TEST REPORT
IEC TR 62778
Application of IEC 62471 for the assessment of blue light hazard to light sources and luminaires

Report Number. ..... :	**422863-1TRFPHO**
Date of issue ..... :	2021-03-22
Total number of pages ..... :	16
Name of Testing Laboratory preparing the Report ..... :	**Nemko Spa**
Applicant's name ..... :	**C Luce Srl**
Address ..... :	Via Marmolada, 5/11 20060 Trucazzano (MI) Italy
Test specification:	
Standard ..... :	IEC TR 62778:2014 (Second Edition)
Test procedure ..... :	Testing
Non-standard test method ..... :	N/A
Test Report Form No. ..... :	IEC62778A_Nemko
Test Report Form(s) Originator .... :	Nemko S.p.A.
Master TRF ..... :	Dated 2016-02

Test item description..... :	**Street LED luminaire**
Trade Mark..... :	CLuce ( )
Manufacturer ..... :	CLuce Srl
Model/Type reference..... :	VENTO AS 510643.362
Ratings..... :	700 mA 220-240 V 50-60 Hz 72 W 4000 K IP66
s/n of model tested ..... :	422863 1/1 assigned by Nemko Spa

Responsible Testing Laboratory (as applicable), testing procedure and testing location(s):			
☒	**Testing Laboratory:**		
Testing location/ address ..... :		**Nemko Spa** Via del Carroccio, 4 – 20853 Biassono (MB) – Italy	
☐	**Associated Testing Laboratory:**		
Testing location/ address ..... :			
Tested by (name, function, signature)..... :		Oscar Segantin (Project handler)	Segantin Oscar
Approved by (name, function, signature) .. :		Visconti Gaetano (Verifier)	Gaetano Visconti
☐	**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):

- Attachment 1: Measurement uncertainty (4 pages)
- Attachment 2: Characteristics of lamps (1 page)
- Attachment 3: Photo documentation (2 pages)
- Attachment 4: Equipment used for testing (1 page)

Summary of testing:

The equipment under test is a street LED luminaire.
The tests were performed with the following settings:

1- Measure distance of 200mm (IEC_62778)

Tests performed (name of test and test clause):

Cl. 8 – Risk Group classification

Note: The following Nemko technical procedures were also applied during testing:
- WML0177 General routines for using instruments at Nemko**.**
- WML1002: Measurement Uncertainty – Policy and Statement.
- WML0066: Procedure for measurement of Photobiological safety of lamps and lamp systems

Statement of the measurement uncertainty:

See Attachment 1 for Measurement Uncertainty

Unless different values are declared in the test case, following ambient conditions apply for the tests:

- Ambient temperature 18-33 °C
- Relative Humidity 30-70 %
- Atmospheric Pressure 860-1060 hPa

Equipment used for testing is recorded and saved into Attachment 4 to this test report.

Testing location:

Nemko Spa
Via del Carroccio, 4 – 20853 Biassono (MB) – ITALY
(for all tests)

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

- All CENELEC member countries (no deviation listed on IECEE website, as checked on March 2021)

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.

NOT PROVIDED

Calibration	All instruments used in the tests given in this test report are calibrated and traceable to national or international standards. Further information about traceability will be given on request.
Measurement uncertainty	The measurement uncertainty was calculated for each test and quantity listed in this test report, according to IEC Guide 115 and other specific test standard and is documented in Nemko Spa working manual WML1002.
Assessment of conformity	The assessment of conformity for each test performed on the equipment is performed not taking into account the measurement uncertainty. The two following possible verdicts are stated in the report: P (Pass) - The measured values of the equipment respect the specification limit at the points tested. The specific risk of false accept is up to 50% when the measured result is close to the limit. F (Fail) - One or more measured values of the equipment do not respect the specification limit at the points tested. The specific risk of false reject is up to 50% when the measured result is close to the limit.

Test item particulars..... :	**Street LED luminaire**
Product evaluated..... :	☐ **LED package** ☐ **LED module** ☐ **Lamp** ☒ **Luminaire**
Rated voltage (V)..... :	220-240 V
Rated current (mA) ..... :	700 mA
Rated CCT (K)..... :	4000 K
Rated Luminance (Mcd/m^2) ..... :	-
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 (Not applicated)
- test object does meet the requirement.....:	P (Pass)
- test object does not meet the requirement.....:	F (Fail)
Testing.....:	
Date of receipt of test item .....:	2021-02-09
Date (s) of performance of tests.....:	2021-03-19

General remarks:

"The phase of sampling / collection of equipment under test is carried out by the customer."

"(See Enclosure #)" refers to additional information appended to the report.
"(See appended table)" refers to a table appended to the report.
The phase of sampling/collection is carried out by manufacturer.

Results indicated in this test report apply to samples as received.

Throughout this report a ☒ comma / ☐ point is used as the decimal separator.

Name and address of factory (ies) .....:	**Midstream Lighting Ltd** Wessex house - 1 Chesham Street SW1X 8ND London - UK

General product information:

The equipment under test is a street LED luminaire, composed by:

- 3 LED modules each module consists of 12 LED packages (total 36 LED package), see attachment 4 for further characteristics of the LED packages;
- Asymmetric beam light lens
- 1 LED DRIVER model Xi BP 75W0.3-1.0A S230V133 sXt manufactured by PHILIPS with ratings:
  Input: 220-240 V 50/60 Hz 0,4-0,34 A 84 W
  Output: 75 Wmax 35-108 Vdc 300-105 mA
- Light emitting area: 150x150 mm

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		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		P
	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)		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**		P
	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		P
	- E_{thr} ..... (lx) : Distance to reach RG1 ..... (m) :		N/A

	TABLE: Spectroradiometric measurement		**P**
	Measurement performed on:	☐ **LED package** ☐ **LED module** ☐ **Lamp** ☒ **Luminaire**	
	Model number ..... :	VENTO AS 510643.362	
	Test voltage (V) ..... :	240 V 50 Hz	—
	Test current (mA) ..... :	-	—
	Test frequency (Hz) ..... :	-	—
	Ambient, t (°C) ..... :	23	—
	Measurement distance ..... :	☒ 20 cm ☐ ... cm	—
	Source size ..... :	☒ Non-small ☐ Small : .... mm	—
	Field of view ..... :	☐ 100 mrad ☒ 11 mrad ☐ 1,7 mrad (for small sources)	—

Item	Symbol	Units	Result	Remark
Correlated colour temperature	CCT	K	N/A	See component datasheet
x/y colour coordinates			N/A	See component datasheet
Blue light hazard radiance	LB	W/(mv•sr1)	**2870**	RG1
Blue light hazard irradiance	EB	W/m^2	N/A	
Luminance	L	cd/m^2	**4,38 E06**	
Illuminance	E	lx	N/A	

Supplementary information:

ATTACHMENT 1: MEASUREMENT UNCERTAINTY

Hereafter Nemko's measurement uncertainties are reported:

Test	Range	Measurement Uncertainty	Note
Environmental testing	Temperature -70 °C ÷ 180 °C – Chamber center	1.4 °C	(1)
	Temperature -70 °C ÷ 180 °C – Overall chamber	1.8 °C	(1)
	Relative Humidity 10 % ÷ 98 % – Chamber center	3 %	(1)
	Relative Humidity 10 % ÷ 98 % – Overall chamber	4 %	(1)
IP protection	Water flow 0.5 l/min ÷ 100 l/min	5 %	(1)
	Air flow	5 %	(1)
	Force 50 N, 30 N, 3 N, 1 N	6 %	(1)
	Dimensions 50 mm, 12.5 mm, 2.5 mm, 1 mm	0.05 mm	(1)
Construction verifications	AC/DC Voltage 10 mV ÷ 1000 V up to 5 kHz	1.5·%	(1)
	AC/DC Voltage 10 mV ÷ 1000 V 5÷100 kHz	2.5·%	(1)
	AC/DC Current 0.1 mA ÷ 5 A up to 1 kHz	1.5·%	(1)
	AC/DC Current 5 A ÷ 400 A up to 1 kHz	2.5·%	(1)
	Resistance 100 mΩ ÷ 10 MΩ	2.0·%	(1)
	Active/Apparent Power 200 mW ÷ 1 W	20 mW	(1)
	Active/Apparent Power 1 W ÷ 6 kW	3.0 %	(1)
	Power factor	0.05	(1)
	Frequency	0.2 %	(1)
	Dimensions 0 ÷ 200 mm	0.05 mm	(1)
	Dimensions 0.2 ÷ 200 m	0.5 %	(1)
	Angle and Inclination 0 ÷ 360 °	0.3 °	(1)
	Force 0.2 ÷ 2.5 kN	3 %	(1)
	Torque 0.1 ÷ 200 Nm	5 %	(1)
	Mechanical energy 0.2 ÷ 50 J	10 %	(1)
	Weight 1 g ÷ 2 kg	1.0 % or 0.1 g	(1)
	Weight 2 kg ÷ 100 kg	2 %	(1)
Heating	Temperature 20 °C ÷ 400 °C	4.5 °C	(1)
Pressure measurement	Pressure -0.5 bar ÷ 700 bar	1.0·%	(1)
Temperature measurement	Temperature -40 °C ÷ 300 °C	2.0 °C	(1)
Protection against access to live parts	Dimensions 1 ÷ 1000 mm	0.08 mm or 0.3 %	(1)
	Force 0.2 ÷ 1000 N	3%	(1)
Power input and current	Active/Apparent Power 0.2 W ÷ 6 kW	20 mW or 3 %	(1)
	AC/DC Current 1 mA ÷ 5 A up to 1 kHz	1.5 %	(1)
Leakage and touch current	AC Current 0.01 mA ÷ 200 mA up to 5 kHz	3.0 %	(1)
	AC Current 0.01 mA ÷ 200 mA 5 kHz to 100 kHz	10.0 %	(1)
	AC Current 0.01 mA ÷ 200 mA 100 kHz to 1 MHz	20.0 %	(1)
Earth impedance	Impedance 1 mΩ ÷ 10 kΩ	3 mΩ or 4 %	(1)
Continuity resistance	AC 10 mΩ ÷ 2 Ω, 5 A ÷ 32 A	3 mΩ or 5 %	(1)
	AC 2 Ω ÷ 100 Ω, 100 mA or 200 mA	5 %	(1)
	DC 1 mΩ ÷ 1 kΩ, 0.01 A ÷ 10 A	5 %	(1)
Insulation resistance	10 kΩ ÷ 200 GΩ, 10 V ÷ 1000 V	3.0·%	(1)
	200 GΩ ÷ 1000 GΩ, 500 V ÷ 1000 V	5.0·%	(1)
Dielectric strength	AC Voltage 0.1 kV ÷ 5 kV (50 Hz or 60 Hz)	3.0 %	(1)
	DC Voltage 0.1 kV ÷ 6 kV	3.0 %	(1)
	AC/DC Current 0.1 mA ÷ 200 mA up to 1 kHz	5 %	(1)
Transients	Pulse voltage	10·%	(1)
EMF	-	25 %	(1)
Plug discharge	Voltage	5 %	(1)
Working voltage	Voltage	5 %	(1)
	Frequency	5 %	(1)
Tracking test	Voltage, Current	1.5 %	(1)
	Drops - count	7	(1)

NOTES:
(1) The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k = 2, which for a normal distribution corresponds to a coverage probability of approximately 95 %

Test	Range	Measurement Uncertainty	Note
Moisture resistance	See Environmental testing and IP protection		(1)
Overload protection	See Construction verifications and Heating		(1)
Abnormal operation	See Construction verifications and Heating		(1)
Mechanical strength Impact energy	Force 0.2 ÷ 2.5 kN Length 1 ÷ 1000 mm	See Construction verifications	(1)
Resistance to heat and fire (Glow wire test)	Glow wire temperature	3 °C	(1)
Resistance to heat and fire(Ball pressure test)	Ball pressure dimension	0.1 mm	(1)
Time Measurements	10 ms ÷ 8 h	1 %	(1)
Velocity Measurements	0 ÷ 5 m/s	5 %	(1)
Salt mist	See 60068-2-11	(2)	(1)
Vibration	5 Hz ÷ 2 kHz	5.0 %	(1)
Sound power/pressure level	31 Hz ÷ 4 kHz	3.0 dB	(1)
	4 kHz ÷ 10 kHz	6.0 dB	(1)
	A-weighted, C-weighted	2.0 dB	(1)

NOTES:
(1) The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k = 2, which for a normal distribution corresponds to a coverage probability of approximately 95 %
(2) The instruments used for this test is according to the tolerances requested by the standard 60068-2-11

Test	Range	Measurement Uncertainty	Note
Radiance Blue light, Retinal thermal, Retinal thermal weak visual stimulus	0 ÷ 0.1 MW/(sr·m^2) 300 ÷ 1400 nm	7.0 %	(1) (4)
	0.1 ÷ 100 MW/(sr·m^2) 300 ÷ 1400 nm	8.0 %	
Luminance	0 ÷ 0.1 Mcd/m^2	7.0 %	(1)
	0.1 ÷ 100 Mcd/m^2	8.0 %	
Irradiance Actinic UV, Near UV, Blue light small source, IR radiation, eye	0 ÷ 0.1 MW/(m^2) 200 ÷ 300 nm	9.2 %	(1) (5)
	0.1 ÷ 100 MW/(m^2) 200 ÷ 300 nm	10.0 %	
	0 ÷ 0.1 MW/(m^2) 300 ÷ 3000 nm	6.4 %	
	0.1 ÷ 100 MW/(m^2) 300 ÷ 3000 nm	7.2 %	
Illuminance	0 ÷ 20 klx	4.0 %	(1)
Spectral Radiance	0 ÷ 0.1 MW/(sr·m^2·nm) 300 ÷ 1400 nm	6.2 %	(1)
	0.1 ÷ 1 MW/(sr·m^2·nm) 300 ÷ 1400 nm	7.0 %	
Spectral Irradiance	0 ÷ 0.1 MW/(m^2·nm) 200 ÷ 300 nm	8.6 %	(1)
	0.1 ÷ 1 MW/(m^2·nm) 200 ÷ 300 nm	9.2 %	
	0-0.1 MW/(m^2·nm) 300 ÷ 3000nm	5.4 %	
	0.1 ÷ 1 MW/(m^2·nm) 300 ÷ 3000 nm	6.4 %	
Radiant power Laser radiation Output power	350 ÷ 400 nm 950 ÷ 3000 nm 30 uW ÷ 30 W	9.0 %	(1), (2), (3)
	400 ÷ 950 nm 50 nW ÷ 3 W	4.6 %	(1), (2), (3)
Radiant energy Laser radiation	350 ÷ 400 nm 950 ÷ 3000 nm 20 uJ ÷ 2 J	9.0 %	(1), (2)
	400 ÷ 950 nm 20 uJ ÷ 2 J	4.6 %	(1), (2)
Wavelength	200 ÷ 3000 nm	4.5 %	(1)
Length in optical measurement	0 ÷ 20 mm	0.5 mm	(1)
	20 ÷ 200 mm	2 mm	
	0.2 ÷ 200 m	0.5 %	

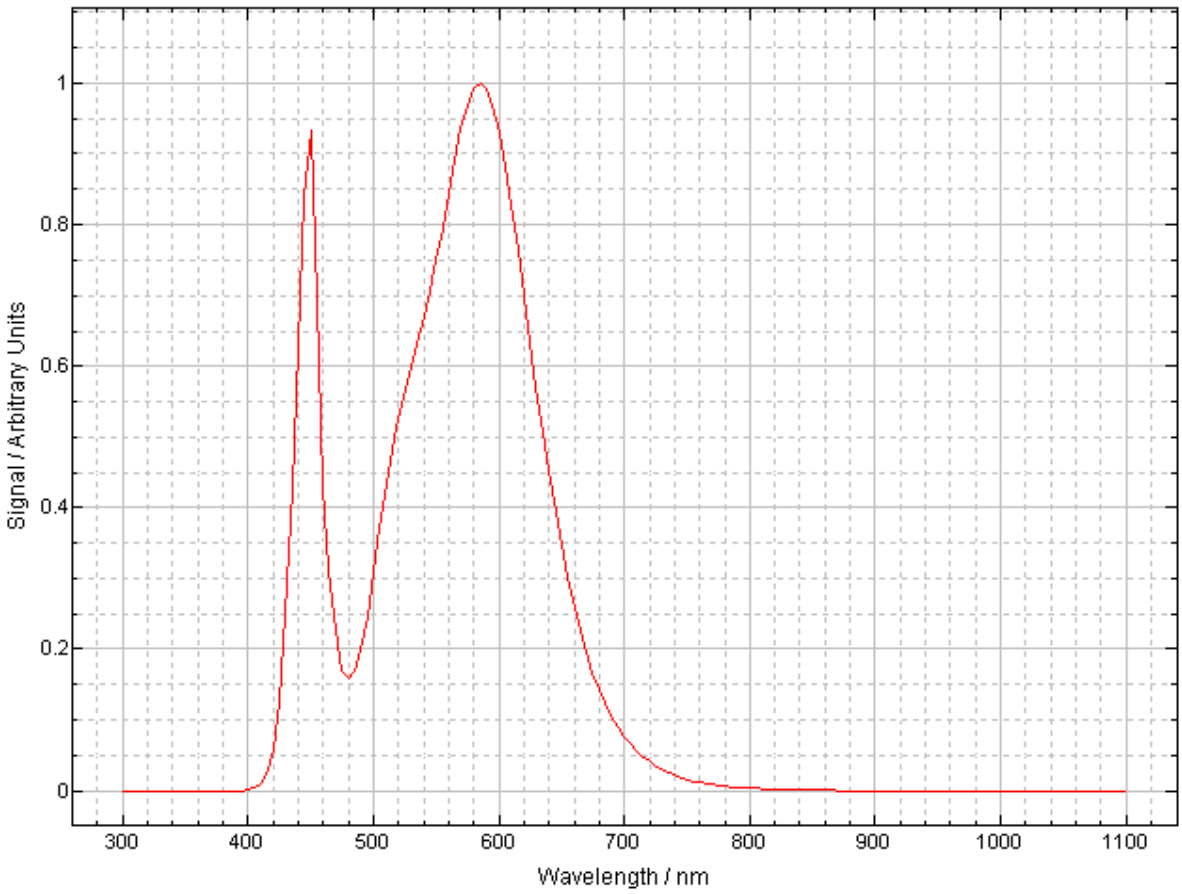
NOTES:
(1) The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k = 2, which for a normal distribution corresponds to a coverage probability of approximately 95 %
(2) In the standard 60825-1 laser radiation can indicate radiant power or radiant energy
(3) In the standard 60825-1 the radiant power can be called also output power
(4) The uncertainty value expressed in W/(m^2) is the maximum value between the value measured and the limit stated in the standard (see IEC/EN62471) multiplied to the measurement uncertainty stated in the table
(5) The uncertainty value expressed in W/(sr·m^2) is the maximum value between the value measured and the limit stated in the standard (see IEC/EN62471) multiplied to the measurement uncertainty stated in the table

Test	Range	Measurement Uncertainty	Notes
Radiated Disturbance 10m Chamber	Antenna distance 3 m, 10 m 0.009 ÷ 200 MHz	5.0 dB	(1)
	Antenna distance 1 m, 3 m, 10 m 200 ÷ 1000 MHz	5.2 dB	(1)
	Antenna distance 1 m, 3 m, 10 m 1 ÷ 6 GHz	5.2 dB	(1)
	Antenna distance 1 m, 3 m 6 ÷ 18 GHz	5.5 dB	(1)
	Antenna distance 1 m, 3 m 18 ÷ 40 GHz	7.2 dB	(1)
Radiated Disturbance with large loop antenna system (LLAS)	0.009 ÷ 30 MHz	3.3 dB	(1)
Conducted Disturbance	0.02 ÷ 150 kHz with AMN	3.8 dB	(1)
	150 kHz ÷ 30 MHz with AMN	3.4 dB	(1)
	150 kHz ÷ 30 MHz with AAN	4.6 dB	(1)
	9 kHz ÷ 30 MHz with voltage probe	2.9 dB	(1)
	150 kHz ÷ 30 MHz with current probe	2.9 dB	(1)
Clicks	9 ÷ 150 kHz	3.8 dB	(1)
	150 kHz ÷ 30 MHz	3.4 dB	(1)
Disturbance Power	30 MHz ÷300 MHz	4.5 dB	(1)
Frequency	10 Hz ÷ 1 kHz	0.2 %	(1)
	1 kHz ÷ 40 GHz	10^{-6}	(1)
Harmonic Current Emission	50 Hz ÷ 2 kHz	3 %	(1)
Fluctuation and Flikers	Fluctuation (d%)	0.05 %	(1)
	Flikers (Pst)	5 %	(1)
Radiated Immunity Anechoic Chambers	20 MHz ÷ 6 GHz	3.4 dB	(1) (3)
Radiated Immunity TEM Cell	0.01 ÷ 200 MHz	3.0 dB	(1) (3)
Bulk Current	1 ÷ 200 MHz	3.0 dB	(1)
Immunity to conducted disturbances	9 kHz ÷ 230 MHz	3.0 dB	(1)
ESD Immunity	Voltage, Current, Rise time, Duration	(2)	(1)
Burst Immunity	Voltage, frequency, burst period and duration, rise time and pulse width	(2)	(1)
Surge Immunity	Voltage, Current, Rise time, Duration	(2)	(1)
DIPS, Interruption and Voltage duration Immunity	Amplitude	5 %	(1)
	Duration	5 %	
Impulse Magnetic Field Immunity	Peak Current	10 %	(1)
	Rise time, Duration	20 %	(3)
Power Frequency Magnetic Field Immunity	16.7 Hz, 50 Hz, 60 Hz	2.0 dB	(1) (3)
Damped Oscillatory Wave Immunity, Ring Wave Immunity	Voltage, front time, frequency 100 kHz, 1 MHz	(2)	(1)
Damped Magnetic Field	Amplitude: 100 kHz, 1 MHz	3 dB	(1)
	Frequency: 100 kHz, 1 MHz	10 %	
Low Frequency Immunity	15 Hz ÷ 150 kHz	2.2 dB	(1)
Automotive transients Immunity	Voltage, rise time, duration time Impulses 1, 2a, 2b, 3a, 3b and 4	(2)	(1)
Automotive transients Emission	Amplitude, Time	10 %	(1)
EMF for Lighting Equipment	-	25 %	(1)
Electromagnetic fields (EMF)	Magnetic, Electric and Electromagnetic fields: 0 Hz ÷ 40 GHz	25 %	(1)
Electrical quantities (voltage, current, resistance)	AC/DC Voltage 10 mV ÷ 1000 V 0÷100 kHz AC/DC Current 0.1 mA ÷ 400 A 0÷1 kHz Resistance 100 mΩ ÷ 10 MΩ	2.5 %	(1)

NOTES:
(1) The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k = 2, which for a normal distribution corresponds to a coverage probability of approximately 95 %
(2) The instruments used for this immunity test is according to the tolerances requested by the applicable standard
(3) The reported expanded uncertainty of measurement is related to the stimulus quantity

ATTACHMENT 2: CHARACTERISTICS OF LAMP

Application / Function	Manufacturer trademark	Type / Model	Technical data	Standard	Mark(s) of conformity evidence of acceptance
LED	SAMSUNG	LH351B	4000 K V_{MAX}: 3,0 V at 350 mA	IEC/EN 62471	Tested in appliance

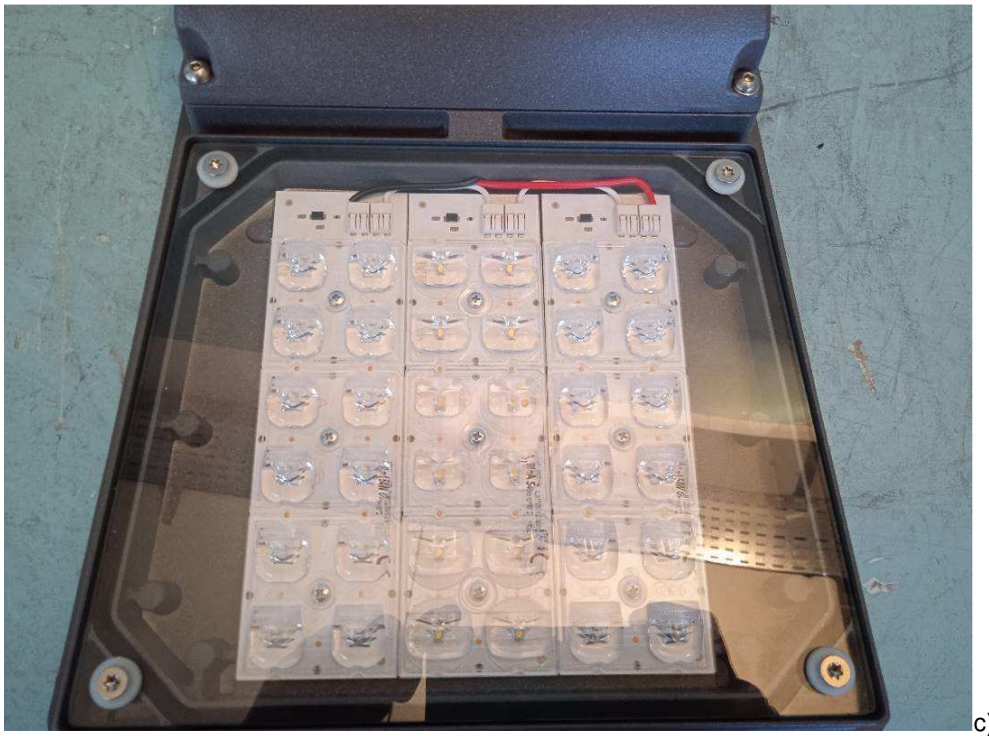


Spectral measurement normalized

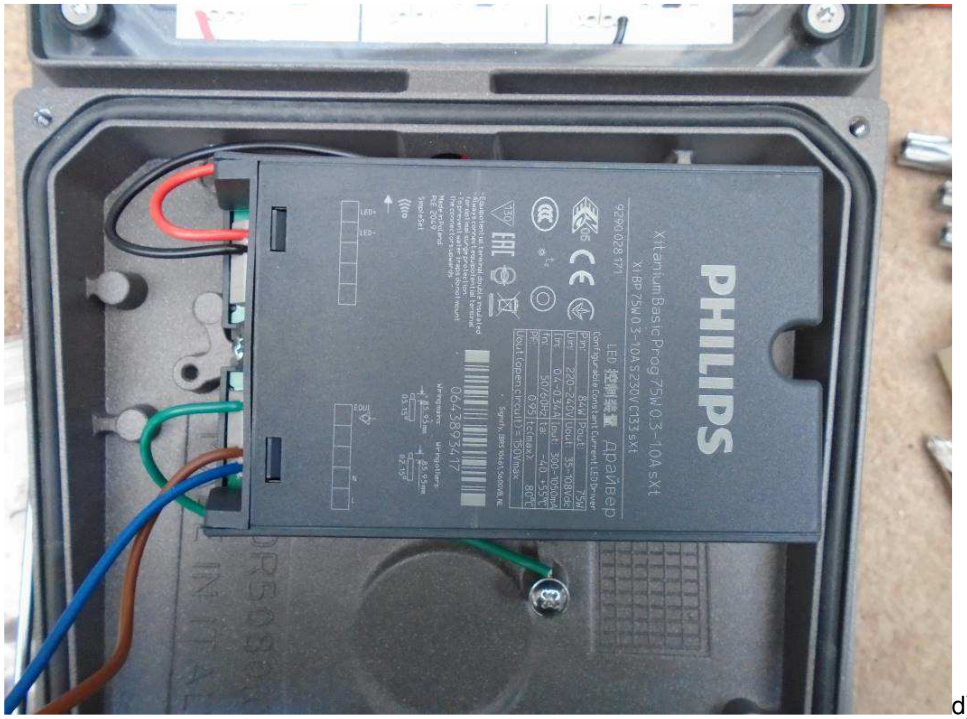
ATTACHMENT 3: PHOTO DOCUMENTATION

a)

b)



c)



d)

From a) to d) General view of the equipment

ATTACHMENT 4: EQUIPMENT USED FOR TESTING

MEASUREMENT EQUIPMENT			
Manufacturer	**Type of equipment**	**Type designation**	**Serial number**
Bentham instruments	Double monochromator	IDR300	12290
	Calibration lamp for irradiance measurement	CL6-H	12094/5
	Calibration lamp for irradiance measurements (UV)	CL7	12281/3
	Calibration lamp for radiance measurements	SRS12	12283/3
	Telescope for radiance measurements	TEL309	12280/3
	Illuminance detector	DH400_vl	12284/3
	Power supply	PSU605	12236/4
	Power supply	PSU705	12295
	Diffuser	DIFF_D7	12279/3
	Source Profiler	PSL_Profiler	12698/4
Other instruments	Tape	Stanley 8 m	30-457
	Distance meter	Bosch DLE70	005558860
	Multimeter	Fluke 8846	9673012
	Power supply	Philips	003926
	Data logger	Testo 176P1+0572 6174	41002029+206 38516
	Data logger	Testo 184H1	44220017

END OF TEST REPORT