

IES LM-79-08

MEASUREMENT AND TEST REPORT

For

ATG Electronics Corp.

9020 Rancho Park Court Rancho Cucamonga, CA 91730

Test Model: RTUS22-S-40W-35-PE

Report Type:	Electrical and Photometric tests including: Luminous Flux, Chromaticity, Luminous Intensity Distribution, THD, Power factor
Test Engineer:	Bill Xiong <i>Bill Xiong</i>
Report Number:	RSZ160630509-10
Test Date:	2016-07-01 to 2016-07-04
Report Date:	2016-07-06
Reviewed By:	Jeanne Han/Safety Manager <i>Jeanne Han</i>
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Test Facility:	Test facility was located at Pu Long Cun 69, Puxinghu Industrial Area, Tangxia Town, Dongguan, Guangdong, P.R.China.
Accreditation:	The NVLAP Lab Code is 200707-0.

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1. Product Description

General Information:

One sample was received on 2016-06-30 and used for testing.

Model Tested: RTUS22-S-40W-35-PE
Manufacturer: ATG Electronics Co.,Ltd
Brand Name: ATG
Product Designation: 2x2 Luminaires for Ambient Lighting of Interior Commercial Spaces
Burning Time Before Test: 0hour(For New Products)

Rated Values:

Rated Voltage/Frequency: 120-277VAC 50/60Hz
Rated Power: 40 W
Nominal CCT: 3500K
Nominal Lumen Output: 5000 lm

2. Standards Used

- IES LM-79-08: Approved Method: Electrical & Photometric Measurement of Solid-state Lighting Products
- ANSI C82.77-2002: Harmonic Emission Limits – Related Power Quality Requirements for Lighting
- IES TM-30-15: IES Method for Evaluating Light Source Color Rendition (This method is not in NVLAP accreditation scope)

3. Description of Test Equipment

Device	Manufacturer	Model No	Serial No	Test Range	Calibration date	Calibration due date
2.0m integrating sphere	EVERFINE	R98	11010018	R98	2015-11-09	2016-11-08
High accuracy array spectroradiometer	EVERFINE	HAAS-2000	1012016T	380-780nm	2016-03-10	2017-03-09
Digital Power Meter	EVERFINE	PF2010A	1011004	600V/20A	2015-07-24	2016-07-23
Digital CC&CV DC Power Supply	EVERFINE	WY305-V1	1101047	30V/5A	2015-07-27	2016-07-26
Temperature/humidity/clock	Victor	VC230	EE023	0~40°C0~90%	2016-03-21	2017-03-20
Standard Light Source	SENSING	N/A	LSD090808	N/A	2015-09-25	2016-09-24
Special zero-voltage synchronous switching AC	EVERFINE	DPS1010-YF	1011001T	30V/5A	2016-03-04	2017-03-03
AC Power Supply	EVERFINE	VPS1030 PWM	1012017	0-150V, 0-300V	2016-03-04	2017-03-03
DC Power Supply	EVERFINE	WY12010	1009009	30V/5A	2016-03-04	2017-03-03
Power Meter	YOKOGAWA	WT-210	91KB35700	15/30/60/150/300/600 V	2016-03-04	2017-03-03
Goniophotometer	EVERFINE	GO-R5000	YG108492N10120001	1600mm,3000W/10A	2016-03-10	2017-03-09
Wireless Remote Sensor	N/A	433MHz	N/A	0°C~50°C;-20°C~60°C	2016-03-21	2017-03-20
Standard Light Source	EVERFINE	D908	1012003	N/A	2015-09-08	2016-09-07

Statement of Traceability: Bay Area Compliance Laboratories Corp. (Shenzhen) attested that all calibration has been performed using suitable standards traceable to National Primary Standards and International System of Units (SI).

4. Test Method

Product was tested with no seasoning. All stabilization and measurements were made in compliance with IES LM-79-08. The product was operated at rated voltage or at voltage required by manufacturer. The ambient temperature of the sample was maintained at $25^{\circ}\text{C} \pm 1^{\circ}\text{C}$ during measurement. And relative humidity is less than 65%.

Integrating Sphere System

The system includes AC power source, digital power meter, DC power supply, Spectroradiometer, and integrating sphere. The integrating sphere system is calibrated by standard spectrum light source before measurement.

4π geometry was used during measurement. The product was operated in its intended orientation in application and was recorded in this report.

The uncertainty of the light output (luminous flux) measurements is $U=1.8\%$ ($K=2$), at the 95% confidence level. The uncertainty of the correlated color temperature measurements is $U=20\text{K}$ ($K=2$), at the 95% confidence level. The uncertainty of the CRI is $U=1.8(K=2)$, at the 95% confidence level.

The uncertainty of power meter AC current $U=0.19\%$ of rdg, AC Voltage $U=0.15\%$ of rdg, Power $U=0.20\%$ ($K=2$), at the 95% confidence level.

Goniophotometer System

The goniophotometer system is calibrated by standard light source before measurement.

Type C goniophotometer was used for measuring total luminous flux, luminous intensity distribution, and color spatial uniformity. The product was operated in its intended orientation in application and was recorded in this report. The vertical angle (γ) test intervals were set no more than 1 degree while data for 5 degree intervals is reported. The horizontal angle (C plane) test intervals were set no more than 22.5 degree.

The uncertainty of the luminous intensity is $U=1.6\%$ ($K=2$), at the 95% confidence level.

Additional Test

The Additional Test item may not be covered by IESNA LM-79-2008. Additional test including power factor, off-state power and THD, was measured by Digital Power Meter after stabilized at $25^{\circ}\text{C} \pm 1^{\circ}\text{C}$. Test voltage for THD and power factor test would be equal to rated voltage or, in case of a voltage range, maximum value of that range.

The uncertainty of power meter AC current $U=0.19\%$ of rdg, AC Voltage $U=0.15\%$ of rdg, Power $U=0.20\%$ ($K=2$), at the 95% confidence level.

Fidelity Index and Gamut Index Calculation

The R_i , R_g was calculated according to IES TM-30-15 by using calculation tools. The calculation was based on the measured SPD from 380nm to 780nm with 1nm intervals. All the colors in this report is for reference only.

5. Test Result

[Integrating Sphere System]

Total operating time for integrating sphere test: **1.0 hour**

Test orientation: **Downward**

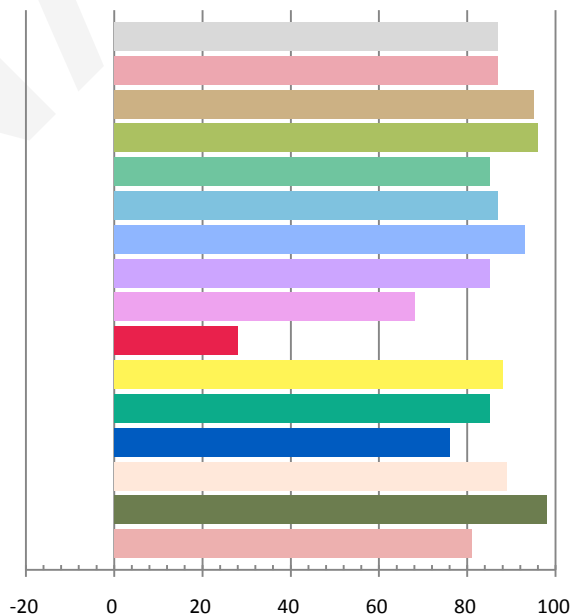
Photometric and Electrical Measurement Result

Voltage (V)	Frequency (Hz)	Current (A)	Power (W)	Power Factor	Luminous Flux(lm)	Efficacy (lm/W)
120.00	60	0.3355	40.03	0.9943	5005.3	125.04

Radiant Flux (W)	CCT (K)	Duv	x	y	u'	v'
15.862	3363	-0.00284	0.4100	0.3865	0.2405	0.5102

Color Rendering Index

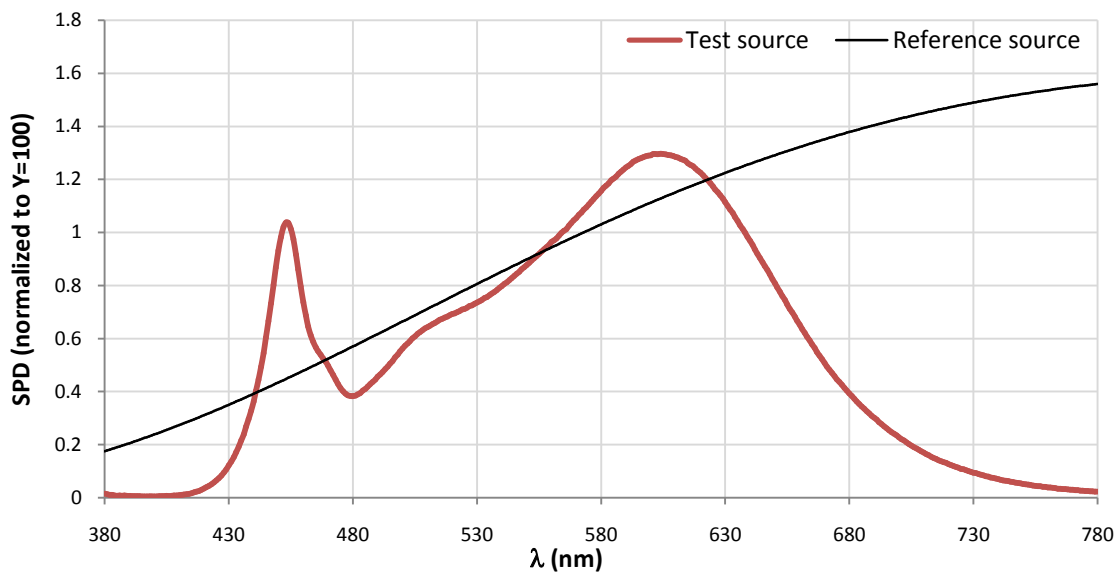
Ra			
87.0			
R1	R2	R3	R4
87	95	96	85
R5	R6	R7	R8
87	93	85	68
R9	R10	R11	R12
28	88	85	76
R13	R14	R15	
89	98	81	



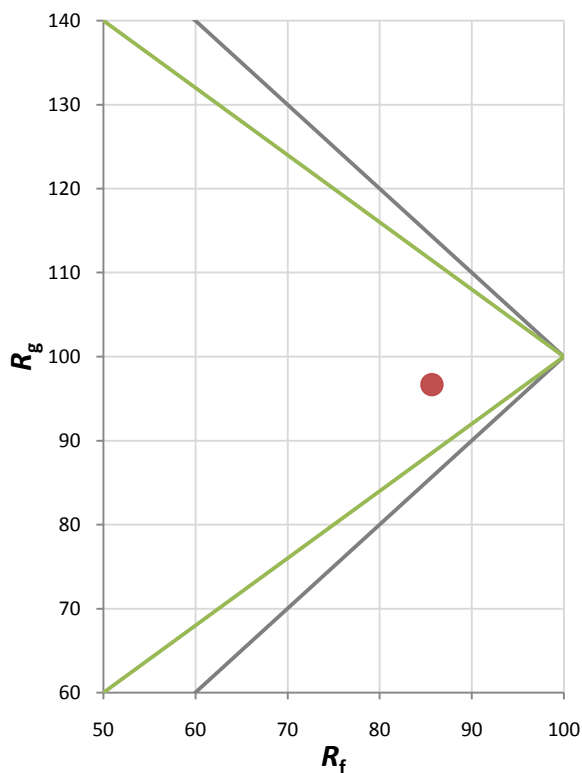
Fidelity Index and Gamut Index

Fidelity Index R_f	86
Gamut Index R_g	97

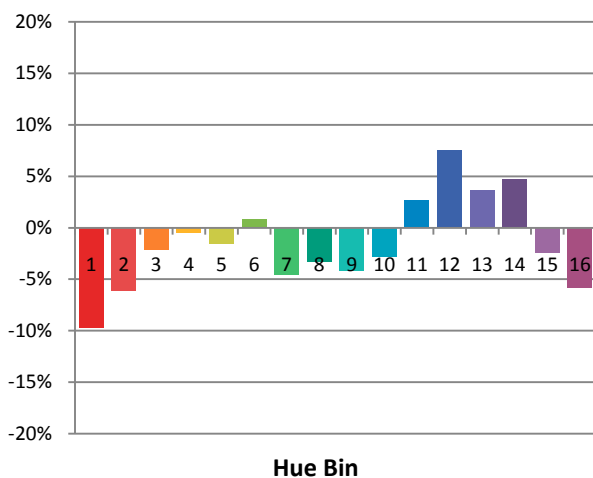
Spectral Power Distribution Comparison



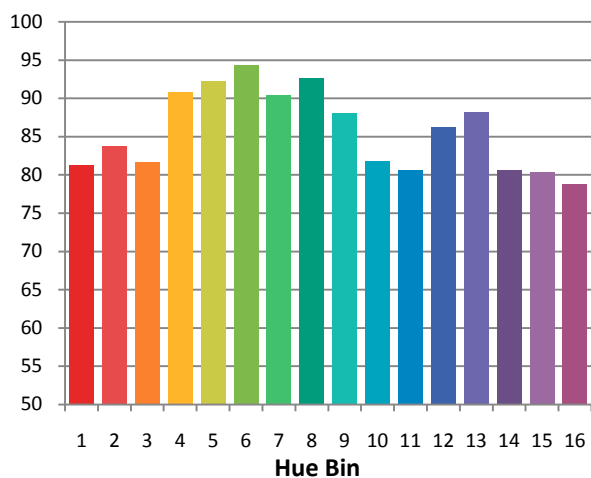
Plot of R_g versus R_f



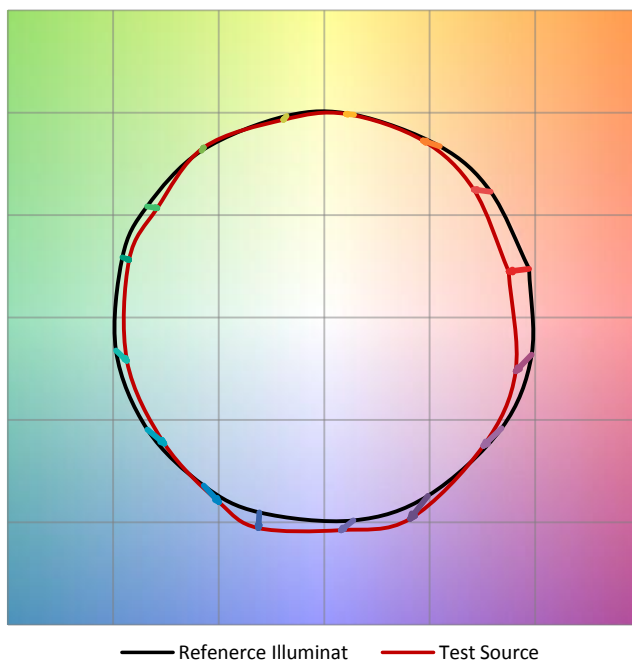
Chroma Shift by Hue



R_f by Hue

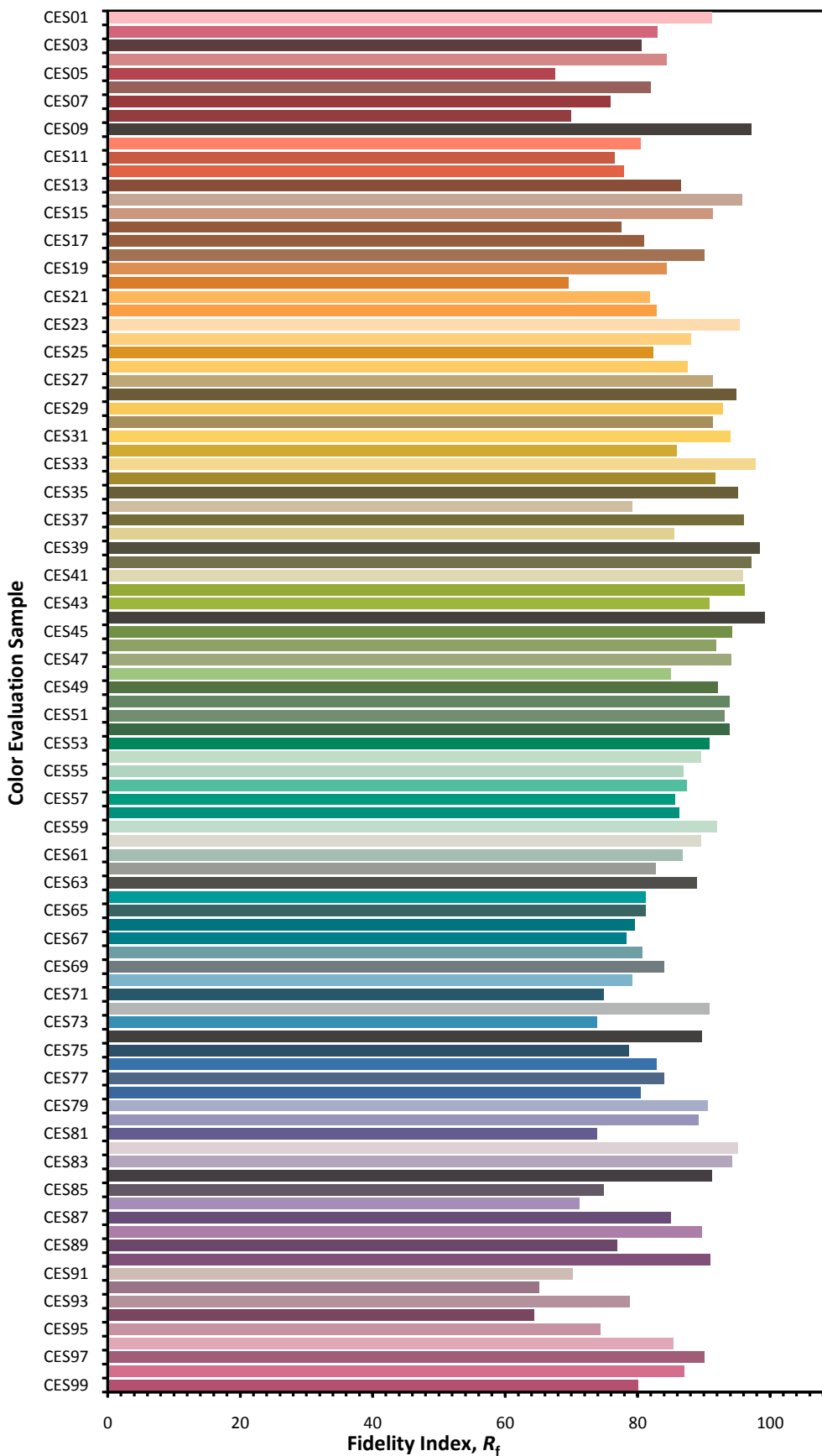


Color Vector Graphic

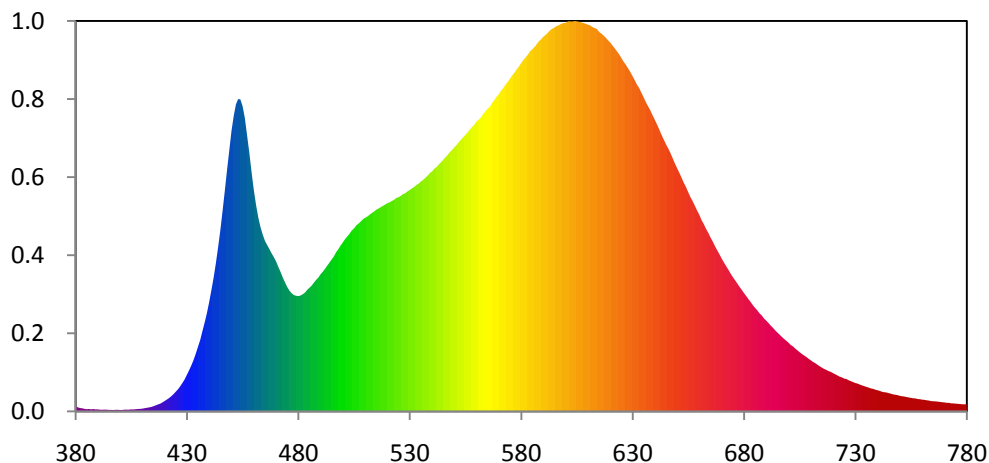


— Reference Illuminat — Test Source

Color Fidelity by CES Sample



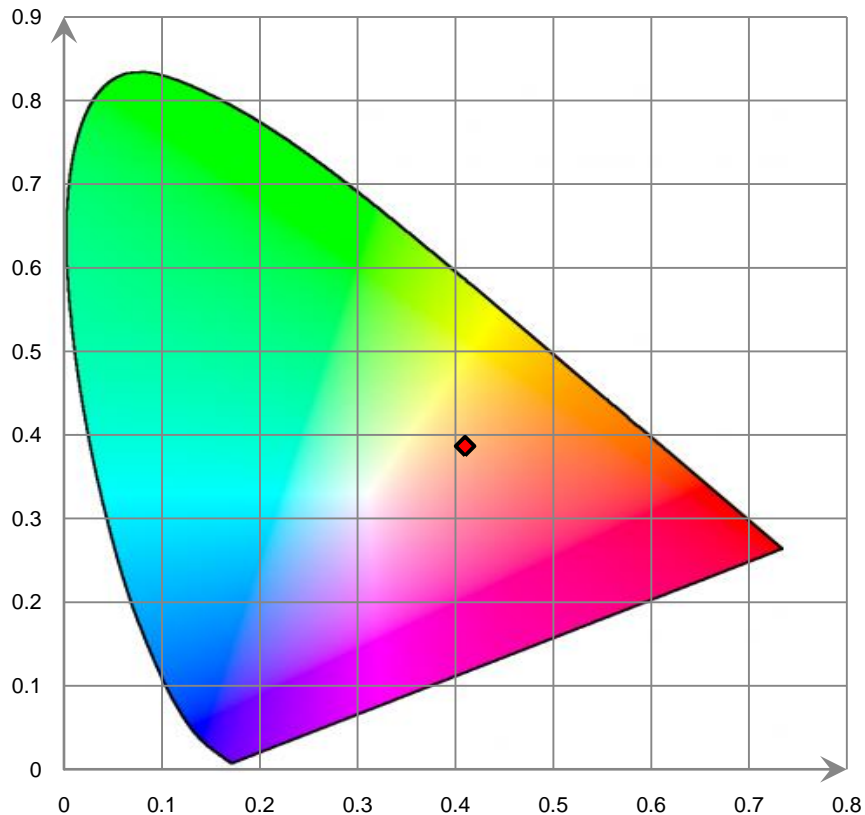
Relative Spectral Power Distribution



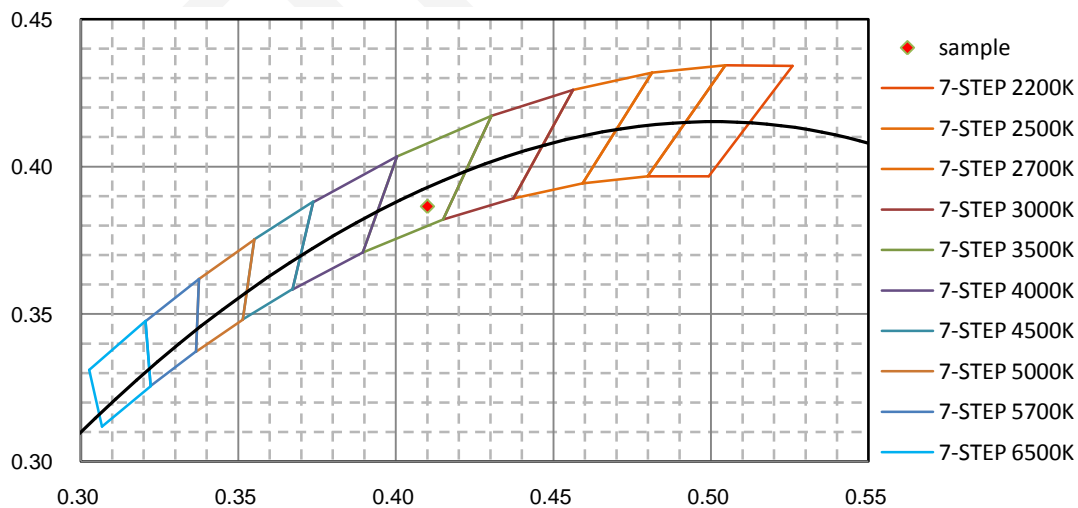
nm	mW	nm	mW	nm	mW	nm	mW	nm	mW
380	1.161E+00	421	2.878E+00	462	4.728E+01	503	4.325E+01	544	6.062E+01
381	9.986E-01	422	3.248E+00	463	4.490E+01	504	4.404E+01	545	6.123E+01
382	8.059E-01	423	3.701E+00	464	4.308E+01	505	4.455E+01	546	6.183E+01
383	7.543E-01	424	4.214E+00	465	4.154E+01	506	4.525E+01	547	6.242E+01
384	6.203E-01	425	4.798E+00	466	4.051E+01	507	4.572E+01	548	6.312E+01
385	5.257E-01	426	5.395E+00	467	3.953E+01	508	4.621E+01	549	6.364E+01
386	5.937E-01	427	6.120E+00	468	3.849E+01	509	4.678E+01	550	6.427E+01
387	4.962E-01	428	6.942E+00	469	3.755E+01	510	4.714E+01	551	6.484E+01
388	5.705E-01	429	7.810E+00	470	3.653E+01	511	4.745E+01	552	6.553E+01
389	4.872E-01	430	8.921E+00	471	3.521E+01	512	4.788E+01	553	6.614E+01
390	4.811E-01	431	1.002E+01	472	3.397E+01	513	4.830E+01	554	6.672E+01
391	4.126E-01	432	1.123E+01	473	3.261E+01	514	4.866E+01	555	6.736E+01
392	3.951E-01	433	1.256E+01	474	3.142E+01	515	4.910E+01	556	6.793E+01
393	4.159E-01	434	1.409E+01	475	3.029E+01	516	4.939E+01	557	6.862E+01
394	4.218E-01	435	1.578E+01	476	2.941E+01	517	4.972E+01	558	6.925E+01
395	3.539E-01	436	1.747E+01	477	2.876E+01	518	5.004E+01	559	6.979E+01
396	3.654E-01	437	1.961E+01	478	2.831E+01	519	5.035E+01	560	7.061E+01
397	3.337E-01	438	2.173E+01	479	2.814E+01	520	5.071E+01	561	7.105E+01
398	3.876E-01	439	2.400E+01	480	2.807E+01	521	5.089E+01	562	7.159E+01
399	3.833E-01	440	2.664E+01	481	2.821E+01	522	5.124E+01	563	7.243E+01
400	3.394E-01	441	2.956E+01	482	2.852E+01	523	5.153E+01	564	7.308E+01
401	3.537E-01	442	3.263E+01	483	2.893E+01	524	5.196E+01	565	7.372E+01
402	4.265E-01	443	3.612E+01	484	2.959E+01	525	5.215E+01	566	7.420E+01
403	4.218E-01	444	3.996E+01	485	3.009E+01	526	5.247E+01	567	7.511E+01
404	4.135E-01	445	4.415E+01	486	3.063E+01	527	5.290E+01	568	7.580E+01
405	4.869E-01	446	4.880E+01	487	3.135E+01	528	5.311E+01	569	7.663E+01
406	4.706E-01	447	5.368E+01	488	3.200E+01	529	5.354E+01	570	7.721E+01
407	5.223E-01	448	5.874E+01	489	3.258E+01	530	5.391E+01	571	7.811E+01
408	5.823E-01	449	6.351E+01	490	3.339E+01	531	5.428E+01	572	7.872E+01
409	6.071E-01	450	6.823E+01	491	3.402E+01	532	5.463E+01	573	7.955E+01
410	6.651E-01	451	7.195E+01	492	3.474E+01	533	5.512E+01	574	8.020E+01
411	7.743E-01	452	7.476E+01	493	3.549E+01	534	5.543E+01	575	8.101E+01
412	8.702E-01	453	7.605E+01	494	3.624E+01	535	5.596E+01	576	8.178E+01
413	9.594E-01	454	7.593E+01	495	3.701E+01	536	5.637E+01	577	8.245E+01
414	1.087E+00	455	7.428E+01	496	3.778E+01	537	5.685E+01	578	8.327E+01
415	1.261E+00	456	7.141E+01	497	3.878E+01	538	5.736E+01	579	8.397E+01
416	1.474E+00	457	6.721E+01	498	3.952E+01	539	5.802E+01	580	8.477E+01
417	1.685E+00	458	6.300E+01	499	4.040E+01	540	5.840E+01	581	8.553E+01
418	1.871E+00	459	5.831E+01	500	4.115E+01	541	5.905E+01	582	8.618E+01
419	2.185E+00	460	5.398E+01	501	4.196E+01	542	5.948E+01	583	8.682E+01
420	2.530E+00	461	5.038E+01	502	4.261E+01	543	6.007E+01	584	8.767E+01

nm	mW	nm	mW	nm	mW	nm	mW	nm	mW
585	8.817E+01	626	8.514E+01	667	4.024E+01	708	1.325E+01	749	3.959E+00
586	8.870E+01	627	8.438E+01	668	3.922E+01	709	1.281E+01	750	3.788E+00
587	8.941E+01	628	8.350E+01	669	3.825E+01	710	1.244E+01	751	3.689E+00
588	9.011E+01	629	8.265E+01	670	3.723E+01	711	1.204E+01	752	3.616E+00
589	9.060E+01	630	8.163E+01	671	3.627E+01	712	1.175E+01	753	3.492E+00
590	9.124E+01	631	8.062E+01	672	3.538E+01	713	1.135E+01	754	3.387E+00
591	9.167E+01	632	7.955E+01	673	3.451E+01	714	1.099E+01	755	3.287E+00
592	9.219E+01	633	7.871E+01	674	3.357E+01	715	1.065E+01	756	3.187E+00
593	9.279E+01	634	7.755E+01	675	3.272E+01	716	1.033E+01	757	3.152E+00
594	9.315E+01	635	7.645E+01	676	3.195E+01	717	1.009E+01	758	3.003E+00
595	9.348E+01	636	7.526E+01	677	3.116E+01	718	9.800E+00	759	2.969E+00
596	9.382E+01	637	7.425E+01	678	3.034E+01	719	9.616E+00	760	2.850E+00
597	9.404E+01	638	7.327E+01	679	2.961E+01	720	9.304E+00	761	2.814E+00
598	9.435E+01	639	7.208E+01	680	2.881E+01	721	9.034E+00	762	2.704E+00
599	9.453E+01	640	7.097E+01	681	2.810E+01	722	8.747E+00	763	2.639E+00
600	9.461E+01	641	6.984E+01	682	2.734E+01	723	8.450E+00	764	2.495E+00
601	9.494E+01	642	6.862E+01	683	2.664E+01	724	8.260E+00	765	2.467E+00
602	9.494E+01	643	6.734E+01	684	2.586E+01	725	7.985E+00	766	2.421E+00
603	9.490E+01	644	6.619E+01	685	2.520E+01	726	7.871E+00	767	2.389E+00
604	9.503E+01	645	6.506E+01	686	2.459E+01	727	7.585E+00	768	2.294E+00
605	9.496E+01	646	6.403E+01	687	2.387E+01	728	7.355E+00	769	2.232E+00
606	9.485E+01	647	6.290E+01	688	2.335E+01	729	7.125E+00	770	2.179E+00
607	9.470E+01	648	6.166E+01	689	2.262E+01	730	6.900E+00	771	2.085E+00
608	9.455E+01	649	6.037E+01	690	2.209E+01	731	6.766E+00	772	2.083E+00
609	9.437E+01	650	5.921E+01	691	2.154E+01	732	6.528E+00	773	1.958E+00
610	9.414E+01	651	5.809E+01	692	2.090E+01	733	6.333E+00	774	1.952E+00
611	9.397E+01	652	5.690E+01	693	2.036E+01	734	6.140E+00	775	1.880E+00
612	9.357E+01	653	5.566E+01	694	1.973E+01	735	5.959E+00	776	1.843E+00
613	9.334E+01	654	5.461E+01	695	1.919E+01	736	5.793E+00	777	1.788E+00
614	9.308E+01	655	5.336E+01	696	1.869E+01	737	5.589E+00	778	1.737E+00
615	9.239E+01	656	5.215E+01	697	1.815E+01	738	5.489E+00	779	1.707E+00
616	9.197E+01	657	5.116E+01	698	1.765E+01	739	5.274E+00	780	1.710E+00
617	9.153E+01	658	5.005E+01	699	1.721E+01	740	5.136E+00		
618	9.096E+01	659	4.888E+01	700	1.672E+01	741	4.981E+00		
619	9.033E+01	660	4.784E+01	701	1.618E+01	742	4.773E+00		
620	8.979E+01	661	4.656E+01	702	1.582E+01	743	4.661E+00		
621	8.908E+01	662	4.556E+01	703	1.531E+01	744	4.602E+00		
622	8.840E+01	663	4.445E+01	704	1.486E+01	745	4.436E+00		
623	8.767E+01	664	4.347E+01	705	1.440E+01	746	4.293E+00		
624	8.692E+01	665	4.235E+01	706	1.398E+01	747	4.134E+00		
625	8.602E+01	666	4.135E+01	707	1.362E+01	748	4.061E+00		

CIE 1931 x y Chromaticity Diagram



7-Step Chromaticity Quadrangles



[Goniophotometer System]

Total operating time for luminous intensity distribution: **1.0 hour**

Test orientation: **Downward**

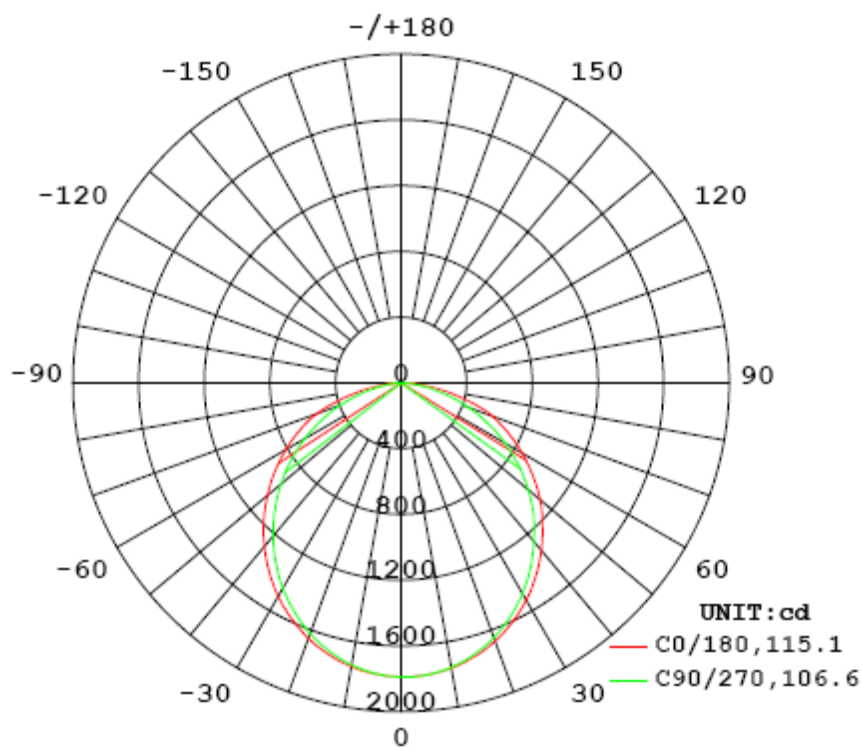
Electrical Measurement

Input Voltage (V)	Frequency (Hz)	Input Current (A)	Power (W)	Power Factor
120.0	60	0.3362	40.1	0.9939

Photometric Measurement

Luminous Flux (lm)	Efficacy (lm/W)	I _{max} (cd)	S/MH (C0/180)	S/MH (C90/270)
5016.56	125.10	1789.0	1.27	1.23

Luminous Intensity Distribution



	C0/180	C45/225	C90/270	C135/315	AVG.
Beam Angle (50% I _{max}):	115.1	110.3	106.6	110.2	110.6
Field Angle (10% I _{max}):	162.8	162.4	157.3	162.3	161.2

Luminous Intensity (cd) Distribution Data

C y	0°	22.5°	45°	67.5°	90°	112.5°	135°	157.5°
0.0°	1788	1788	1788	1788	1788	1788	1788	1788
5.0°	1777	1777	1776	1774	1775	1776	1779	1780
10.0°	1751	1749	1745	1742	1742	1745	1751	1756
15.0°	1710	1705	1698	1691	1690	1696	1706	1716
20.0°	1653	1645	1634	1624	1622	1629	1644	1660
25.0°	1583	1573	1557	1542	1538	1548	1569	1589
30.0°	1499	1486	1464	1446	1442	1453	1478	1505
35.0°	1404	1388	1362	1339	1333	1347	1377	1408
40.0°	1299	1280	1249	1223	1216	1231	1265	1302
45.0°	1185	1164	1128	1098	1090	1107	1144	1186
50.0°	1065	1041	1001	967	958	976	1016	1064
55.0°	940	914	869	832	820	839	884	935
60.0°	813	784	735	692	680	699	749	805
65.0°	684	654	600	552	537	558	612	673
70.0°	548	526	470	413	394	417	480	548
75.0°	373	362	343	279	254	282	353	392
80.0°	203	197	190	160	129	161	205	222
85.0°	52	53	52	47	34	51	65	73
90.0°	0	0	0	0	0	0	0	0
95.0°	0	0	0	0	0	0	0	0
100.0°	0	0	0	0	0	0	0	0
105.0°	1	1	1	0	0	1	1	1
110.0°	1	1	1	1	1	1	1	1
115.0°	1	1	1	1	1	1	1	1
120.0°	1	1	1	1	1	1	1	1
125.0°	1	1	1	1	1	1	1	1
130.0°	1	1	1	1	1	1	1	1
135.0°	1	1	1	1	1	1	1	1
140.0°	1	1	1	1	1	1	1	1
145.0°	1	1	1	1	1	1	1	1
150.0°	2	2	2	2	2	2	2	2
155.0°	2	2	2	2	2	2	2	2
160.0°	2	2	2	2	2	2	2	2
165.0°	2	2	2	2	2	2	2	2
170.0°	2	2	2	2	2	2	2	2
175.0°	2	2	2	2	2	2	2	2
180.0°	2	2	2	1	1	2	2	2

Luminous Intensity (cd) Distribution Data (cont.)

C y	180°	202.5°	225°	247.5°	270°	292.5°	315°	337.5°
0.0°	1788	1788	1788	1788	1788	1788	1788	1788
5.0°	1783	1784	1784	1783	1782	1781	1782	1780
10.0°	1762	1762	1761	1758	1756	1755	1755	1755
15.0°	1724	1725	1722	1715	1712	1710	1714	1714
20.0°	1672	1672	1665	1655	1650	1649	1654	1658
25.0°	1605	1604	1593	1580	1571	1572	1581	1587
30.0°	1525	1523	1507	1489	1479	1480	1492	1503
35.0°	1433	1428	1409	1386	1374	1377	1393	1407
40.0°	1329	1323	1299	1273	1260	1263	1282	1301
45.0°	1218	1211	1184	1159	1143	1148	1168	1189
50.0°	1105	1095	1061	1027	1011	1017	1043	1071
55.0°	979	967	927	890	873	881	911	944
60.0°	850	835	791	749	731	741	775	813
65.0°	720	702	652	604	585	597	638	681
70.0°	591	571	515	460	438	454	503	551
75.0°	423	422	384	320	295	317	374	390
80.0°	248	249	240	193	163	191	223	221
85.0°	90	94	94	76	49	66	75	71
90.0°	0	0	0	0	0	0	0	0
95.0°	0	0	0	0	0	0	0	0
100.0°	0	0	0	0	0	0	0	0
105.0°	0	0	0	0	0	0	0	0
110.0°	0	0	0	0	0	0	0	0
115.0°	0	0	0	0	0	0	0	0
120.0°	1	1	1	1	1	0	0	1
125.0°	1	1	1	1	1	1	1	1
130.0°	1	1	1	1	1	1	1	1
135.0°	1	1	1	1	1	1	1	1
140.0°	1	1	1	1	1	1	1	1
145.0°	1	1	1	1	1	1	1	1
150.0°	1	1	1	1	1	1	1	1
155.0°	1	1	1	1	1	1	1	1
160.0°	1	1	1	1	1	1	1	1
165.0°	1	1	1	1	1	1	1	1
170.0°	1	1	1	1	1	1	1	1
175.0°	2	1	1	1	1	1	1	1
180.0°	2	2	2	2	2	2	2	2

Zonal Lumen Density Measurement

Deg	Flux (lm)	%
0-5	42.7	0.85
5-10	126.4	2.52
10-15	205.4	4.09
15-20	276.8	5.52
20-25	338.1	6.74
25-30	387.3	7.72
30-35	422.8	8.43
35-40	443.7	8.84
40-45	450.1	8.97
45-50	442.5	8.82
50-55	420.1	8.38
55-60	384.8	7.67
60-65	338.4	6.74
65-70	283.5	5.66
70-75	220.0	4.38
75-80	146.1	2.91
80-85	71.1	1.42
85-90	12.5	0.25
90-95	0.1	0.00
95-100	0.2	0.01
100-105	0.2	0.00
105-110	0.2	0.01
110-115	0.2	0.00
115-120	0.3	0.01
120-125	0.3	0.00
125-130	0.3	0.01
130-135	0.3	0.00
135-140	0.3	0.01
140-145	0.4	0.01
145-150	0.4	0.00
150-155	0.4	0.01
155-160	0.3	0.01
160-165	0.3	0.00
165-170	0.2	0.01
170-175	0.1	0.00
175-180	0.0	0.00

Deg	Flux (lm)	%
0-5	42.7	0.85
0-10	169.0	3.37
0-15	374.4	7.46
0-20	651.2	12.98
0-25	989.3	19.72
0-30	1376.5	27.44
0-35	1799.3	35.87
0-40	2242.9	44.71
0-45	2693.0	53.68
0-50	3135.5	62.50
0-55	3555.6	70.88
0-60	3940.4	78.55
0-65	4278.8	85.29
0-70	4562.3	90.95
0-75	4782.4	95.33
0-80	4928.4	98.24
0-85	4999.6	99.66
0-90	5012.1	99.91
0-95	5012.2	99.91
0-100	5012.4	99.92
0-105	5012.6	99.92
0-110	5012.8	99.93
0-115	5013.1	99.93
0-120	5013.3	99.94
0-125	5013.6	99.94
0-130	5013.9	99.95
0-135	5014.2	99.95
0-140	5014.5	99.96
0-145	5014.9	99.97
0-150	5015.3	99.97
0-155	5015.6	99.98
0-160	5016.0	99.99
0-165	5016.2	99.99
0-170	5016.4	100.00
0-175	5016.5	100.00
0-180	5016.6	100.00

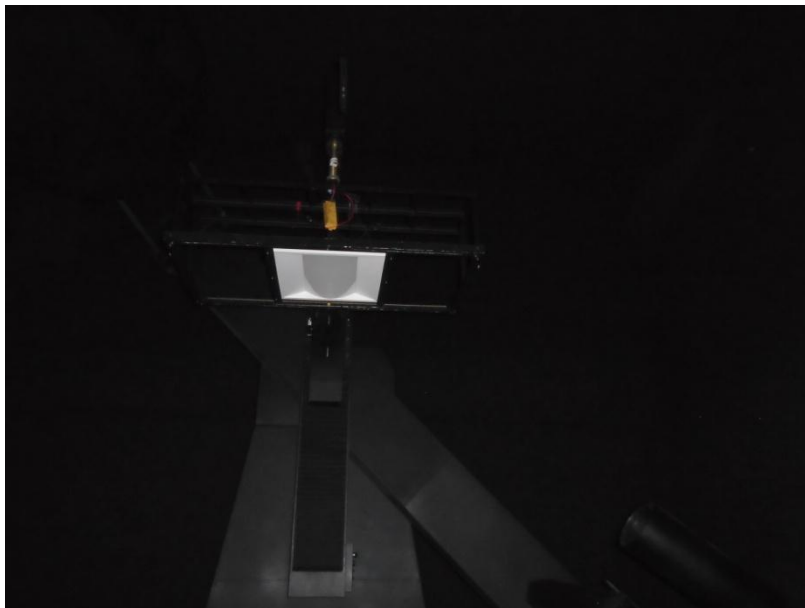
[Additional Test]

Test Item	Test Voltage (V)	Frequency (Hz)	Test Result
Power Factor:	277.0	60	0.9229
Total Harmonic Distortion:	277.0	60	7.66%
Total Harmonic Distortion:	120.0	60	7.83%

6. Product Photo



7. Product Test orientation in the Goniophotometer



*****END OF REPORT*****