TEST REPORT
IES LM-79-08

TÜV SÜD Test Report for
Electrical and Photometric Measurements of Solid-State Lighting Products

Report reference No. ..... :	68.184.22.0284.01
Date of issue ..... :	2022-05-01
Project handler…… ..... :	Sky Feng
Testing laboratory ..... :	TÜV SÜD Certification and Testing (China) Co., Ltd. Shenzhen Branch
Client ..... :	Beyond LED Technology
Standard..... :	This TÜV SÜD test program is based on the following requirements: IES LM-79-08
TRF originated by. ..... :	TÜV SÜD Product Service GmbH, Mr. Kenneth Lau
Copyright blank test report ..... :	This test report is based on the content of the standard (see above). The test report considered selected clauses of the a.m. standard(s) and experience gained with product testing. It was prepared by TÜV SÜD Product Service GmbH. TUV SUD Group takes no responsibility for and will not assume liability for damages resulting from the reader's interpretation of the reproduced material due to its placement and context.
Test procedure ..... :	☐ TÜV Mark ☒ without certification
Non-standard test method ..... :	N/A
National deviations..... :	N/A
Number of pages (Report)..... :	18
Number of pages (Attachments) ..... :	1

Compiled by .... : Sky Feng (+ signature)

Approved by.....: Jake Xu (+ signature)

Test sample..... :	LED Area Light
Type of test object ..... :	Outdoor Pole/Arm-Mounted Area and Roadway Luminaires
Trade mark..... :	zopoise
Model and/or type reference..... :	ZPS-ZD471-150W.V9-50K-E11-J3-F1-PSP-T3 (See below “Product information” for detail)
Rating(s)..... :	277-480VAC; 50/60Hz; 150W
Manufacturer..... :	Same as applicant
Sub-contractors/ tests (clause)..... :	N/A
Name..... :	N/A

Order description ..... :		
	☒	Complete test according to TRF
	☐	Partial test according to manufacturer's specifications
	☐	Preliminary test
	☐	Spot check
	☐	Other:

Date of order ..... :	2022-04-20
Date of receipt of test item..... ..:	2022-04-20
Date(s) of performance of test..... :	2022-04-20 to 2022-05-01

Test item particulars (declared):

Lamp type :	☐ Bare lamp ☐ Covered lamp, no reflector ☐ Lamp with reflector ☒ other: LED Area Light
Lamp cap installed:	--
Rated Voltage:	277-480VAC; 50/60Hz
Rated Power:	150W
Rated Power Factor:	> 0.9
Rated Luminous Flux:	--
Rated CCT:	4000K[ZPS-ZD471-150W.V9-40K-E11-J-F-S-M-T3] 5000K[ZPS-ZD471-150W.V9-50K-E11-J-F-S-M-T3]
Rated CRI:	> 80

Attachments:

1. Test Equipment List

General remarks:

"(See remark #)" refers to a remark appended to the report.
"(See appended table)" refers to a table appended to the report.
Throughout this report a point is used as the decimal separator.
The test results presented in this report relate only to the object tested.
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Measurement uncertainty budgets have been determined for applicable test methods and are available upon request.
Measurement Uncertainty Budget (k=2)

Voltage	U_{rel} =0.29%, K=2
Current	U_{rel} =0.36%, K=2
Power	U_{rel} =0.69%, K=2
Total Luminous Flux by integrated sphere	U_{rel} =4.2%, K=2
Total Luminous Flux by goniophotometer	U_{rel} =2.2%, K=2

Product information:
ZPS-ZD471-150W.V9-50K-E11-J3-F1-PSP-T3

V9: represent input rating 277-480VAC.

T: can be 40K, 50K:
"T" can be "40K" to represent CCT 4000K, can be "50K" to represent CCT 5000K.

E11: represent LED Brand: Lumileds.

J: can be blank, J3, J30:
"J" can be blank to represent not providing receptacle for photocontrol Switch, or "J3" to represent providing receptacle for photocontrol Switch with shorting cap, or "J30" to represent providing receptacle and photocontrol Switch.

F: can be blank, F1
"F" can be blank to represent not providing Surge protective device, can be "F1" to represent providing 10KV Surge protective device.

S: can be blank, M2
"S" can be blank to represent not providing Motion Sensor, can be "M2" to represent providing Motion Sensor.

M: can be SP, TR, YK, SRP, PSP, PSA
"M" can be "SP", "TR", "YK", "SRP, "PSP", "PSA" to represent different mounting assembly, "SP" represents Slip Fitter, "TR" represents Trunnion, "YK" represents Yoke, "SRP" represents Square/Round Pole, "PSP" represents Square/Round Pole mount with adjust function, Slip Fitter. "PSA" represents Square/Round Pole mount with adjust function.

T3: represent design optical type: Type 3.

Model **ZPS-ZD471-150W.V9-50K-E11-J3-F1-PSP-T3** and **ZPS-ZD471-150W.V9-40K-E11-J30-F1-PSP-T3** was selected as representative model to perform all test.

TUV SUD Cert & Testing (China) Co., Ltd. Shenzhen Branch is an accredited Test Laboratory (NVLAP Lab Code: 500067-0) to IESNA LM-79-08 by NVLAP (National Voluntary Laboratory Accreditation Program).	NVLAP® TESTING NVLAP LAB CODE 500067-0
The report must not be used by the client to claim product certification, approval or endorsement by NVLAP, NIST or any agency of the federal government.	

Summary of testing:

Model:	ZPS-ZD471-150W.V9-40K-E11-J3-F1-PSP-T3	ZPS-ZD471-150W.V9-50K-E11-J3-F1-PSP-T3
Luminous Efficacy (Lumens/Watt)	127.6	129.4
Luminous Flux (Lumens)	18238	18503
Input Voltage (Volt)	277	277
Input Power (Watts)	142.91	143.00
Power Factor	0.9960	0.9957
A-THD	7.26%	7.56%
CCT (K)	3952	5001
SDCM (ANSI C78.377-2017)	<7	<7
CRI	83.7	84.5
R9	14	13
Rf	84	84
Rg	96	94
Rcs, h1	-11%	-12%
BUG Ratings	B4-U0-G4	B4-U0-G4
Zonal flux (0-90°)	100%	99.9%
Zonal flux (80-90°)	2.0%	0.9%
Stabilisation Time (Light Power) (mins)	90	90

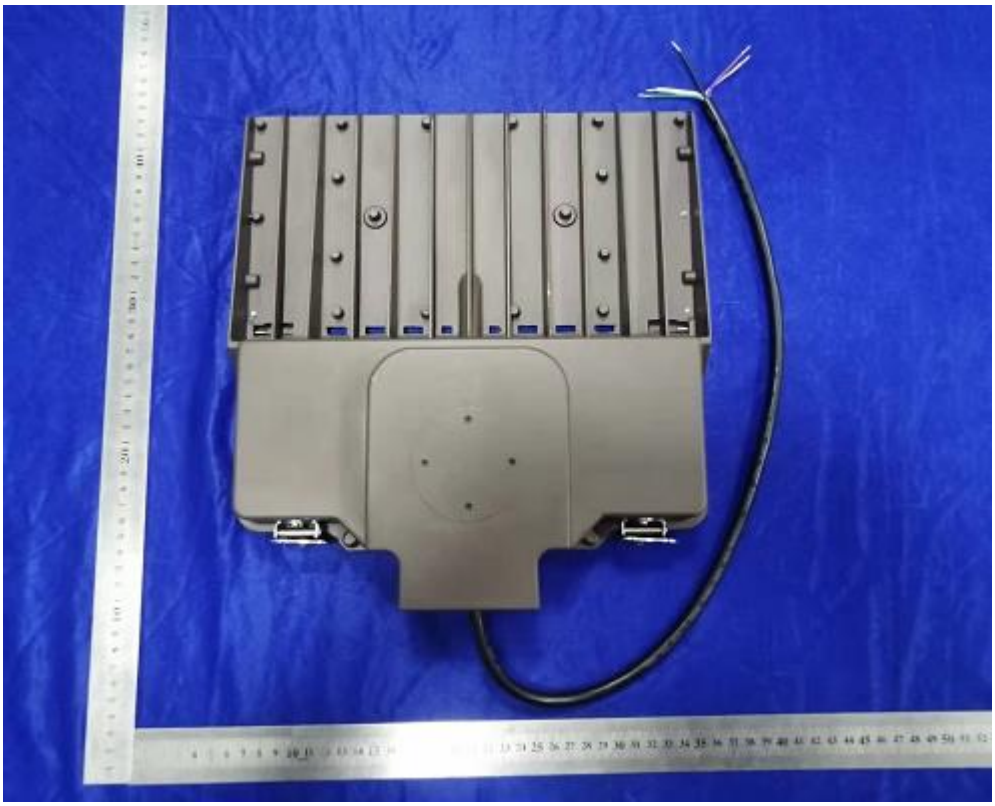
Model	Test Voltage(V)	Test Current(A)	Power(W)	PF	A-THD
ZPS-ZD471-150W.V9-40K-E11-J3-F1-PSP-T3	480	0.3150	143.7	0.9506	19.07%
ZPS-ZD471-150W.V9-50K-E11-J3-F1-PSP-T3	480	0.3162	144.4	0.9523	19.12%

LED specification:

Model	Manufactory	Vf (V)	If (mA)	Viewing angle (°)	CCT (K)	Ra
L128-xx80Rx3500xxx	Lumileds	8.7-9.4	100	120	2700-6500	>80

Picture of the product

1. Overview



2. Overview

Copy of marking plate: --
Characteristic data --
Purpose of the product LED Area Light for general lighting purpose.
Possible test case verdicts: - test case does not apply to the test object: ……..…: N/A - test object does meet the requirement……..…: P(ass) - test object does not meet the requirement: ……..…: F(ail) Possible suffixes to the verdicts: - suffix for detailed information for the client……..…:- C(comment) - suffix for important information for factory inspection...: - M(manufacturing)

IES LM-79-08			
Clause	Requirement – Test	Measuring result – Remark	Verdict

1.0	Introduction		--
2.0	Ambient Conditions		P
2.1	General		P
2.2	Air Temperature		P
2.3	Thermal Condition for Mounting SSL Products		P
2.4	Air Movement		P
3.0	Power Supply Characteristics		P
3.1	Wave shape of AC power supply		P
3.2	Voltage regulation		P
4.0	Seasoning of SSL Product	No seasoning of SSL product	N/A
5.0	Stabilization of SSL Product		P
	SSL product has sufficiently stabilized before measurement		P
6.0	Operation Orientation		P
	SSL product shall be stabilized and measured in intended operating orientation	As normal working	P
7.0	Electrical Settings		P
	SSL product shall be operated at rated voltage		P
	SSL product with dimming capability are tested at maximum input power condition		N/A
	SSL product with different modes are measured in all relevant modes		N/A
8.0	Electrical Instrumentations		P
8.1	Circuits		P
8.2	Uncertainties		P
9.0	Test methods for Luminous Flux measurement		P
9.1	Integrating sphere with a spectroradiometer (Sphere-spectroradiometer system)		P
9.2	Integrating sphere with a photometer head (Sphere-photometer system)		N/A
9.3	Goniophotometer		P
10.0	Luminous Intensity Distribution		P
	Reporting acc, to IEC LM-63		P
11.0	Luminous Efficacy		P
	Calculation	See table 1	P
12.0	Test Methods for Colour Characteristics of SSL Products		P
	Measurements	See table 1	P
13.0	Uncertainty statement		N/A
14.0	Test report		--

Table 1	**Test data**		
Model:	ZPS-ZD471-150W.V9-50K-E11-J3-F1-PSP-T3		
Rated Voltage (V):	277-480VAC	Rated Power (W):	150
Rated luminous flux (lm):	--	Ambient temperature 25 ±1 (°C):	25.1
Test item		**Measured Value**	
		Integrating Sphere	Goniophotometer
Key Photometric Results			
Luminous Efficacy (Lumens/Watt)		--	127.6
Total Luminous Flux (Lumens)		--	18238
Correlated Color Temperature (CCT: K)		3952	--
Color Rendering Index (CRI)		83.7	--
Chromaticity (Chroma x / Chroma y)		0.3829 / 0.3792	--
Chromaticity (Chroma u / Chroma v)		0.2257 / 0.3353	--
Chromaticity (Chroma u' / Chroma v')		0.2257 / 0.5030	--
Duv Value		0.0004	--
Colour Angular Uniformity (Max,du'v')		--	--
Stabilization Time (Light and Power)		90	90
Total Run Time – (Minutes)		100	100
Zonal flux (0-90°)		--	100%
Zonal flux (80-90°)		--	2.0%
Spacing Criteria (C/γ)		--	C:22.5° / γ:1.0°
Electrical Input Results			
Input Power (Watts)		--	142.91
Input Voltage (Volts AC)		--	120
Input Current (Amps)		--	0.5170
Input Frequency (Hertz)		--	60
Power Factor		--	0.9960
A-THD (Current – Total Harmonic Distortion)		--	7.26%
Additional Information			
Ambient Temperature (°C):		25.1	25.1
ISTMT (In-Situ Temperature Measurement) (°C):		--	
Photometric measurement condition		--	--

Supplementary Information:

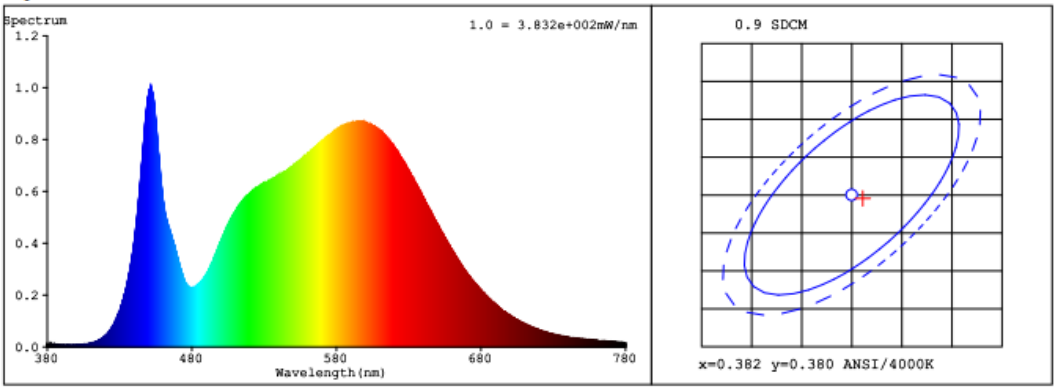
- Absorbtion Correction used: Yes
- Stabilization was considered reached by: the variation (maximum-minimum) of at least 3 readings of the light output and electrical power over a period of 30 minutes is less than 0.5%.

Table 2	**Test data**		
Model:	ZPS-ZD471-150W.V9-50K-E11-J3-F1-PSP-T3		
Rated Voltage (V):	277-480VAC	Rated Power (W):	150
Rated luminous flux (lm):	--	Ambient temperature 25 ±1 (°C):	25.1
Test item		**Measured Value**	
		Integrating Sphere	Goniophotometer
Key Photometric Results			
Luminous Efficacy (Lumens/Watt)		--	129.4
Total Luminous Flux (Lumens)		--	18503
Correlated Color Temperature (CCT: K)		5001	--
Color Rendering Index (CRI)		84.5	--
Chromaticity (Chroma x / Chroma y)		0.3457 / 0.3582	--
Chromaticity (Chroma u / Chroma v)		0.2092 / 0.3253	--
Chromaticity (Chroma u' / Chroma v')		0.2092 / 0.4879	--
Duv Value		0.0030	--
Colour Angular Uniformity (Max,du'v')		--	--
Stabilization Time (Light and Power)		90	90
Total Run Time – (Minutes)		100	100
Zonal flux (0-90°)		--	99.9%
Zonal flux (80-90°)		--	0.9%
Spacing Criteria (C/γ)		--	C:22.5° / γ:1.0°
Electrical Input Results			
Input Power (Watts)		--	143.00
Input Voltage (Volts AC)		--	277
Input Current (Amps)		--	0.5175
Input Frequency (Hertz)		--	60
Power Factor		--	0.9957
A-THD (Current – Total Harmonic Distortion)		--	7.56%
Additional Information			
Ambient Temperature (°C):		25.1	25.1
ISTMT (In-Situ Temperature Measurement) (°C):		--	
Photometric measurement condition		--	--
Supplementary Information: - Absorbtion Correction used: Yes - Stabilization was considered reached by: the variation (maximum-minimum) of at least 3 readings of the light output and electrical power over a period of 30 minutes is less than 0.5%.			

Table 3	Spectral Flux Graph
Model:	ZPS-ZD471-150W.V9-40K-E11-J30-F1-PSP-T3

The following graph shows the spectral response curve of the radiant flux for the sample:

Spectrum



Colorimetric Parameters

Chromaticity Coordinate: x = 0.3829 y = 0.3792 / u' = 0.2257 v' = 0.5030 (duv=4.48e-04)

CCT= 3952K Prcp WL: Ld=579.0nm Purity=28.7%

Peak WL: Lp=452nm FWHM: =20.1nm Ratio:R=18.6% G=78.0% B=3.4%

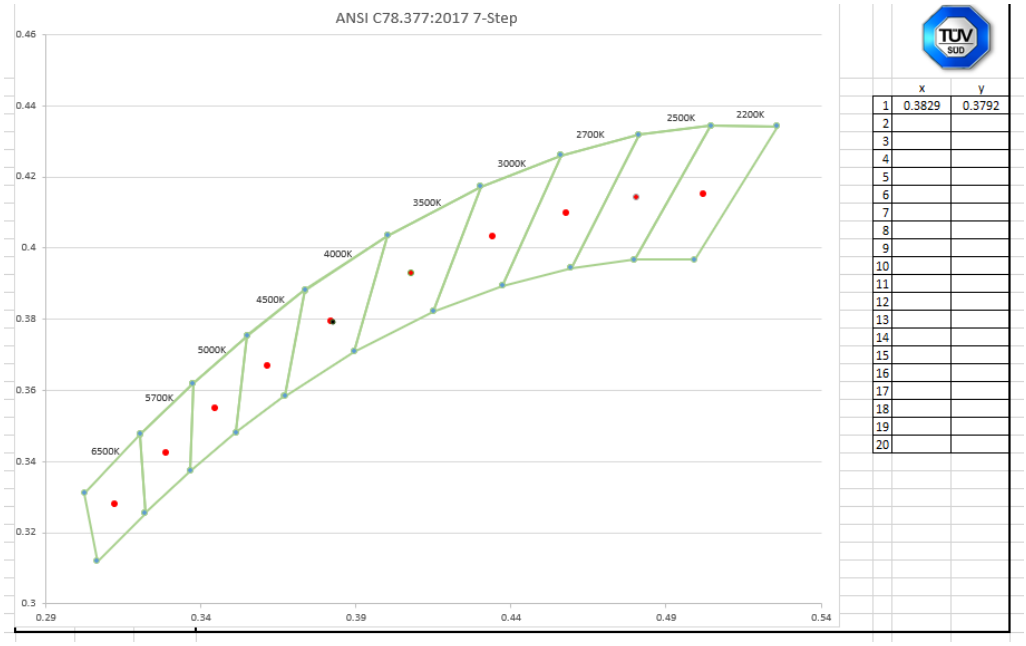
Render Index: Ra = 83.7

R1 =82	R2 =89	R3 =94	R4 =83	R5 =82	R6 =85	R7 =87	
R8 =67	R9 =14	R10=74	R11=82	R12=62	R13=84	R14=97	R15=77

LEVEL:OUT WHITE:ANSI_4000K

Spectral response of the Radiant Flux

(380nm to 780nm – calibrated range of the Spectroradiometer)

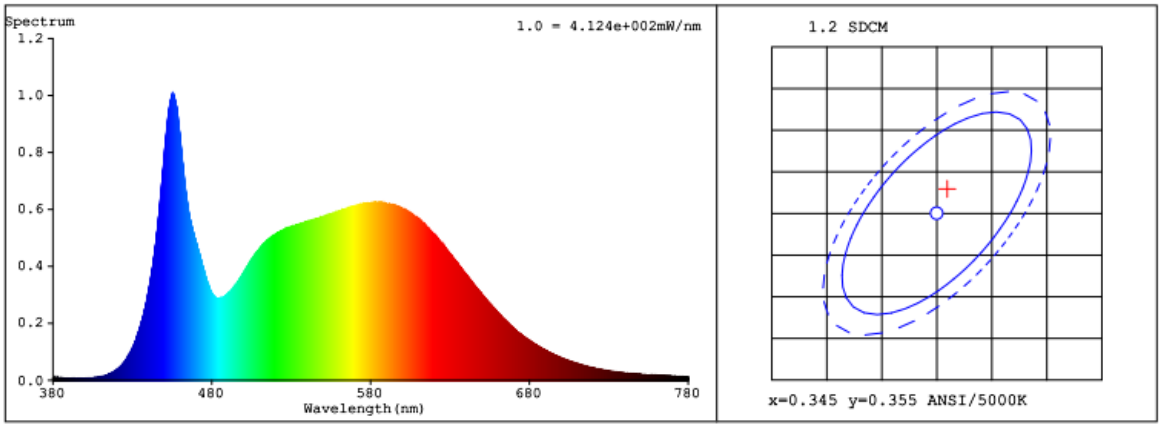


7-step quadrangle

Table 4	Spectral Flux Graph
Model:	ZPS-ZD471-150W.V9-50K-E11-J3-F1-PSP-T3

The following graph shows the spectral response curve of the radiant flux for the sample:

Spectrum



Colorimetric Parameters

Chromaticity Coordinate: x = 0.3457 y = 0.3582 / u' = 0.2092 v' = 0.4879 (duv=3.07e-03)
CCT= 5001K Prcp WL: Ld=569.9nm Purity=11.2%
Peak WL: Lp=456nm FWHM: =24.0nm Ratio:R=15.9% G=79.2% B=4.9%

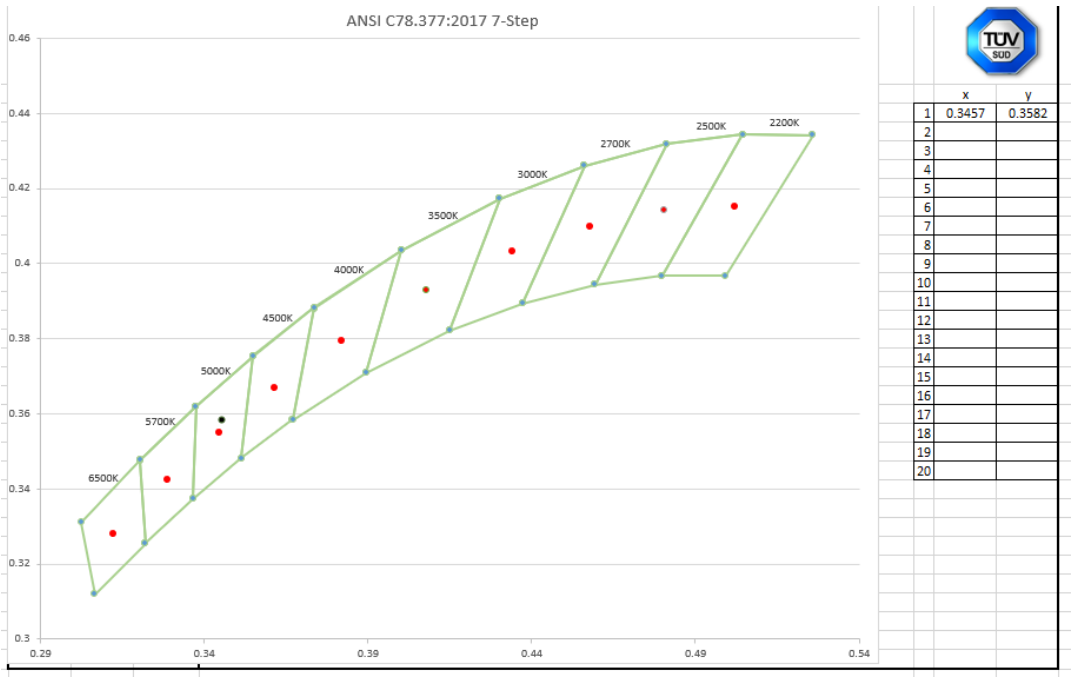
Render Index: Ra = 84.5

R1 =83	R2 =91	R3 =95	R4 =82	R5 =83	R6 =87	R7 =87	
R8 =68	R9 =13	R10=78	R11=82	R12=63	R13=85	R14=98	R15=78

LEVEL:OUT WHITE:ANSI_5000K

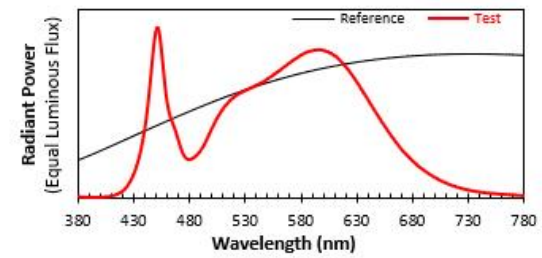
Spectral response of the Radiant Flux

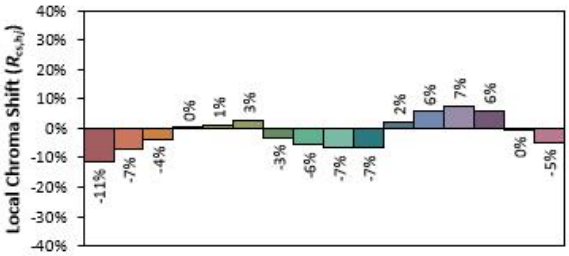
(380nm to 780nm – calibrated range of the Spectroradiometer)

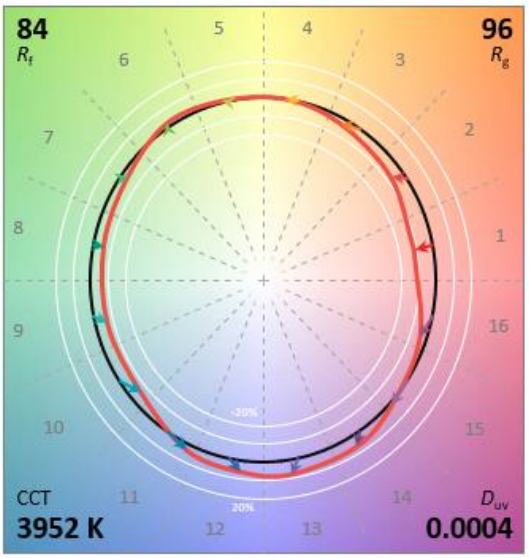


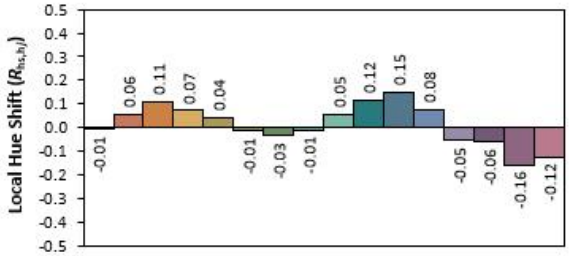
7-step quadrangle

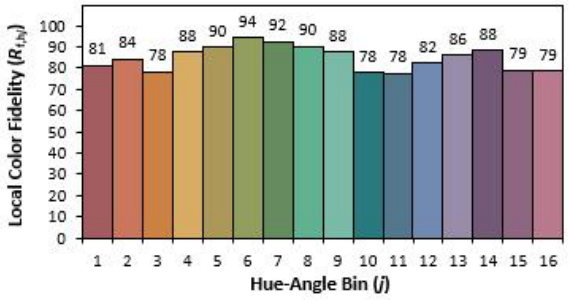
Table 5	ANSI/IES TM-30-18 Full Report
Model:	ZPS-ZD471-150W.V9-50K-E11-J3-F1-PSP-T3

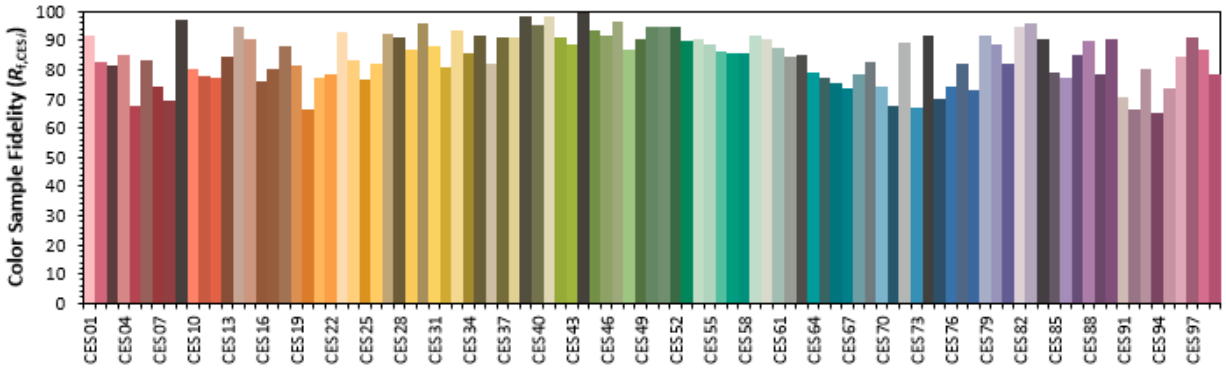












Notes: This is a recommended method for displaying ANSI/IES TM-30-18 information.

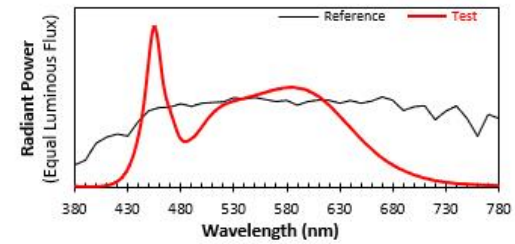
x	0.3829
y	0.3791
u'	0.2258
v'	0.5030

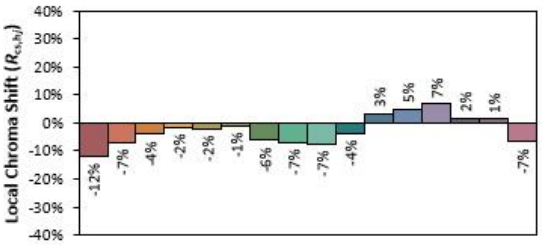
CIE 13.3-1995 (CRI)

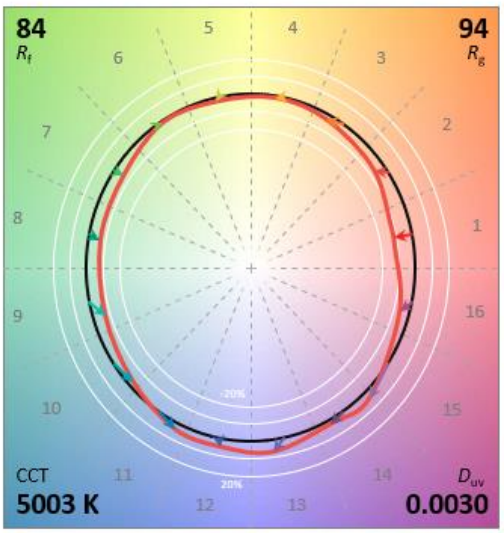
R_a	84
R_9	14

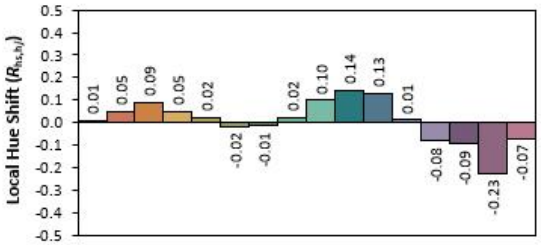
Colors are for visual orientation purposes only. Created with the ANSI/IES TM-30-18 Calculator Version 2.00.

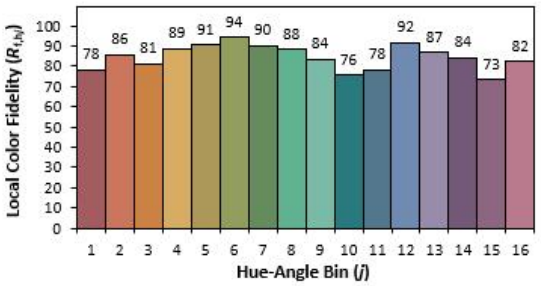
Table 6	ANSI/IES TM-30-18 Full Report
Model:	ZPS-ZD471-150W.V9-50K-E11-J3-F1-PSP-T3

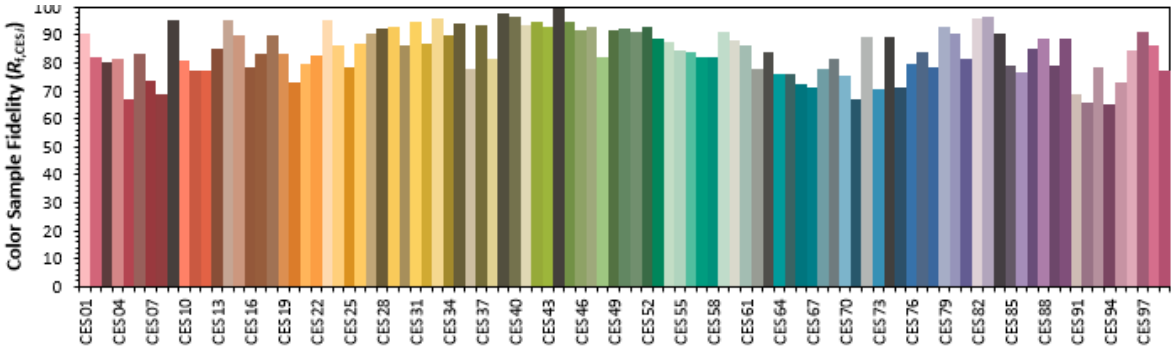












Notes: This is a recommended method for displaying ANSI/IES TM-30-18 information.

x	0.3456
y	0.3581
u'	0.2093
v'	0.4879

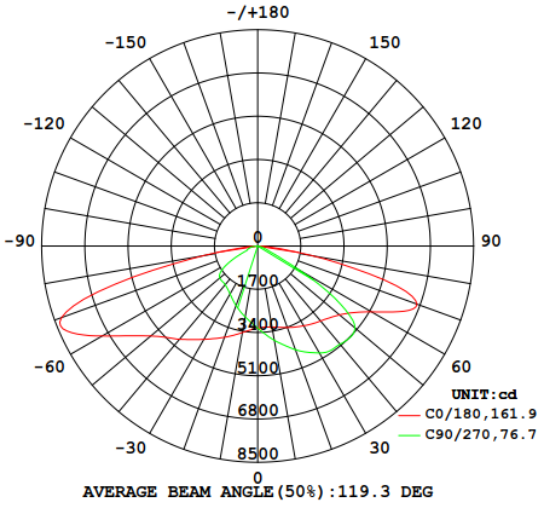
CIE 13.3-1995 (CRI)

R_a	85
R_9	13

Colors are for visual orientation purposes only. Created with the ANSI/IES TM-30-18 Calculator Version 2.00.

Table 7	Luminous Intensity distribution diagram
Model:	ZPS-ZD471-150W.V9-50K-E11-J3-F1-PSP-T3

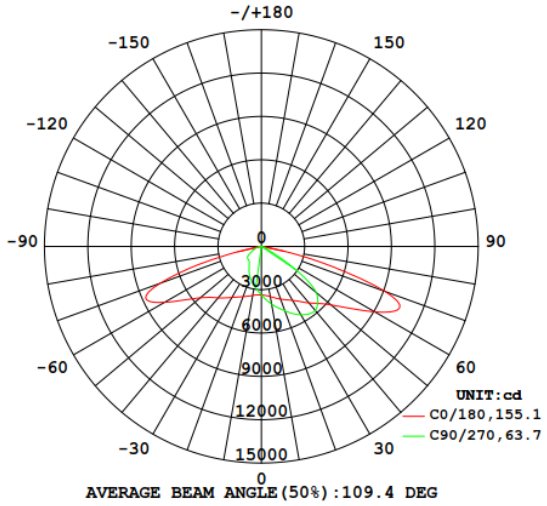
Luminous Intensity distribution diagram (Unit: cd)



γ	C0	C45	C90	C135	C180	C225	C270	C315	γ	Φ zone	Φ total	%lum,lamp
10	323.7	355.9	376.2	375.0	345.1	306.4	283.2	291.0	0- 10	312.7	312.7	1.71,1.71
20	340.8	397.7	433.4	430.3	381.5	298.1	249.3	271.9	10- 20	969.9	1283	7.03,7.03
30	362.1	436.2	485.4	479.9	423.6	293.0	217.8	256.2	20- 30	1669	2951	16.2,16.2
40	385.0	473.8	503.7	532.4	478.6	288.5	198.9	247.0	30- 40	2381	5332	29.2,29.2
50	421.4	517.3	499.5	597.7	550.2	271.2	195.2	238.8	40- 50	3088	8421	46.2,46.2
60	518.0	681.0	194.2	797.8	707.3	175.4	132.9	183.5	50- 60	3660	12081	66.2,66.2
70	667.5	300.3	31.49	345.0	821.2	54.20	43.20	61.18	60- 70	3349	15430	84.6,84.6
80	214.8	40.05	7.167	39.58	213.0	20.51	23.72	21.89	70- 80	2445	17875	98,98
90	0	0	0	0	0	0	0	0	80- 90	363.3	18238	100,100
100	0	0	0	0	0	0	0	0	90-100	0	18238	100,100
110	0	0	0	0	0	0	0	0	100-110	0	18238	100,100
120	0	0	0	0	0	0	0	0	110-120	0	18238	100,100
130	0	0	0	0	0	0	0	0	120-130	0	18238	100,100
140	0	0	0	0	0	0	0	0	130-140	0	18238	100,100
150	0	0	0	0	0	0	0	0	140-150	0	18238	100,100
160	0	0	0	0	0	0	0	0	150-160	0	18238	100,100
170	0	0	0	0	0	0	0	0	160-170	0	18238	100,100
180	0	0	0	0	0	0	0	0	170-180	0	18238	100,100
DEG	LUMINOUS INTENSITY:×10cd									UNIT:lm		

Table 8	Luminous Intensity distribution diagram
Model:	ZPS-ZD471-150W.V9-50K-E11-J3-F1-PSP-T3

Luminous Intensity distribution diagram (Unit: cd)



γ	C0	C45	C90	C135	C180	C225	C270	C315	γ	Φ zone	Φ total	%lum,lamp
10	353.0	394.0	405.1	388.8	344.7	298.1	279.3	301.7	0- 10	325.3	325.3	1.76,1.76
20	388.3	453.6	474.6	441.3	370.5	271.4	228.9	282.6	10- 20	1008	1334	7.21,7.21
30	431.7	510.2	546.5	490.6	407.8	253.3	171.1	270.6	20- 30	1736	3069	16.6,16.6
40	511.0	585.5	579.0	556.4	465.5	241.7	132.7	261.3	30- 40	2511	5580	30.2,30.2
50	630.8	689.1	494.4	666.3	554.2	211.6	125.9	232.6	40- 50	3307	8887	48,48
60	905.1	694.4	112.5	714.9	774.7	103.4	85.31	115.4	50- 60	3830	12717	68.7,68.7
70	910.7	212.1	28.75	259.5	742.8	50.58	47.20	53.29	60- 70	3638	16355	88.4,88.4
80	75.42	18.57	6.019	22.21	39.85	21.76	20.65	23.60	70- 80	1980	18334	99.1,99.1
90	0	0	0	0	0	0	0	0	80- 90	168.7	18503	100,100
100	0	0	0	0	0	0	0	0	90-100	0	18503	100,100
110	0	0	0	0	0	0	0	0	100-110	0	18503	100,100
120	0	0	0	0	0	0	0	0	110-120	0	18503	100,100
130	0	0	0	0	0	0	0	0	120-130	0	18503	100,100
140	0	0	0	0	0	0	0	0	130-140	0	18503	100,100
150	0	0	0	0	0	0	0	0	140-150	0	18503	100,100
160	0	0	0	0	0	0	0	0	150-160	0	18503	100,100
170	0	0	0	0	0	0	0	0	160-170	0	18503	100,100
180	0	0	0	0	0	0	0	0	170-180	0	18503	100,100
DEG	LUMINOUS INTENSITY:×10cd									UNIT:lm		

Table 9	BUG
Model:	ZPS-ZD471-150W.V9-50K-E11-J3-F1-PSP-T3

IES "BUG" RATING (BACK LIGHT, UPLIGHT, GLARE)
PER IES TM-15-11

IESNA Luminaire Flux Distribution Table:

Zone	Lumens	Luminaire %
FL - Front-Low(0-30)	1600.4	8.8
FM - Front-Medium(30-60)	4697.9	25.8
FH - Front-High(60-80)	2800.9	15.4
FVH - Front-Very High(80-90)	212.6	1.2
Total Forward Light	9311.8	51.1
BL - Back-Low(0-30)	1350.9	7.4
BM - Back-Medium(30-60)	4431.4	24.3
BH - Back-High(60-80)	2993.3	16.4
BVH - Back-Very High(80-90)	150.72	0.8
Total Back Light	8926.3	48.9
UL - Uplight-Low(90-100)	0	0.0
UH - Uplight-High(100-180)	0	0.0
Total Up Light	0	0.0

BUG(Back,Up,Glare) Rating	B4-U0-G4

Zone	Downward Lumens	Upward Lumens	Total Lumens
House Side	8926.3	0	8926.3
Street Side	9311.8	0	9311.8

Table 10	BUG
Model:	ZPS-ZD471-150W.V9-50K-E11-J3-F1-PSP-T3

IES "BUG" RATING (BACK LIGHT, UPLIGHT, GLARE)
PER IES TM-15-11

IESNA Luminaire Flux Distribution Table:

Zone	Lumens	Luminaire %
FL - Front-Low(0-30)	1741.4	9.4
FM - Front-Medium(30-60)	5381.4	29.1
FH - Front-High(60-80)	2961.3	16.0
FVH - Front-Very High(80-90)	92.879	0.5
Total Forward Light	10177	55.0

BL - Back-Low(0-30)	1328	7.2
BM - Back-Medium(30-60)	4266.2	23.1
BH - Back-High(60-80)	2656.3	14.4
BVH - Back-Very High(80-90)	75.777	0.4
Total Back Light	8326.3	45.0

UL - Uplight-Low(90-100)	0	0.0
UH - Uplight-High(100-180)	0	0.0
Total Up Light	0	0.0

BUG(Back,Up,Glare) Rating	B4-U0-G4

Zone	Downward Lumens	Upward Lumens	Total Lumens
House Side	8326.3	0	8326.3
Street Side	10177	0	10177

Attachment 1: Equipment List

Equipment	ID No.	Model	Brand/Manufacturer	Calibration due date
Digital Power Meter	13217	WT210	YOKOGAWA	2022-08-21
Anemometer	15798	Testo417	Testo	2022-10-20
Temperature and Humidity meter	13397	SK-L200TH	SATO	2022-08-12
Goniophotometer system	13345	GO-R5000-SML	Everfine	2023-03-23
Integrating sphere test system	13342	CSLMS-7621	Labsphere	2022-10-17

END OF TEST REPORT