

IES LM-79-08

MEASUREMENT AND TEST REPORT

For

ATG Electronics Corp

9020 Rancho Park Court Rancho Cucamonga, CA 91730

Test Model: RTUS24-S-40W-35-PE

Report Type:	Electrical and Photometric tests including: Luminous Flux, Chromaticity, Luminous Intensity Distribution, THD, Power factor
Test Engineer:	Daniel Duan <i>Daniel Duan</i>
Report Number:	RSZ160620511-10
Test Date:	2016-06-21 to 2016-06-29
Report Date:	2016-07-01
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 2016-06-20 and used for testing.

Model Tested: RTUS24-S-40W-35-PE
Manufacturer: ATG Electronics Co.,Ltd
Brand Name: ATG
Product Designation: 2x4 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**

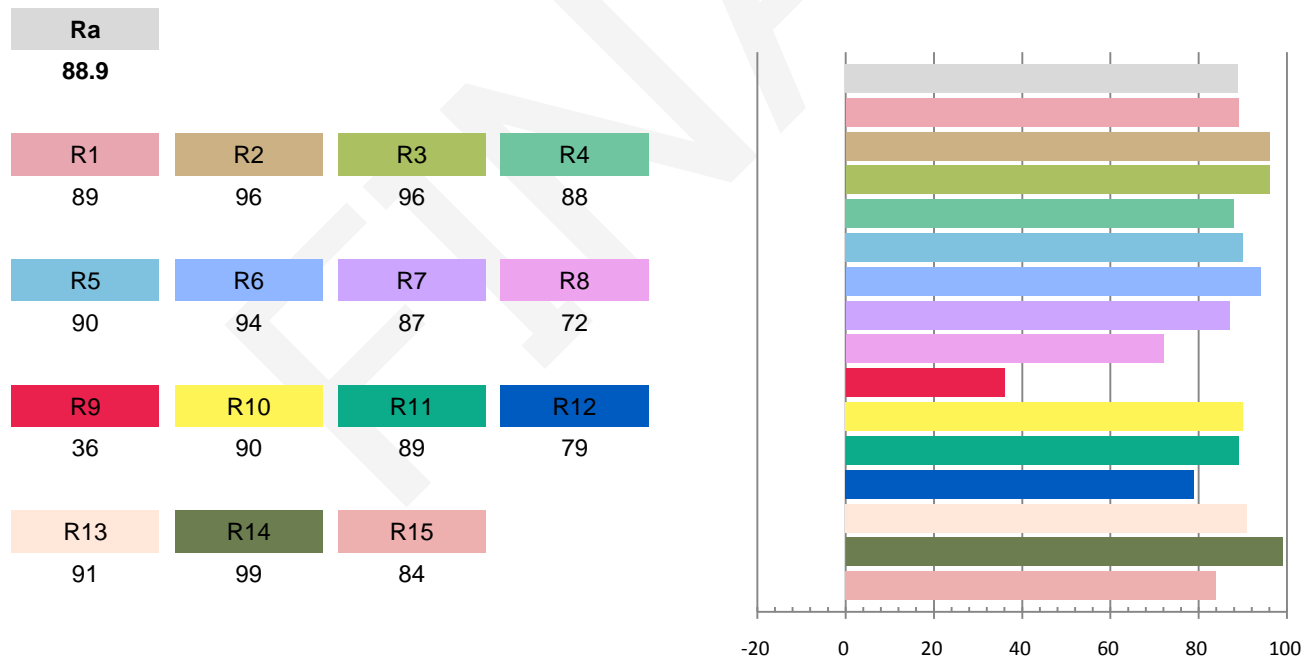
Test orientation: **Downward**

Photometric and Electrical Measurement Result

Voltage (V)	Frequency (Hz)	Current (A)	Power (W)	Power Factor	Luminous Flux(lm)	Efficacy (lm/W)
120.0	60	0.3406	40.29	0.9856	5081.6	126.12

Radiant Flux (W)	CCT (K)	Duv	x	y	u'	v'
16.341	3372	-0.00361	0.4086	0.3841	0.2406	0.5090

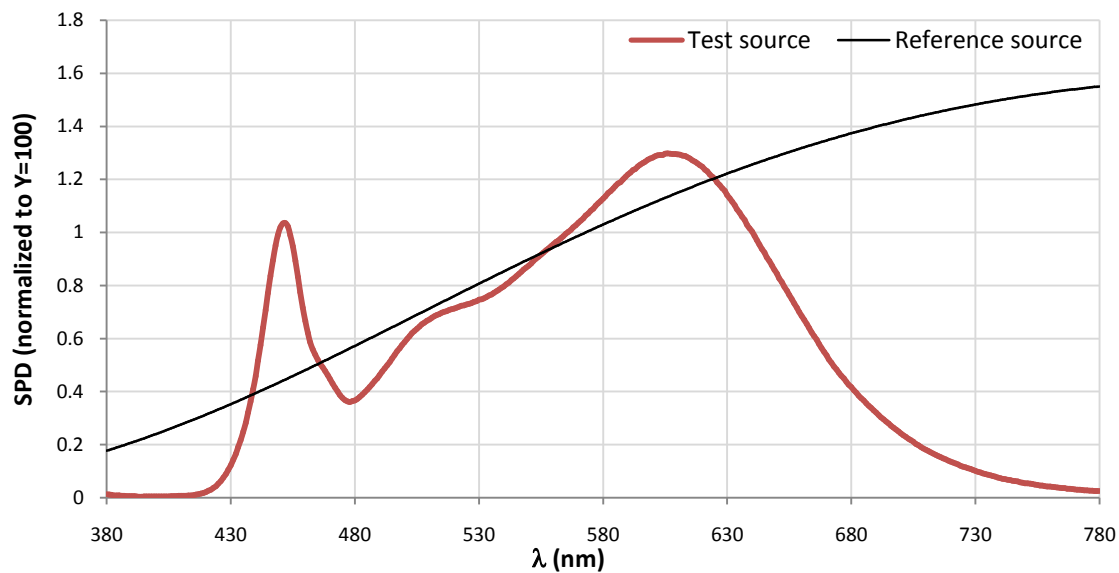
Color Rendering Index



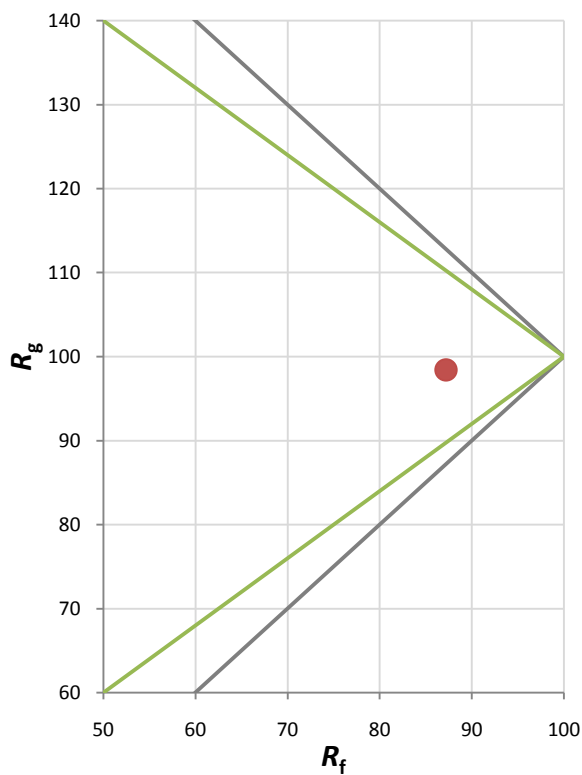
Fidelity Index and Gamut Index

Fidelity Index R_f	87
Gamut Index R_g	98

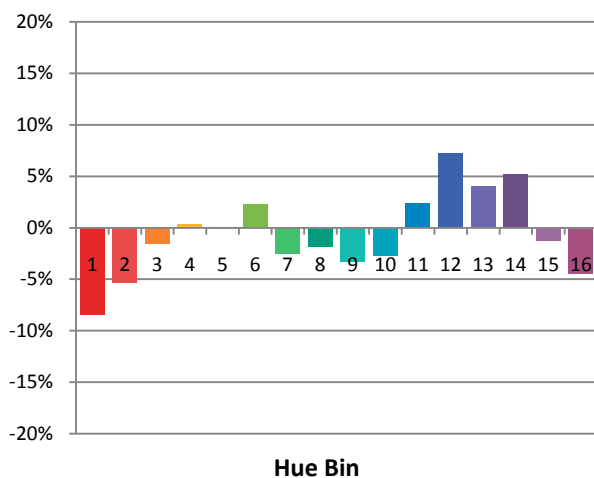
Spectral Power Distribution Comparison



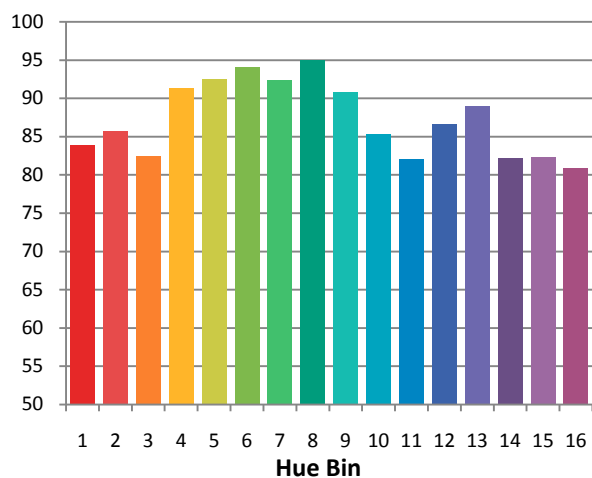
Plot of R_g versus R_f



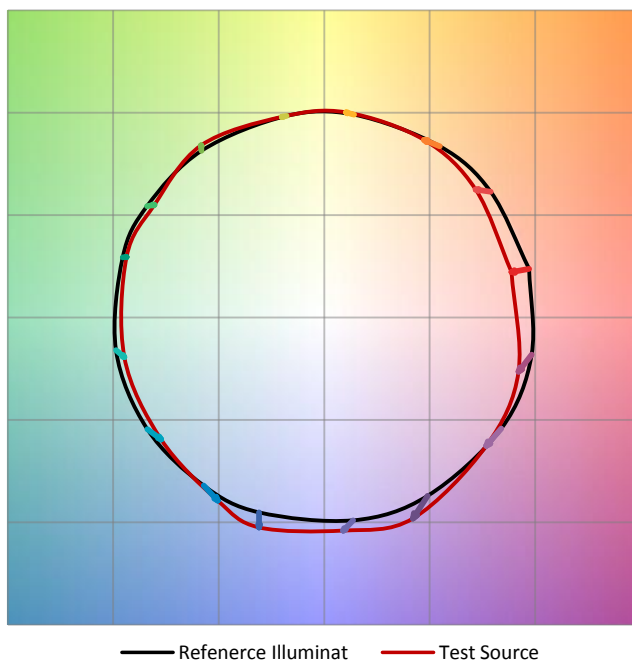
Chroma Shift by Hue



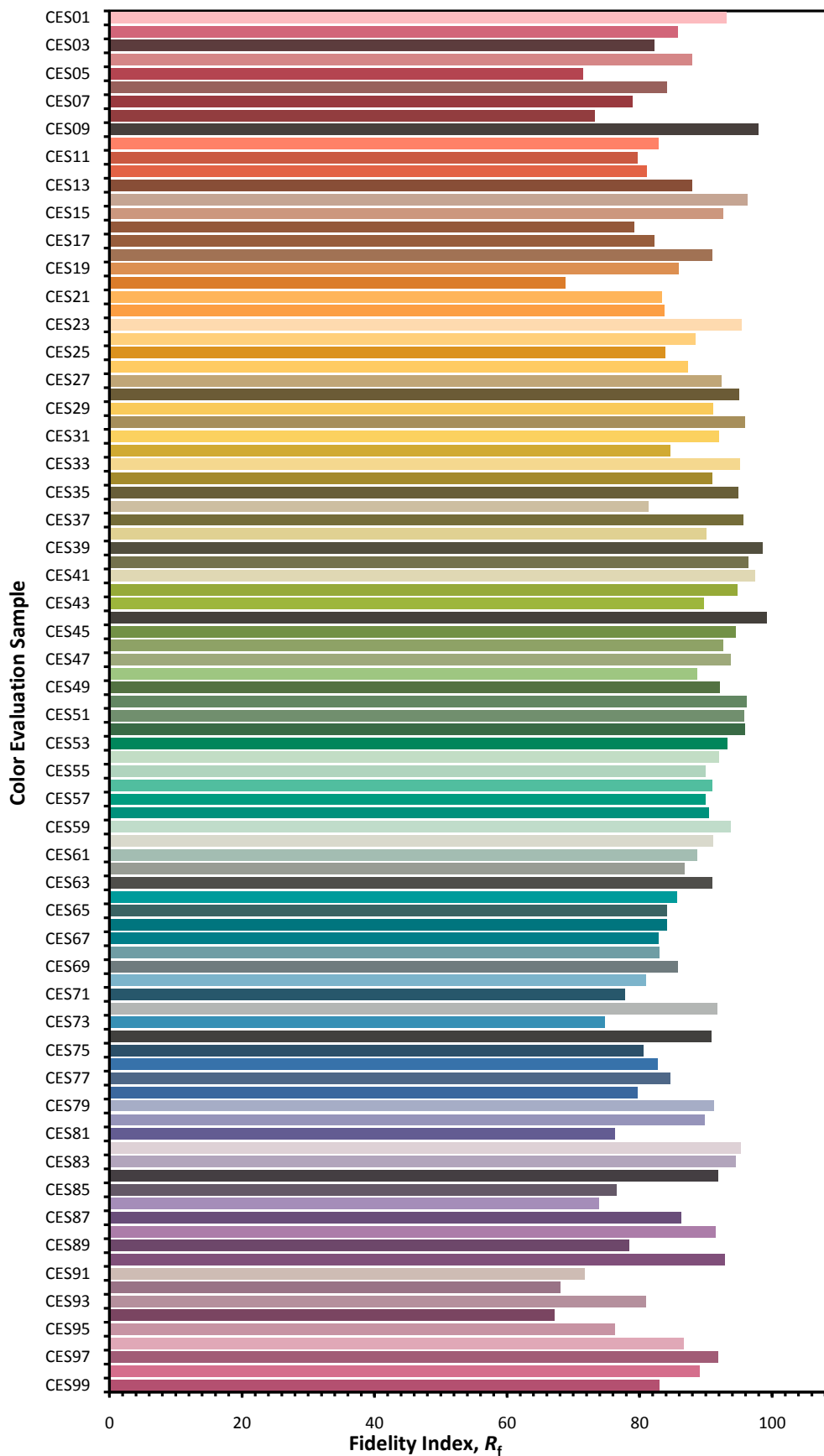
R_f by Hue



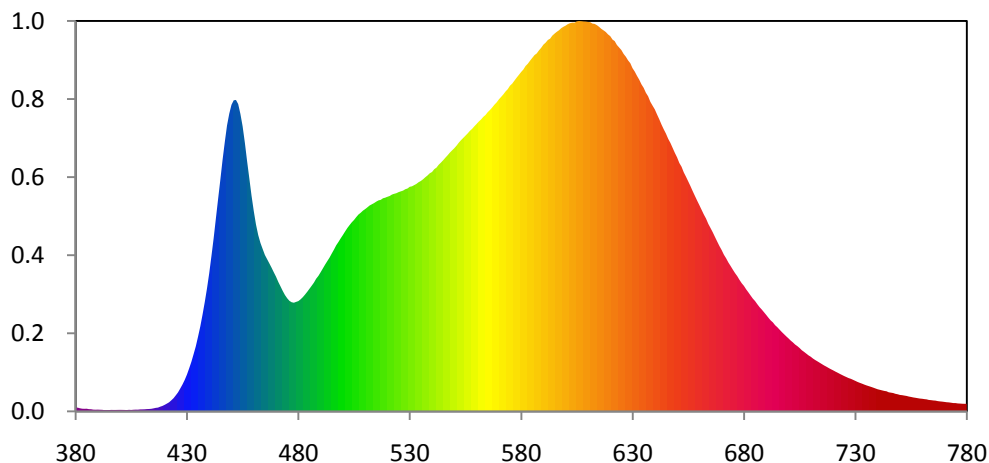
Color Vector Graphic



Color Fidelity by CES Sample



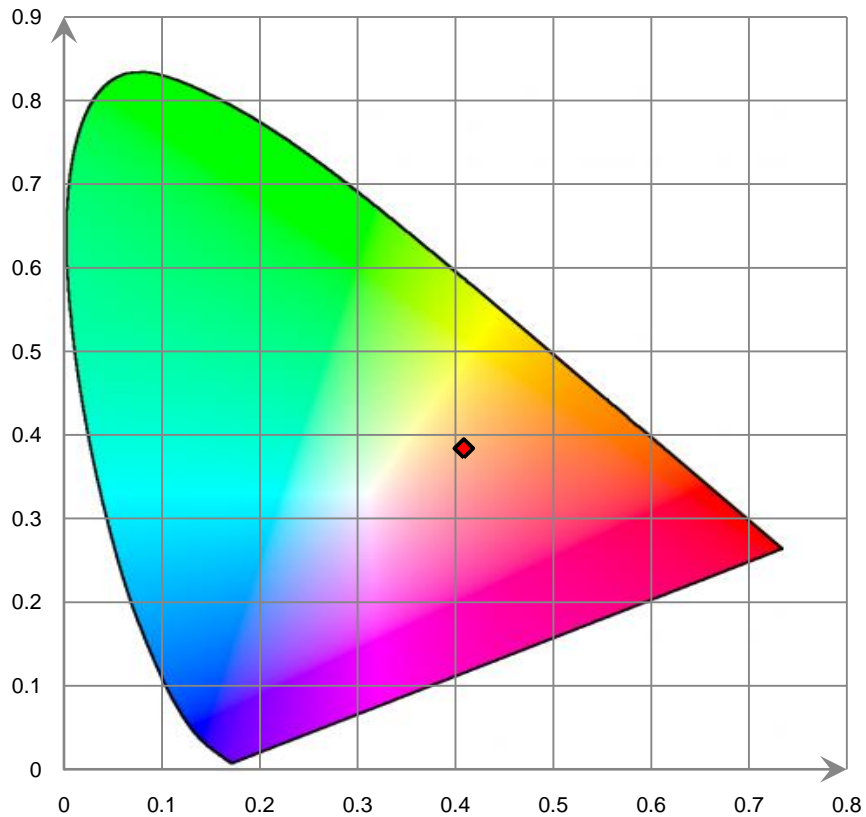
Relative Spectral Power Distribution



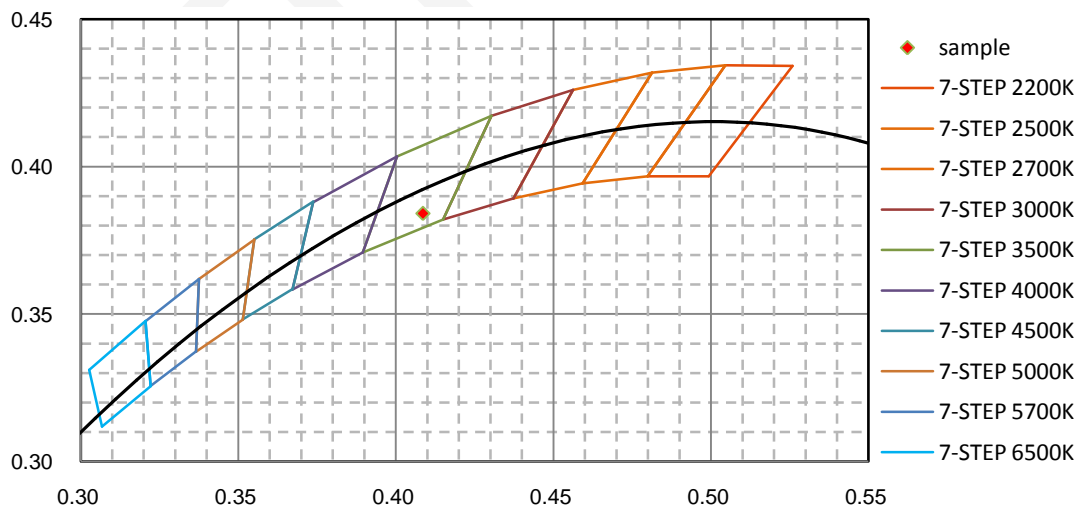
nm	mW	nm	mW	nm	mW	nm	mW	nm	mW
380	9.730E-01	421	1.925E+00	462	4.359E+01	503	4.608E+01	544	6.151E+01
381	9.204E-01	422	2.253E+00	463	4.164E+01	504	4.676E+01	545	6.209E+01
382	7.620E-01	423	2.747E+00	464	4.015E+01	505	4.734E+01	546	6.273E+01
383	6.520E-01	424	3.260E+00	465	3.866E+01	506	4.804E+01	547	6.333E+01
384	6.339E-01	425	3.968E+00	466	3.762E+01	507	4.868E+01	548	6.398E+01
385	6.553E-01	426	4.694E+00	467	3.659E+01	508	4.912E+01	549	6.453E+01
386	5.552E-01	427	5.661E+00	468	3.552E+01	509	4.963E+01	550	6.507E+01
387	5.338E-01	428	6.647E+00	469	3.439E+01	510	5.001E+01	551	6.570E+01
388	4.335E-01	429	7.777E+00	470	3.330E+01	511	5.046E+01	552	6.643E+01
389	4.184E-01	430	9.076E+00	471	3.202E+01	512	5.092E+01	553	6.706E+01
390	4.342E-01	431	1.063E+01	472	3.091E+01	513	5.121E+01	554	6.761E+01
391	4.080E-01	432	1.227E+01	473	2.979E+01	514	5.151E+01	555	6.817E+01
392	3.856E-01	433	1.417E+01	474	2.877E+01	515	5.188E+01	556	6.874E+01
393	3.018E-01	434	1.613E+01	475	2.798E+01	516	5.218E+01	557	6.936E+01
394	3.026E-01	435	1.850E+01	476	2.734E+01	517	5.232E+01	558	6.987E+01
395	3.163E-01	436	2.102E+01	477	2.699E+01	518	5.270E+01	559	7.050E+01
396	3.656E-01	437	2.389E+01	478	2.687E+01	519	5.284E+01	560	7.106E+01
397	3.587E-01	438	2.701E+01	479	2.707E+01	520	5.307E+01	561	7.167E+01
398	3.552E-01	439	3.038E+01	480	2.727E+01	521	5.326E+01	562	7.218E+01
399	3.621E-01	440	3.414E+01	481	2.770E+01	522	5.361E+01	563	7.281E+01
400	3.729E-01	441	3.838E+01	482	2.823E+01	523	5.380E+01	564	7.329E+01
401	3.704E-01	442	4.284E+01	483	2.888E+01	524	5.396E+01	565	7.399E+01
402	3.598E-01	443	4.774E+01	484	2.957E+01	525	5.421E+01	566	7.454E+01
403	3.295E-01	444	5.255E+01	485	3.033E+01	526	5.441E+01	567	7.514E+01
404	3.837E-01	445	5.733E+01	486	3.107E+01	527	5.459E+01	568	7.582E+01
405	3.557E-01	446	6.221E+01	487	3.185E+01	528	5.493E+01	569	7.641E+01
406	4.052E-01	447	6.663E+01	488	3.279E+01	529	5.511E+01	570	7.713E+01
407	4.300E-01	448	7.071E+01	489	3.350E+01	530	5.554E+01	571	7.775E+01
408	4.240E-01	449	7.363E+01	490	3.439E+01	531	5.565E+01	572	7.837E+01
409	4.913E-01	450	7.581E+01	491	3.534E+01	532	5.594E+01	573	7.911E+01
410	5.023E-01	451	7.692E+01	492	3.627E+01	533	5.626E+01	574	7.968E+01
411	5.177E-01	452	7.702E+01	493	3.715E+01	534	5.668E+01	575	8.054E+01
412	5.652E-01	453	7.601E+01	494	3.803E+01	535	5.698E+01	576	8.106E+01
413	5.862E-01	454	7.355E+01	495	3.903E+01	536	5.741E+01	577	8.180E+01
414	6.393E-01	455	7.049E+01	496	4.001E+01	537	5.791E+01	578	8.254E+01
415	7.459E-01	456	6.644E+01	497	4.106E+01	538	5.835E+01	579	8.322E+01
416	8.705E-01	457	6.191E+01	498	4.190E+01	539	5.889E+01	580	8.393E+01
417	9.381E-01	458	5.764E+01	499	4.278E+01	540	5.919E+01	581	8.453E+01
418	1.160E+00	459	5.333E+01	500	4.361E+01	541	5.989E+01	582	8.542E+01
419	1.342E+00	460	4.955E+01	501	4.449E+01	542	6.028E+01	583	8.596E+01
420	1.612E+00	461	4.621E+01	502	4.534E+01	543	6.098E+01	584	8.671E+01

nm	mW	nm	mW	nm	mW	nm	mW	nm	mW
585	8.742E+01	626	8.839E+01	667	4.313E+01	708	1.428E+01	749	4.227E+00
586	8.810E+01	627	8.769E+01	668	4.200E+01	709	1.384E+01	750	4.068E+00
587	8.851E+01	628	8.680E+01	669	4.088E+01	710	1.350E+01	751	4.005E+00
588	8.927E+01	629	8.610E+01	670	3.990E+01	711	1.307E+01	752	3.915E+00
589	8.991E+01	630	8.486E+01	671	3.875E+01	712	1.270E+01	753	3.809E+00
590	9.068E+01	631	8.402E+01	672	3.787E+01	713	1.237E+01	754	3.665E+00
591	9.119E+01	632	8.298E+01	673	3.683E+01	714	1.204E+01	755	3.567E+00
592	9.185E+01	633	8.203E+01	674	3.597E+01	715	1.170E+01	756	3.449E+00
593	9.216E+01	634	8.089E+01	675	3.507E+01	716	1.136E+01	757	3.360E+00
594	9.291E+01	635	8.000E+01	676	3.421E+01	717	1.106E+01	758	3.266E+00
595	9.341E+01	636	7.878E+01	677	3.345E+01	718	1.074E+01	759	3.165E+00
596	9.386E+01	637	7.791E+01	678	3.252E+01	719	1.043E+01	760	3.115E+00
597	9.425E+01	638	7.655E+01	679	3.170E+01	720	1.016E+01	761	3.035E+00
598	9.477E+01	639	7.560E+01	680	3.103E+01	721	9.858E+00	762	2.971E+00
599	9.510E+01	640	7.467E+01	681	3.018E+01	722	9.582E+00	763	2.830E+00
600	9.539E+01	641	7.343E+01	682	2.943E+01	723	9.286E+00	764	2.773E+00
601	9.577E+01	642	7.223E+01	683	2.866E+01	724	9.009E+00	765	2.700E+00
602	9.601E+01	643	7.094E+01	684	2.789E+01	725	8.736E+00	766	2.652E+00
603	9.613E+01	644	6.976E+01	685	2.729E+01	726	8.483E+00	767	2.538E+00
604	9.612E+01	645	6.870E+01	686	2.650E+01	727	8.227E+00	768	2.464E+00
605	9.645E+01	646	6.740E+01	687	2.578E+01	728	8.055E+00	769	2.414E+00
606	9.653E+01	647	6.638E+01	688	2.519E+01	729	7.801E+00	770	2.338E+00
607	9.649E+01	648	6.517E+01	689	2.453E+01	730	7.536E+00	771	2.261E+00
608	9.642E+01	649	6.392E+01	690	2.386E+01	731	7.281E+00	772	2.218E+00
609	9.640E+01	650	6.282E+01	691	2.315E+01	732	7.055E+00	773	2.145E+00
610	9.631E+01	651	6.143E+01	692	2.250E+01	733	6.856E+00	774	2.059E+00
611	9.624E+01	652	6.051E+01	693	2.201E+01	734	6.638E+00	775	2.044E+00
612	9.590E+01	653	5.910E+01	694	2.131E+01	735	6.429E+00	776	1.959E+00
613	9.581E+01	654	5.803E+01	695	2.081E+01	736	6.244E+00	777	1.932E+00
614	9.551E+01	655	5.687E+01	696	2.022E+01	737	6.071E+00	778	1.888E+00
615	9.509E+01	656	5.571E+01	697	1.963E+01	738	5.880E+00	779	1.871E+00
616	9.458E+01	657	5.446E+01	698	1.909E+01	739	5.675E+00	780	1.874E+00
617	9.422E+01	658	5.328E+01	699	1.855E+01	740	5.474E+00		
618	9.382E+01	659	5.212E+01	700	1.805E+01	741	5.330E+00		
619	9.322E+01	660	5.100E+01	701	1.751E+01	742	5.194E+00		
620	9.279E+01	661	4.985E+01	702	1.704E+01	743	5.061E+00		
621	9.196E+01	662	4.869E+01	703	1.652E+01	744	4.971E+00		
622	9.156E+01	663	4.768E+01	704	1.613E+01	745	4.718E+00		
623	9.061E+01	664	4.638E+01	705	1.566E+01	746	4.625E+00		
624	8.997E+01	665	4.536E+01	706	1.511E+01	747	4.535E+00		
625	8.935E+01	666	4.430E+01	707	1.472E+01	748	4.341E+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**

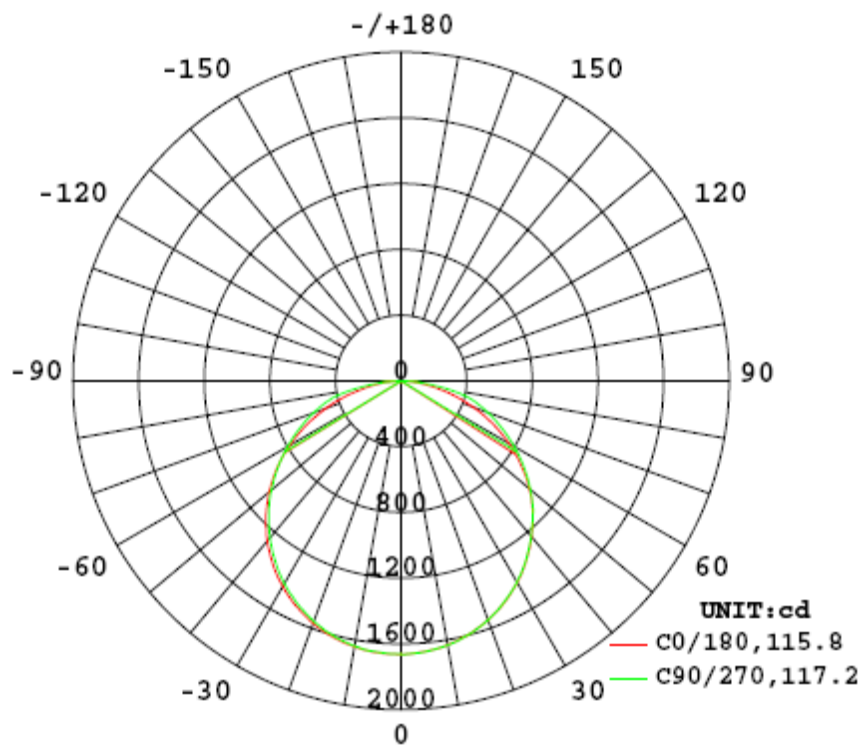
Electrical Measurement

Input Voltage (V)	Frequency (Hz)	Input Current (A)	Power (W)	Power Factor
120.0	60	0.3408	40.30	0.9855

Photometric Measurement

Luminous Flux (lm)	Efficacy (lm/W)	I _{max} (cd)	S/MH (C0/180)	S/MH (C90/270)
5124.38	127.16	1698	1.27	1.27

Luminous Intensity Distribution



	C0/180	C45/225	C90/270	C135/315	AVG.
Beam Angle (50% I _{max}):	115.8	116.3	117.2	116.3	116.4
Field Angle (10% I _{max}):	161.9	166.9	166.4	166.9	165.5

Luminous Intensity (cd) Distribution Data

C y	0°	22.5°	45°	67.5°	90°	112.5°	135°	157.5°
0.0°	1695	1695	1695	1695	1695	1695	1695	1695
5.0°	1692	1693	1692	1692	1688	1687	1688	1686
10.0°	1674	1677	1674	1672	1671	1665	1666	1662
15.0°	1645	1646	1643	1640	1635	1631	1631	1625
20.0°	1600	1603	1596	1593	1587	1585	1583	1578
25.0°	1544	1546	1542	1534	1526	1522	1519	1515
30.0°	1473	1476	1469	1460	1453	1447	1445	1442
35.0°	1392	1393	1386	1376	1367	1361	1358	1355
40.0°	1296	1299	1291	1281	1270	1265	1261	1256
45.0°	1191	1192	1185	1176	1166	1159	1154	1148
50.0°	1071	1074	1069	1064	1054	1045	1037	1030
55.0°	943	947	944	943	937	926	913	902
60.0°	802	809	815	821	818	805	784	766
65.0°	654	664	681	698	698	682	653	624
70.0°	502	517	547	575	581	571	522	481
75.0°	347	370	418	459	467	445	395	338
80.0°	202	230	294	307	296	291	274	206
85.0°	79	112	125	115	104	101	103	95
90.0°	6	25	14	1	0	0	1	1
95.0°	0	0	0	0	0	0	0	0
100.0°	1	0	0	0	1	0	0	0
105.0°	1	1	1	1	1	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°	1	1	1	1	1	1	1	1
155.0°	1	1	1	2	2	2	1	1
160.0°	1	1	1	2	2	2	1	1
165.0°	1	1	1	1	1	1	1	1
170.0°	1	1	1	1	1	1	1	1
175.0°	1	1	1	1	1	1	1	1
180.0°	1	1	1	1	1	1	1	1

Luminous Intensity (cd) Distribution Data (cont.)

C y	180°	202.5°	225°	247.5°	270°	292.5°	315°	337.5°
0.0°	1695	1695	1695	1695	1695	1695	1695	1695
5.0°	1686	1688	1684	1686	1687	1688	1690	1692
10.0°	1663	1664	1662	1662	1664	1667	1672	1673
15.0°	1628	1628	1625	1626	1629	1632	1639	1643
20.0°	1578	1576	1574	1575	1578	1584	1593	1599
25.0°	1517	1514	1510	1514	1515	1523	1533	1541
30.0°	1444	1440	1435	1436	1440	1449	1460	1472
35.0°	1357	1353	1351	1351	1355	1365	1378	1390
40.0°	1261	1256	1252	1254	1259	1270	1283	1296
45.0°	1157	1154	1152	1157	1159	1169	1181	1193
50.0°	1041	1037	1036	1041	1048	1057	1070	1081
55.0°	912	909	914	923	931	938	945	953
60.0°	774	774	785	800	810	816	816	817
65.0°	628	632	652	677	691	691	681	672
70.0°	478	488	520	555	573	569	546	524
75.0°	328	345	393	440	458	451	416	376
80.0°	189	213	274	286	289	301	295	238
85.0°	73	101	106	100	101	113	129	119
90.0°	0	0	0	0	0	0	0	15
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°	1	0	0	0	0	0	0	0
115.0°	1	1	1	1	0	0	0	0
120.0°	1	1	1	1	1	1	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°	1	1	1	1	1	1	1	1
180.0°	1	1	1	1	1	1	1	1

Zonal Lumen Density Measurement

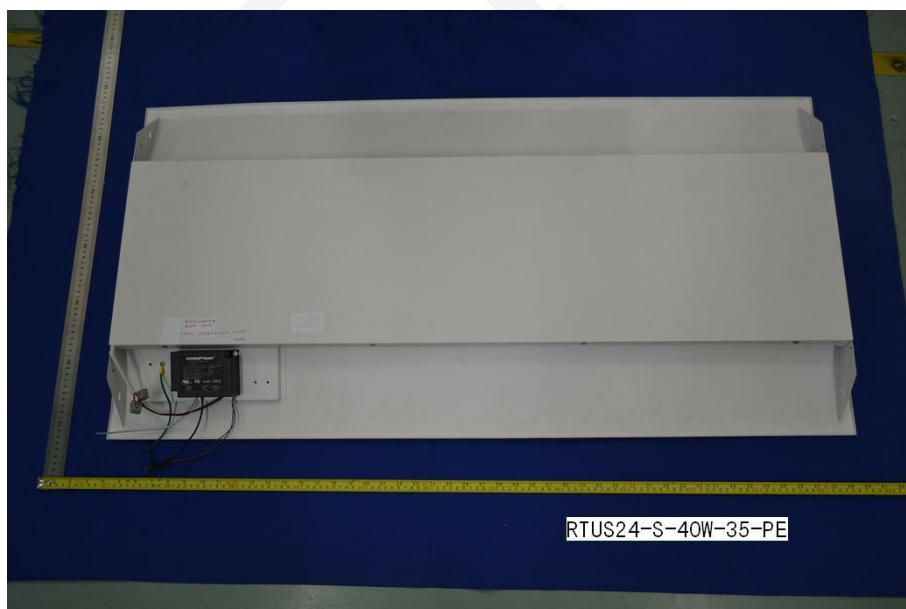
Deg	Flux (lm)	%
0-5	40.5	0.79
5-10	120.1	2.34
10-15	195.9	3.83
15-20	265.4	5.18
20-25	326.4	6.37
25-30	376.9	7.35
30-35	415.3	8.10
35-40	440.4	8.60
40-45	451.6	8.81
45-50	449.1	8.76
50-55	431.2	8.42
55-60	400.0	7.80
60-65	356.7	6.97
65-70	303.8	5.92
70-75	244.7	4.78
75-80	179.1	3.49
80-85	99.4	1.94
85-90	23.5	0.46
90-95	0.5	0.01
95-100	0.2	0.00
100-105	0.2	0.01
105-110	0.2	0.00
110-115	0.3	0.01
115-120	0.3	0.00
120-125	0.3	0.01
125-130	0.3	0.00
130-135	0.3	0.01
135-140	0.3	0.01
140-145	0.3	0.00
145-150	0.3	0.01
150-155	0.3	0.01
155-160	0.3	0.00
160-165	0.2	0.00
165-170	0.1	0.01
170-175	0.1	0.00
175-180	0.0	0.00

Deg	Flux (lm)	%
0-5	40.5	0.79
0-10	160.6	3.13
0-15	356.5	6.96
0-20	621.9	12.14
0-25	948.3	18.51
0-30	1325.2	25.86
0-35	1740.5	33.96
0-40	2180.8	42.56
0-45	2632.4	51.37
0-50	3081.5	60.13
0-55	3512.7	68.55
0-60	3912.7	76.35
0-65	4269.4	83.32
0-70	4573.2	89.24
0-75	4817.9	94.02
0-80	4997.0	97.51
0-85	5096.3	99.45
0-90	5119.8	99.91
0-95	5120.3	99.92
0-100	5120.5	99.92
0-105	5120.7	99.93
0-110	5121.0	99.93
0-115	5121.2	99.94
0-120	5121.5	99.94
0-125	5121.8	99.95
0-130	5122.1	99.95
0-135	5122.4	99.96
0-140	5122.7	99.97
0-145	5123.0	99.97
0-150	5123.4	99.98
0-155	5123.6	99.99
0-160	5123.9	99.99
0-165	5124.1	99.99
0-170	5124.3	100.00
0-175	5124.4	100.00
0-180	5124.4	100.00

[Additional Test]

Test Item	Test Voltage (V)	Frequency (Hz)	Test Result
Power Factor:	277.0	60	0.9306
Total Harmonic Distortion:	277.0	60	18.27%
Total Harmonic Distortion:	120.0	60	13.36%

6. Product Photo



7. Product Test orientation in the Goniophotometer



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