^{-2}$	for $t > 100 \text{ s}$	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
	$E_{IR} = \sum_{780}^{3000} E_\lambda \cdot \Delta\lambda \leq 18\,000 \cdot t^{-0,75} \quad \text{W} \cdot \text{m}^{-2}$	$t \leq 1000 \text{ s}$	P
	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

IEC 62471			
Clause	Requirement + Test	Result – Remark	Verdict
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
	$E_H \cdot t = \sum_{380}^{3000} \sum_t E_\lambda(\lambda, t) \cdot \Delta t \cdot \Delta \lambda \leq 20\,000 \cdot t^{0.25} \quad \text{J} \cdot \text{m}^{-2}$		P
5	MEASUREMENT OF LAMPS AND LAMP SYSTEMS		
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		N/A
	Operation of the test lamp shall be provided in accordance with:		N/A
	– the appropriate IEC lamp standard, or		N/A
	– the manufacturer's recommendation		N/A
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.		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

IEC 62471			
Clause	Requirement + Test	Result – Remark	Verdict
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
	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		
	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 (GLS), 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		P
	– for all other light sources, including pulsed lamp sources, the hazard values shall be reported at a distance of 200 mm		N/A

IEC 62471			
Clause	Requirement + Test	Result – Remark	Verdict
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:	For the products with Seoul 5050 LEDs	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)		P
	In this group are lamps, which exceeds the limits for the except group but that does not pose:	For the products with Seoul 3535 LEDs	P
	– an actinic ultraviolet hazard (E_S) within 10000 s, nor		P
	– a near ultraviolet hazard (E_{UVA}) within 300 s, nor		P
	– a retinal blue-light hazard (L_B) within 100 s, nor		P
	– a retinal thermal hazard (L_R) within 10 s, nor		P
	– an infrared radiation hazard for the eye (E_{IR}) within 100 s		P
	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.		P
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

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Clause	Requirement + Test	Result – Remark	Verdict
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

IEC 62471			
Clause	Requirement + Test	Result – Remark	Verdict

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.				

IEC 62471			
Clause	Requirement + Test	Result – Remark	Verdict

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	

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)				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	

IEC 62471			
Clause	Requirement + Test	Result – Remark	Verdict

Table 6.1		Emission limits for risk groups of continuous wave lamps (for AOK-300WiL02-NV-S3-PH-6570-T2-P (with Seoul 3535, 6500 K LEDs))							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	0,000359	0,003	--	0,03	--
Near UV		E_{UVA}	$W \cdot m^{-2}$	10	0,00023	33	--	100	--
Blue light	$B(\lambda)$	L_B	$W \cdot m^{-2} \cdot sr^{-1}$	100	--	10000	4722,1	4000000	--
Blue light, small source	$B(\lambda)$	E_B	$W \cdot m^{-2}$	1,0*	--	1,0	--	400	--
Retinal thermal	$R(\lambda)$	L_R	$W \cdot m^{-2} \cdot sr^{-1}$	$28000/\alpha$	2405,01 ($\alpha=46,2$ mrad)	$28000/\alpha$	--	$71000/\alpha$	--
Retinal thermal, weak visual stimulus**	$R(\lambda)$	L_{IR}	$W \cdot m^{-2} \cdot sr^{-1}$	$6000/\alpha$	--	$6000/\alpha$	--	$6000/\alpha$	--
IR radiation, eye		E_{IR}	$W \cdot m^{-2}$	100	0,0088	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									

IEC 62471			
Clause	Requirement + Test	Result – Remark	Verdict

Table 6.1		Emission limits for risk groups of continuous wave lamps (for AOK-100WiLA-NV-S5-PH-6570-T2-P (with Seoul 5050, 6500 K LEDs))							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	0,000599	0,003	--	0,03	--
Near UV		E_{UVA}	$W \cdot m^{-2}$	10	0,00028	33	--	100	--
Blue light	$B(\lambda)$	L_B	$W \cdot m^{-2} \cdot sr^{-1}$	100	67,315	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	$W \cdot m^{-2} \cdot sr^{-1}$	$28000/\alpha$	1528,215 ($\alpha=45,6$ mrad)	$28000/\alpha$	--	$71000/\alpha$	--
Retinal thermal, weak visual stimulus**	$R(\lambda)$	L_{IR}	$W \cdot m^{-2} \cdot sr^{-1}$	$6000/\alpha$	--	$6000/\alpha$	--	$6000/\alpha$	--
IR radiation, eye		E_{IR}	$W \cdot m^{-2}$	100	0,00538	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									

Attachment 1: Furthermore remarks:

List of test equipment used:

Clause	Measurement/ testing	Registration Number	Testing/measuring equipment/material used	Range used
5	Irradiance measurements Radiance measurements	G/L655	Spectroradiometer	200-3000 nm

Attachment 2: Photos



Overall view of AOK-300WIL02-NV-S3-PH-6570-T2-P



Rear view of AOK-300WIL02-NV-S3-PH-6570-T2-P



Internal view of AOK-300WiL02-NV-S3-PH-6570-T2-P



Internal view of AOK-300WiL02-NV-S3-PH-6570-T2-P



Overall view of AOK-100WiLA-NV-S5-PH-6570-T2-P



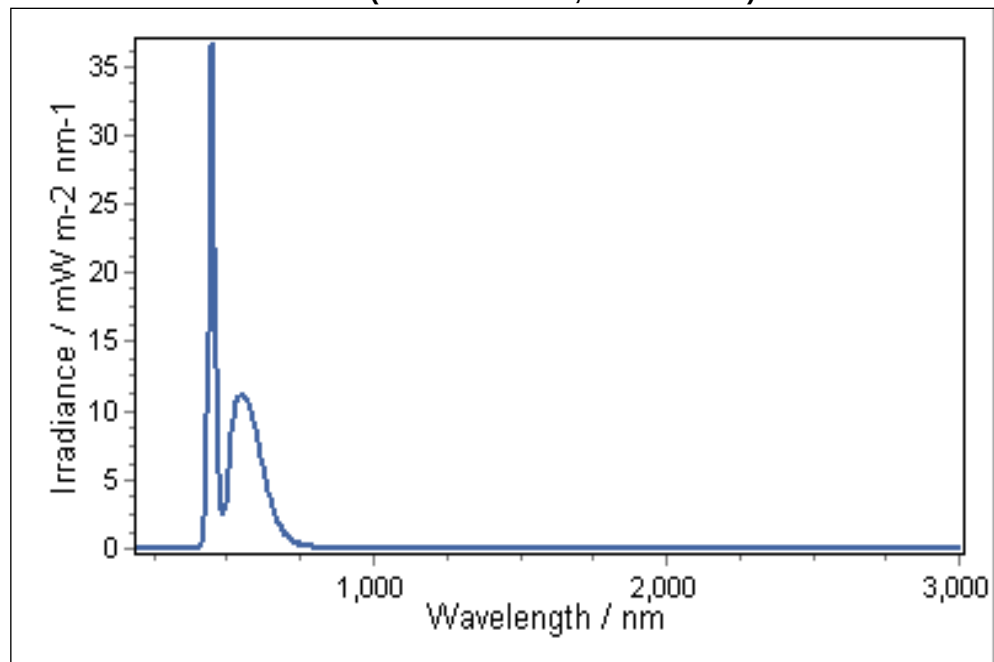
Rear view of AOK-100WiLA-NV-S5-PH-6570-T2-P



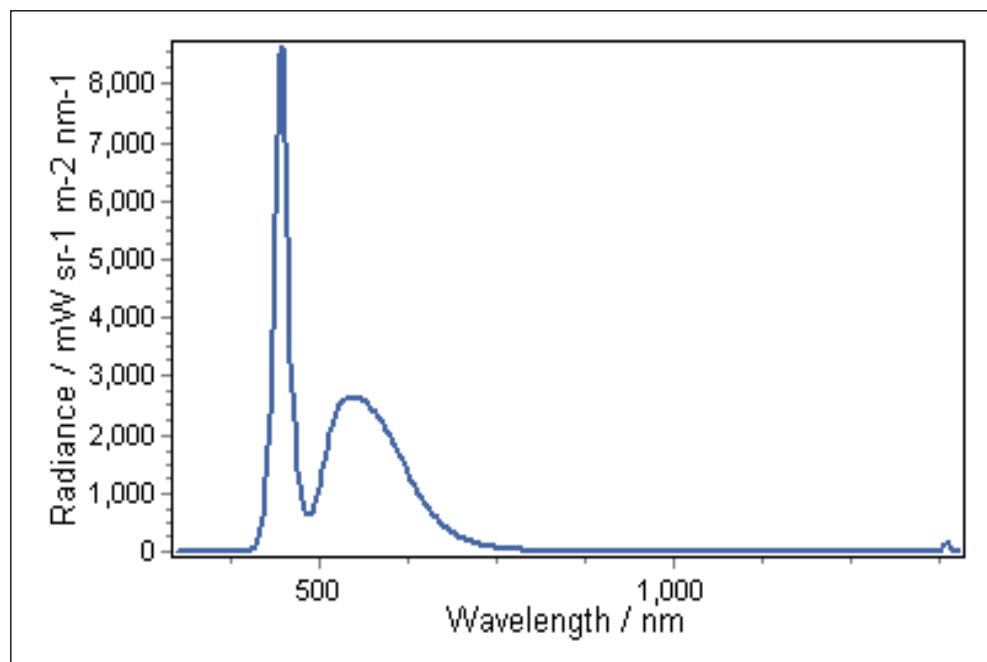
Internal view of AOK-100WiLA-NV-S5-PH-6570-T2-P



Internal view of AOK-100WiLA-NV-S5-PH-6570-T2-P

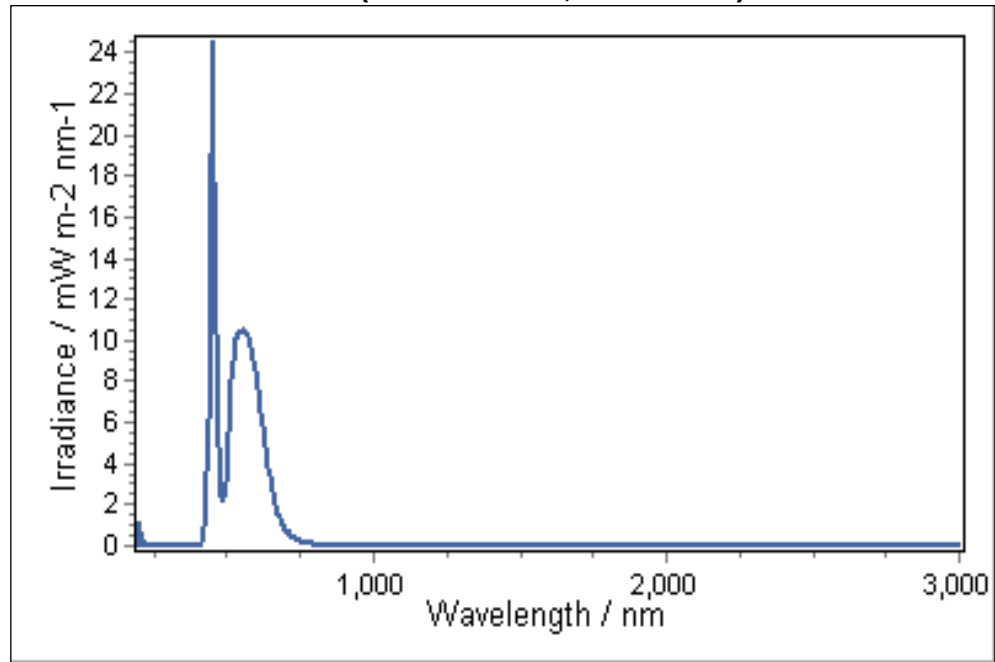
Attachment 3: Test Result**For AOK-300WiL02-NV-S3-PH-6570-T2-P (with Seoul 3535, 6500 K LEDs):**

Measured spectral irradiance distribution

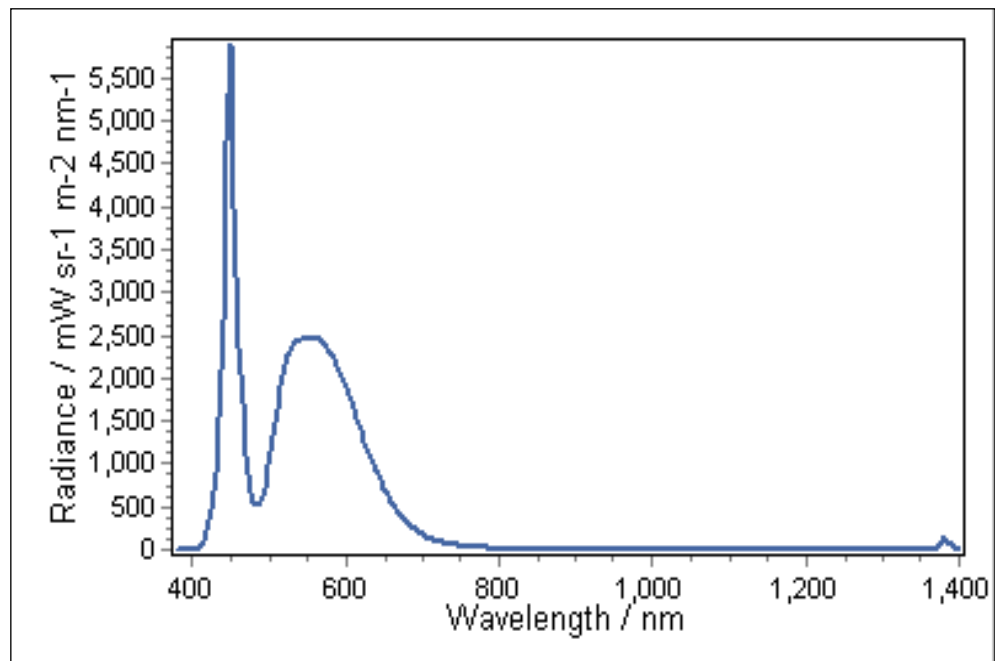


Measured spectral radiance distribution

For AOK-100WILA-NV-S5-PH-6570-T2-P (with Seoul 5050, 6500 K LEDs):



Measured spectral irradiance distribution



Measured spectral radiance distribution

Attachment 4: LED chip specification

Manufacturer	LED type no.	Technical Data	Remark
Seoul	Seoul 3535	V_F : 2,75-2,95 V, I_F : 700 mA, 2700-6500 K	Refer to Attachment 6
Seoul	Seoul 5050	V_F : 5,8-6,4 V, I_F : 640 mA, 2700-6500 K	Refer to Attachment 6

Attachment 5: The difference between IEC 62471: 2006 and EN 62471: 2008

Table 4.1 wavelength step of the $SUV(\lambda)$ is 1nm listed according to EN 62471 and 5nm listed according to IEC 62471. The system is calculated according to both IEC 62471 and EN 62471, so that the results which calculated have no influence to the issued result, especially for the lamp classification. As the result, EN 62471 can be covered for the tested items in this report.

About the starting wavelength from 180nm of EN 62471 and starting wavelength from 200nm of IEC 62471, it is very difficult to the radiation below 200nm at common condition and also from the behaviour of samples which are tested. However, there should be no any output below 200nm for the normal lamps. As the result, EN 62471 can be covered for the tested items in this report.

About Blue Light Small Source, the limit of Exempt Group is 0, 01 $W \cdot m^{-2}$ according to EN 62471 and 1, 0 $W \cdot m^{-2}$ according to IEC 62471. Since the evaluation of Blue Light in this report do not consider as small source, so there is no influence to the Blue Light hazard classification also.

Attachment 6: Detailed Model List

No.	Model	Power (W)	LED Type	Dimension (mm)	Remark
1-1	AOK-20WiLA-NV-XX-XX-XXYY-BN-P	20	Seoul 5050	537*210*88	Length*Width*Height
1-2	AOK-30WiLA-NV-XX-XX-XXYY-BN-P	30		537*210*88	Length*Width*Height
1-3	AOK-40WiLA-NV-XX-XX-XXYY-BN-P	40		537*210*88	Length*Width*Height
1-4	AOK-50WiLA-NV-XX-XX-XXYY-BN-P	50		537*210*88	Length*Width*Height
1-5	AOK-60WiLA-NV-XX-XX-XXYY-BN-P	60		537*210*88	Length*Width*Height
1-6	AOK-70WiLA-NV-XX-XX-XXYY-BN-P	70		537*210*88	Length*Width*Height
1-7	AOK-75WiLA-NV-XX-XX-XXYY-BN-P	75		537*210*88	Length*Width*Height
1-8	AOK-80WiLA-NV-XX-XX-XXYY-BN-P	80		567*228*88	Length*Width*Height
1-9	AOK-90WiLA-NV-XX-XX-XXYY-BN-P	90		567*228*88	Length*Width*Height
1-10	AOK-100WiLA-NV-XX-XX-XXYY-BN-P	100		567*228*88	Length*Width*Height
2-1	AOK-20WiL02-NV-XX-XX-XXYY-BN-P	20	Seoul 3535	492*179*119	Length*Width*Height
2-2	AOK-30WiL02-NV-XX-XX-XXYY-BN-P	30		492*179*119	Length*Width*Height
2-3	AOK-40WiL02-NV-XX-XX-XXYY-BN-P	40		492*179*119	Length*Width*Height
2-4	AOK-50WiL02-NV-XX-XX-XXYY-BN-P	50		492*179*119	Length*Width*Height
2-5	AOK-60WiL02-NV-XX-XX-XXYY-BN-P	60		492*179*119	Length*Width*Height
2-6	AOK-80WiL02-NV-XX-XX-XXYY-BN-P	80		646*240*137	Length*Width*Height
2-7	AOK-90WiL02-NV-XX-XX-XXYY-BN-P	90		646*240*137	Length*Width*Height
2-8	AOK-100WiL02-NV-XX-XX-XXYY-BN-P	100		646*240*137	Length*Width*Height
2-9	AOK-120WiL02-NV-XX-XX-XXYY-BN-P	120		646*240*137	Length*Width*Height
2-10	AOK-130WiL02-NV-XX-XX-XXYY-BN-P	130		676*290*137	Length*Width*Height
2-11	AOK-140WiL02-NV-XX-XX-XXYY-BN-P	140		676*290*137	Length*Width*Height
2-12	AOK-150WiL02-NV-XX-XX-XXYY-BN-P	150		676*290*137	Length*Width*Height
2-13	AOK-160WiL02-NV-XX-XX-XXYY-BN-P	160		676*290*137	Length*Width*Height
2-14	AOK-180WiL02-NV-XX-XX-XXYY-BN-P	180		676*290*137	Length*Width*Height
2-15	AOK-200WiL02-NV-XX-XX-XXYY-BN-P	200		756*308*138	Length*Width*Height
2-16	AOK-220WiL02-NV-XX-XX-XXYY-BN-P	220		756*308*138	Length*Width*Height
2-17	AOK-225WiL02-NV-XX-XX-XXYY-BN-P	225		756*308*138	Length*Width*Height
2-18	AOK-230WiL02-NV-XX-XX-XXYY-BN-P	230		756*308*138	Length*Width*Height
2-19	AOK-240WiL02-NV-XX-XX-XXYY-BN-P	240		756*308*138	Length*Width*Height
2-20	AOK-250WiL02-NV-XX-XX-XXYY-BN-P	250		756*308*138	Length*Width*Height
2-21	AOK-275WiL02-NV-XX-XX-XXYY-BN-P	275		756*308*138	Length*Width*Height
2-22	AOK-300WiL02-NV-XX-XX-XXYY-BN-P	300		756*308*138	Length*Width*Height
Description: The first "XX" can be any letters to denote manufacturer of LED; and can be replaced by S5 to represent Seoul 5050 LED, or S35 to represent Seoul 3535 LED; The second "XX" denotes dimming control; which can be as followings: 00=No sensor provided, PH=Plug-In photocontrol or NEMA Short-circuit cap provided, DV=dimming function; The third "XX" can be 27, 30, 40, 50, 57 or 65 to denote colour temperature of LEDs, e.g. 27=2700K, 30=3000K, 40=4000K, 50=5000K, 57=5700K, 65=6500K; "YY" can be 70, 80 or 90 to denote colour rendering index of LEDs, e.g. 70: CRI: 70, 80: CRI: 80, 90: CRI: 90; "BN" can be any letter or number to denote beam angles					

-END-