

IES LM-79-08

MEASUREMENT AND TEST REPORT

For

L-TECH CORPORATION

Shaogangtou District, Qiaotou Town Dongguan City, Guangdong, China

Test Model: LRKT488 4000K

Report Type:	Electrical and Photometric tests including: Luminous Flux, Chromaticity, Luminous Intensity Distribution.
Test Engineer:	Daniel Duan <i>Daniel Duan</i>
Report Number:	RSZ160526517-10
Test Date:	2016-06-17
Report Date:	2016-06-22
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.

STATEMENT: This test may not be duplicated or used in part without prior written consent from Bay Area Compliance Laboratories Corp. (Shenzhen). The test data was only valid for the test sample(s). This report **must not** be used by the customer to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the U.S. Federal Government. This report is valid only with a valid digital signature. The digital signature may be available only under the Adobe software above version 7.0.

1. Product Description

General Information:

One sample was received on 2016-05-26 and used for testing.

Model Tested: LRKT488 4000K
 Manufacturer: L-TECH CORPORATION
 Brand Name: L-TECH CORP
 Product Designation: LED Downlight
 Burning Time Before Test: 0hour(For New Products)

Rated Values:

Rated Voltage/Frequency: AC 120V, 60Hz
 Rated Power: 9 W
 Nominal CCT: 4000K
 Nominal Lumen Output: 600 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
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.

Fidelity Index and Gamut Index Calculation

The R_f , 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**

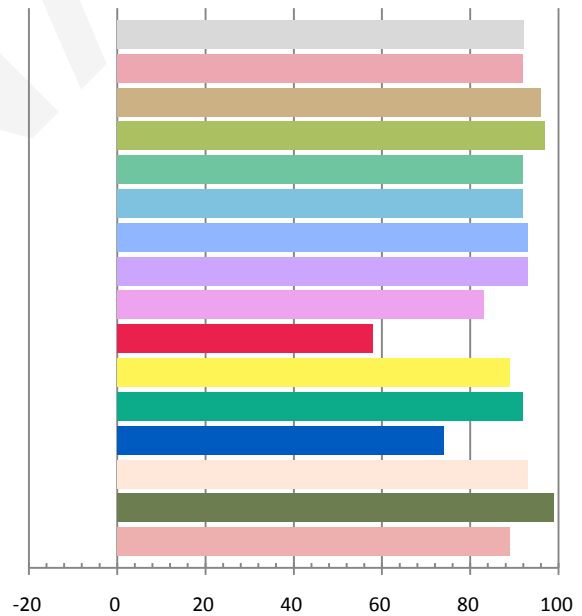
Photometric and Electrical Measurement Result

Voltage (V)	Frequency (Hz)	Current (A)	Power (W)	Power Factor	Luminous Flux(lm)	Efficacy (lm/W)
120.1	60	0.07303	8.623	0.9833	690.53	80.08

Radiant Flux (W)	CCT (K)	Duv	x	y	u'	v'
2.320	4075	-0.000399	0.3768	0.3737	0.2240	0.4997

Color Rendering Index

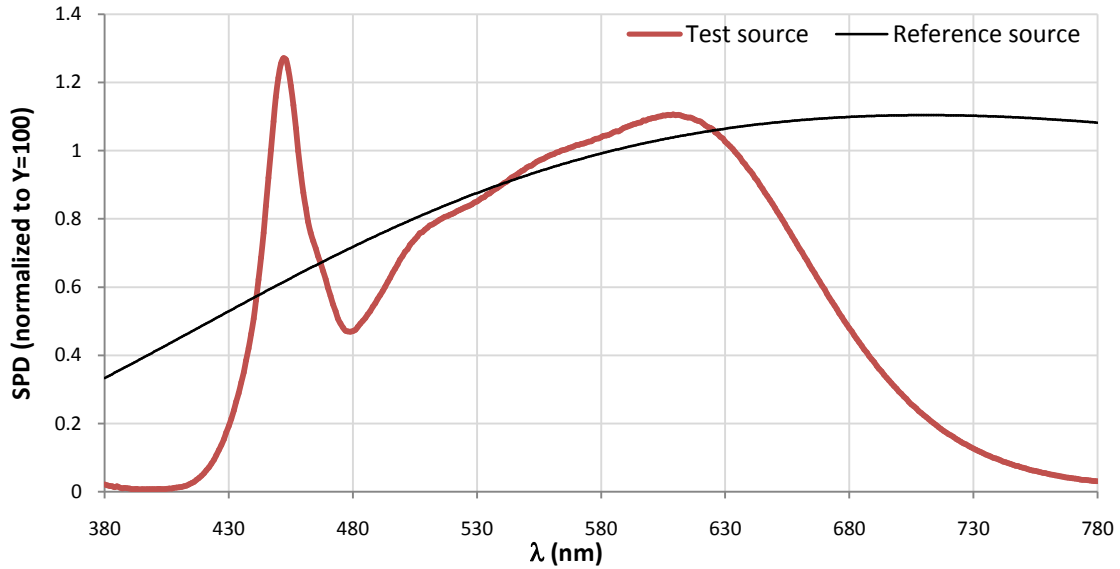
Ra			
92.2			
R1	R2	R3	R4
92	96	97	92
R5	R6	R7	R8
92	93	93	83
R9	R10	R11	R12
58	89	92	74
R13	R14	R15	
93	99	89	



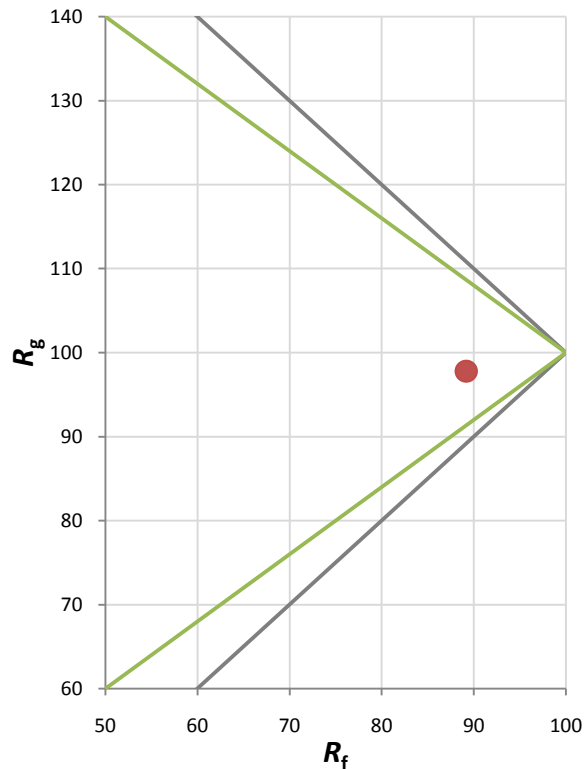
Fidelity Index and Gamut Index

Fidelity Index R_f	89
Gamut Index R_g	98

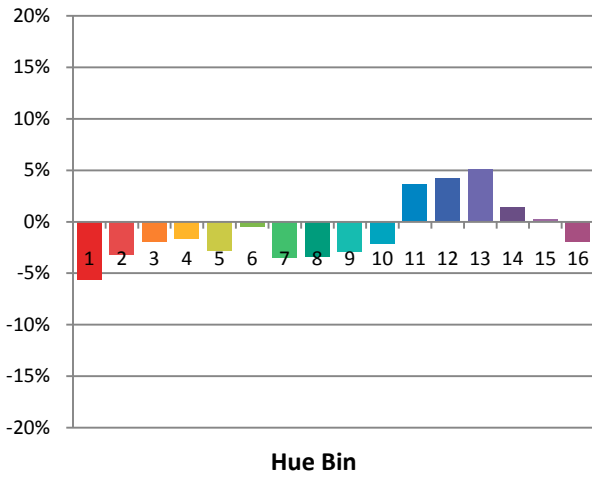
Spectral Power Distribution Comparison



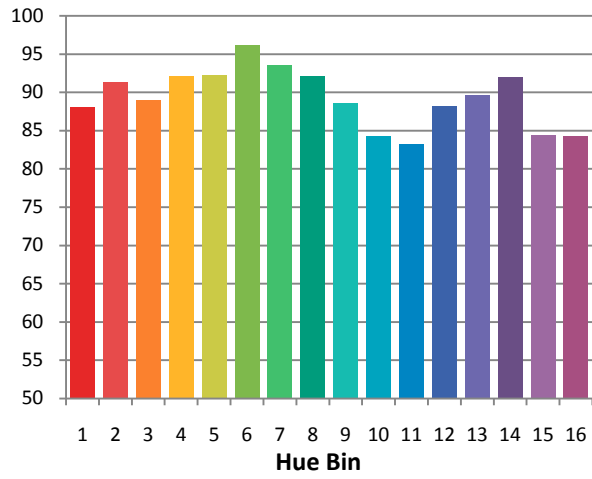
Plot of R_g versus R_f



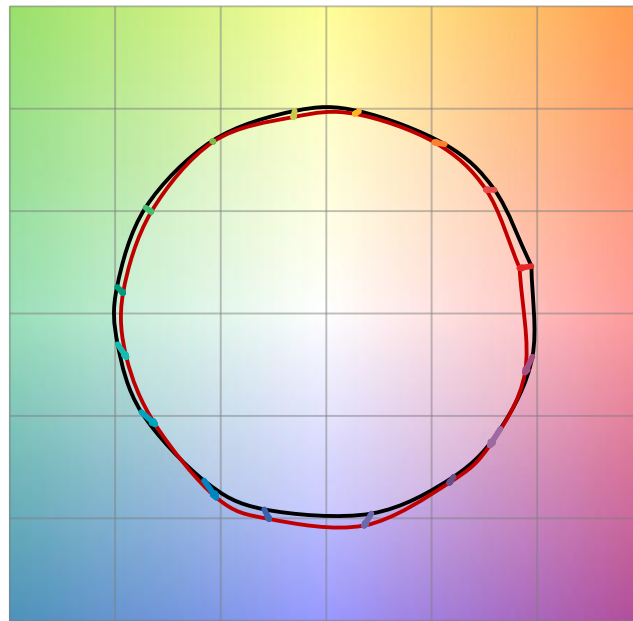
Chroma Shift by Hue



R_f by Hue

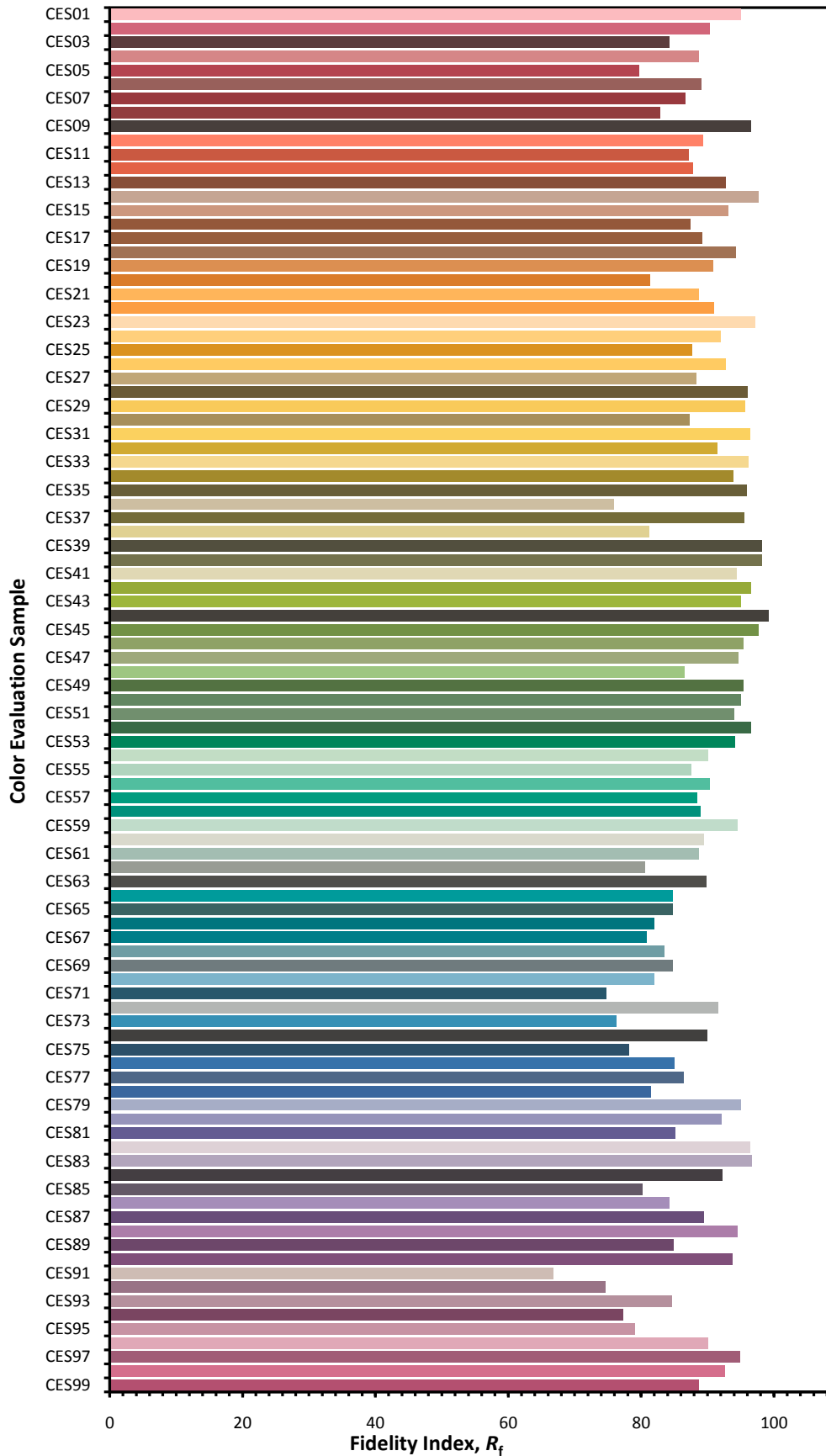


Color Vector Graphic

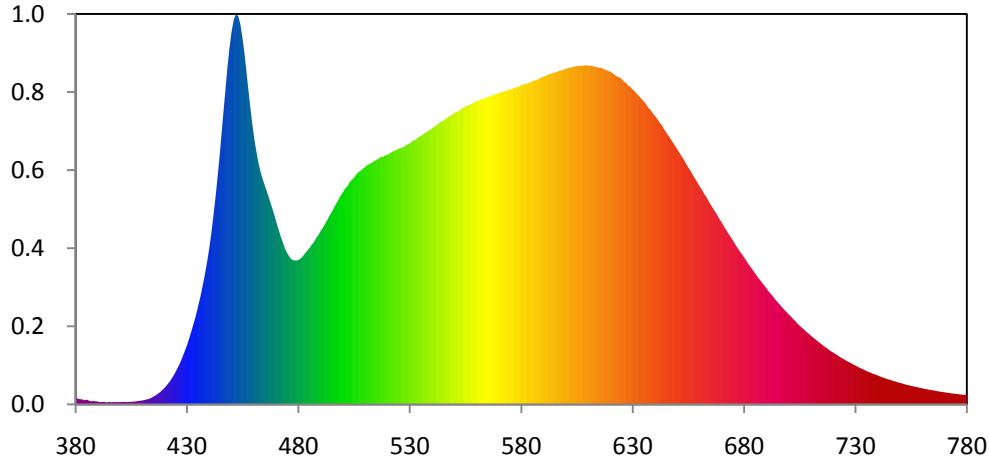


— Reference Illuminat — Test Source

Color Fidelity by CES Sample



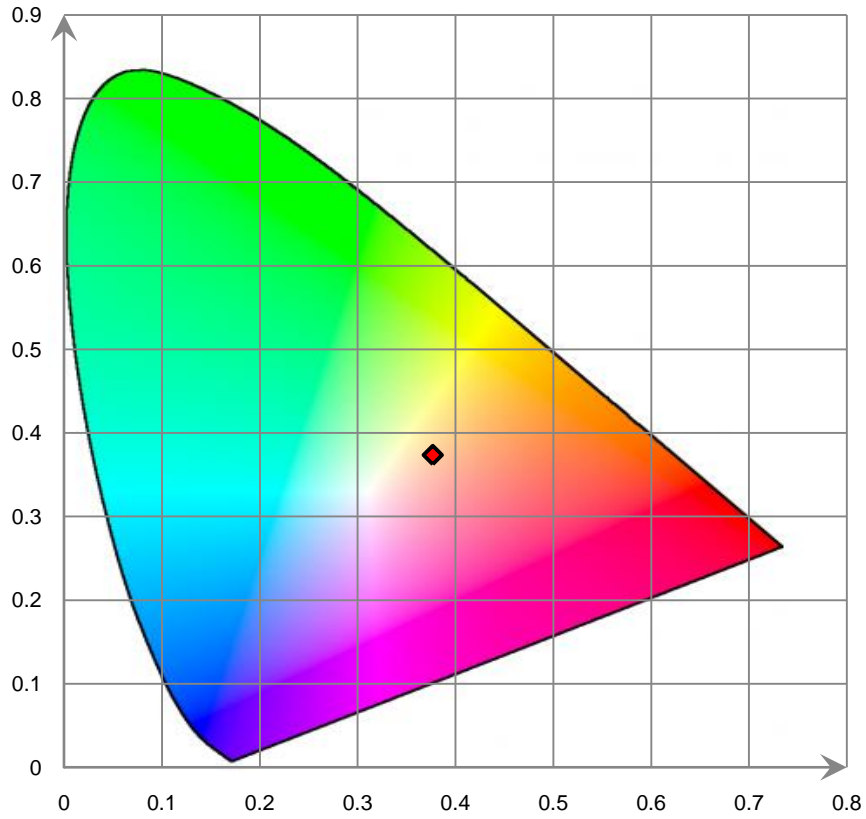
Relative Spectral Power Distribution



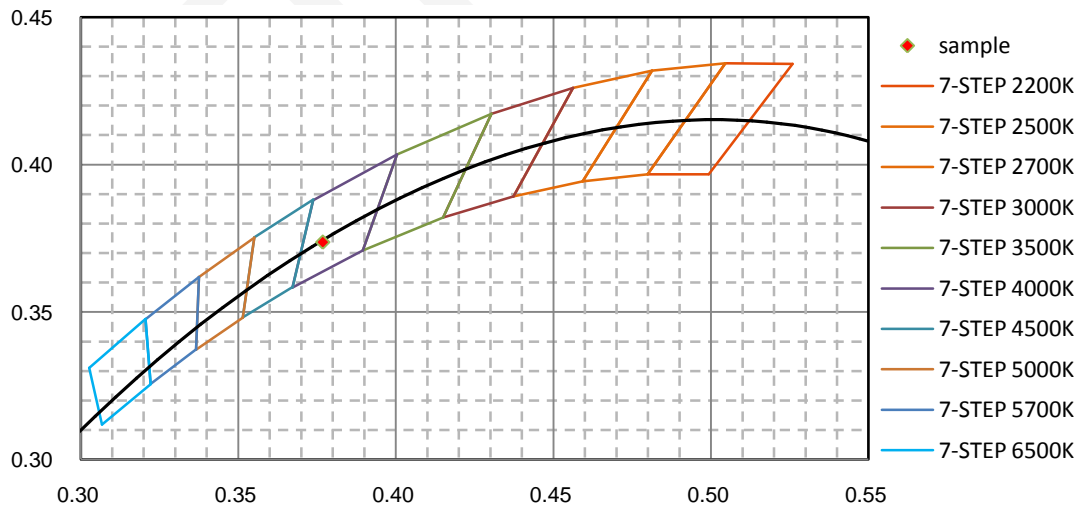
nm	mW	nm	mW	nm	mW	nm	mW	nm	mW
380	2.137E-01	421	6.356E-01	462	7.998E+00	503	7.317E+00	544	9.317E+00
381	1.916E-01	422	7.248E-01	463	7.673E+00	504	7.399E+00	545	9.351E+00
382	1.715E-01	423	8.313E-01	464	7.426E+00	505	7.479E+00	546	9.404E+00
383	1.645E-01	424	9.499E-01	465	7.207E+00	506	7.573E+00	547	9.452E+00
384	1.349E-01	425	1.083E+00	466	6.985E+00	507	7.661E+00	548	9.508E+00
385	1.570E-01	426	1.228E+00	467	6.770E+00	508	7.695E+00	549	9.544E+00
386	1.239E-01	427	1.382E+00	468	6.537E+00	509	7.772E+00	550	9.606E+00
387	1.000E-01	428	1.559E+00	469	6.295E+00	510	7.824E+00	551	9.642E+00
388	1.120E-01	429	1.751E+00	470	6.043E+00	511	7.892E+00	552	9.667E+00
389	1.009E-01	430	1.942E+00	471	5.804E+00	512	7.923E+00	553	9.721E+00
390	9.442E-02	431	2.165E+00	472	5.552E+00	513	7.963E+00	554	9.774E+00
391	7.347E-02	432	2.411E+00	473	5.350E+00	514	8.015E+00	555	9.817E+00
392	7.894E-02	433	2.664E+00	474	5.132E+00	515	8.059E+00	556	9.847E+00
393	8.358E-02	434	2.920E+00	475	4.989E+00	516	8.100E+00	557	9.876E+00
394	6.295E-02	435	3.232E+00	476	4.861E+00	517	8.148E+00	558	9.917E+00
395	7.798E-02	436	3.535E+00	477	4.775E+00	518	8.162E+00	559	9.959E+00
396	7.073E-02	437	3.886E+00	478	4.748E+00	519	8.202E+00	560	9.987E+00
397	7.563E-02	438	4.252E+00	479	4.740E+00	520	8.228E+00	561	1.001E+01
398	7.549E-02	439	4.671E+00	480	4.760E+00	521	8.272E+00	562	1.005E+01
399	7.196E-02	440	5.135E+00	481	4.803E+00	522	8.321E+00	563	1.007E+01
400	7.296E-02	441	5.666E+00	482	4.881E+00	523	8.350E+00	564	1.011E+01
401	7.967E-02	442	6.292E+00	483	4.977E+00	524	8.386E+00	565	1.013E+01
402	8.093E-02	443	6.938E+00	484	5.064E+00	525	8.422E+00	566	1.015E+01
403	7.746E-02	444	7.674E+00	485	5.154E+00	526	8.448E+00	567	1.019E+01
404	7.877E-02	445	8.459E+00	486	5.258E+00	527	8.480E+00	568	1.021E+01
405	8.465E-02	446	9.301E+00	487	5.351E+00	528	8.520E+00	569	1.023E+01
406	9.010E-02	447	1.013E+01	488	5.480E+00	529	8.572E+00	570	1.027E+01
407	9.826E-02	448	1.097E+01	489	5.584E+00	530	8.600E+00	571	1.028E+01
408	1.091E-01	449	1.169E+01	490	5.710E+00	531	8.662E+00	572	1.031E+01
409	1.192E-01	450	1.226E+01	491	5.820E+00	532	8.706E+00	573	1.032E+01
410	1.293E-01	451	1.268E+01	492	5.946E+00	533	8.738E+00	574	1.035E+01
411	1.454E-01	452	1.285E+01	493	6.077E+00	534	8.810E+00	575	1.038E+01
412	1.647E-01	453	1.280E+01	494	6.221E+00	535	8.844E+00	576	1.039E+01
413	1.817E-01	454	1.252E+01	495	6.339E+00	536	8.898E+00	577	1.043E+01
414	2.170E-01	455	1.204E+01	496	6.488E+00	537	8.954E+00	578	1.046E+01
415	2.597E-01	456	1.146E+01	497	6.612E+00	538	8.994E+00	579	1.047E+01
416	2.973E-01	457	1.077E+01	498	6.742E+00	539	9.046E+00	580	1.051E+01
417	3.530E-01	458	1.009E+01	499	6.879E+00	540	9.096E+00	581	1.055E+01
418	4.053E-01	459	9.448E+00	500	6.984E+00	541	9.150E+00	582	1.056E+01
419	4.775E-01	460	8.871E+00	501	7.110E+00	542	9.194E+00	583	1.058E+01
420	5.458E-01	461	8.407E+00	502	7.185E+00	543	9.257E+00	584	1.061E+01

nm	mW	nm	mW	nm	mW	nm	mW	nm	mW
585	1.065E+01	626	1.065E+01	667	6.359E+00	708	2.392E+00	749	7.256E-01
586	1.068E+01	627	1.060E+01	668	6.241E+00	709	2.334E+00	750	7.102E-01
587	1.068E+01	628	1.052E+01	669	6.107E+00	710	2.268E+00	751	6.886E-01
588	1.073E+01	629	1.047E+01	670	6.001E+00	711	2.205E+00	752	6.665E-01
589	1.077E+01	630	1.038E+01	671	5.871E+00	712	2.148E+00	753	6.479E-01
590	1.080E+01	631	1.031E+01	672	5.749E+00	713	2.087E+00	754	6.290E-01
591	1.083E+01	632	1.023E+01	673	5.636E+00	714	2.029E+00	755	6.116E-01
592	1.086E+01	633	1.016E+01	674	5.522E+00	715	1.973E+00	756	5.943E-01
593	1.089E+01	634	1.007E+01	675	5.412E+00	716	1.915E+00	757	5.785E-01
594	1.091E+01	635	9.991E+00	676	5.287E+00	717	1.861E+00	758	5.632E-01
595	1.094E+01	636	9.901E+00	677	5.175E+00	718	1.805E+00	759	5.451E-01
596	1.095E+01	637	9.783E+00	678	5.059E+00	719	1.752E+00	760	5.303E-01
597	1.100E+01	638	9.709E+00	679	4.962E+00	720	1.711E+00	761	5.134E-01
598	1.100E+01	639	9.600E+00	680	4.849E+00	721	1.665E+00	762	5.018E-01
599	1.104E+01	640	9.513E+00	681	4.749E+00	722	1.620E+00	763	4.850E-01
600	1.106E+01	641	9.418E+00	682	4.625E+00	723	1.569E+00	764	4.722E-01
601	1.108E+01	642	9.305E+00	683	4.532E+00	724	1.522E+00	765	4.589E-01
602	1.109E+01	643	9.216E+00	684	4.425E+00	725	1.482E+00	766	4.474E-01
603	1.112E+01	644	9.087E+00	685	4.322E+00	726	1.436E+00	767	4.309E-01
604	1.113E+01	645	8.980E+00	686	4.214E+00	727	1.399E+00	768	4.197E-01
605	1.115E+01	646	8.864E+00	687	4.122E+00	728	1.356E+00	769	4.116E-01
606	1.115E+01	647	8.761E+00	688	4.019E+00	729	1.318E+00	770	3.971E-01
607	1.117E+01	648	8.646E+00	689	3.930E+00	730	1.281E+00	771	3.867E-01
608	1.116E+01	649	8.534E+00	690	3.837E+00	731	1.243E+00	772	3.768E-01
609	1.118E+01	650	8.412E+00	691	3.731E+00	732	1.205E+00	773	3.639E-01
610	1.116E+01	651	8.297E+00	692	3.645E+00	733	1.173E+00	774	3.545E-01
611	1.117E+01	652	8.183E+00	693	3.563E+00	734	1.139E+00	775	3.476E-01
612	1.115E+01	653	8.064E+00	694	3.462E+00	735	1.096E+00	776	3.392E-01
613	1.113E+01	654	7.939E+00	695	3.378E+00	736	1.073E+00	777	3.276E-01
614	1.111E+01	655	7.815E+00	696	3.299E+00	737	1.041E+00	778	3.176E-01
615	1.109E+01	656	7.701E+00	697	3.211E+00	738	1.005E+00	779	3.165E-01
616	1.109E+01	657	7.573E+00	698	3.127E+00	739	9.840E-01	780	3.171E-01
617	1.106E+01	658	7.447E+00	699	3.054E+00	740	9.534E-01		
618	1.102E+01	659	7.328E+00	700	2.971E+00	741	9.258E-01		
619	1.099E+01	660	7.197E+00	701	2.903E+00	742	8.932E-01		
620	1.097E+01	661	7.090E+00	702	2.820E+00	743	8.701E-01		
621	1.092E+01	662	6.955E+00	703	2.750E+00	744	8.418E-01		
622	1.086E+01	663	6.855E+00	704	2.667E+00	745	8.204E-01		
623	1.081E+01	664	6.718E+00	705	2.592E+00	746	7.988E-01		
624	1.078E+01	665	6.594E+00	706	2.528E+00	747	7.722E-01		
625	1.074E+01	666	6.474E+00	707	2.465E+00	748	7.558E-01		

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**

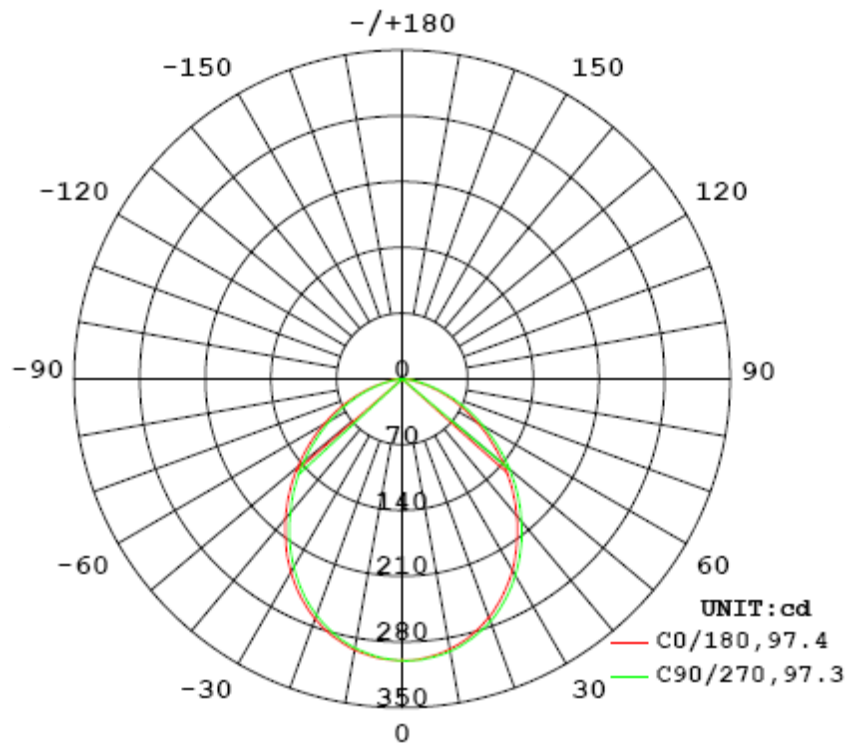
Electrical Measurement

Input Voltage (V)	Frequency (Hz)	Input Current (A)	Power (W)	Power Factor
120.09	60	0.07286	8.633	0.9867

Photometric Measurement

Luminous Flux (lm)	Efficacy (lm/W)	I _{max} (cd)	S/MH (C0/180)	S/MH (C90/270)
703.348	81.47	300.1	1.17	1.20

Luminous Intensity Distribution



	C0/180	C45/225	C90/270	C135/315	AVG.
Beam Angle (50% I _{max}):	97.4	97.4	97.3	97.3	97.4
Field Angle (10% I _{max}):	149.8	149.7	149.7	149.7	149.7

Luminous Intensity (cd) Distribution Data

C \ γ	0°	22.5°	45°	67.5°	90°	112.5°	135°	157.5°
0.0°	300	300	300	300	300	300	300	300
5.0°	298	298	297	297	297	297	297	297
10.0°	293	292	291	291	291	291	291	291
15.0°	284	283	282	281	281	281	281	281
20.0°	272	271	270	268	268	267	267	268
25.0°	256	255	254	252	251	251	251	251
30.0°	238	236	234	233	231	231	231	232
35.0°	217	215	213	211	209	209	209	210
40.0°	194	192	190	188	186	185	186	187
45.0°	170	168	166	164	162	161	162	162
50.0°	145	144	141	139	137	137	137	138
55.0°	121	119	117	115	113	112	112	113
60.0°	97	95	93	91	89	89	89	89
65.0°	74	72	70	68	67	66	66	67
70.0°	51	50	48	46	45	45	44	45
75.0°	31	30	28	27	26	25	25	26
80.0°	14	13	12	12	11	11	11	11
85.0°	3	3	3	3	2	2	2	2
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°	0	0	0	0	0	0	0	0
125.0°	0	0	0	0	0	0	0	0
130.0°	0	0	0	0	0	0	0	0
135.0°	0	0	0	0	0	0	0	0
140.0°	0	0	0	0	0	0	0	0
145.0°	0	0	0	0	0	0	0	0
150.0°	0	0	0	0	0	0	0	0
155.0°	0	0	0	0	0	0	0	0
160.0°	0	0	0	0	0	0	0	0
165.0°	0	0	0	0	0	0	0	0
170.0°	0	0	0	0	0	0	0	0
175.0°	0	0	0	0	0	0	0	0
180.0°	0	0	0	0	0	0	0	0

Luminous Intensity (cd) Distribution Data (cont.)

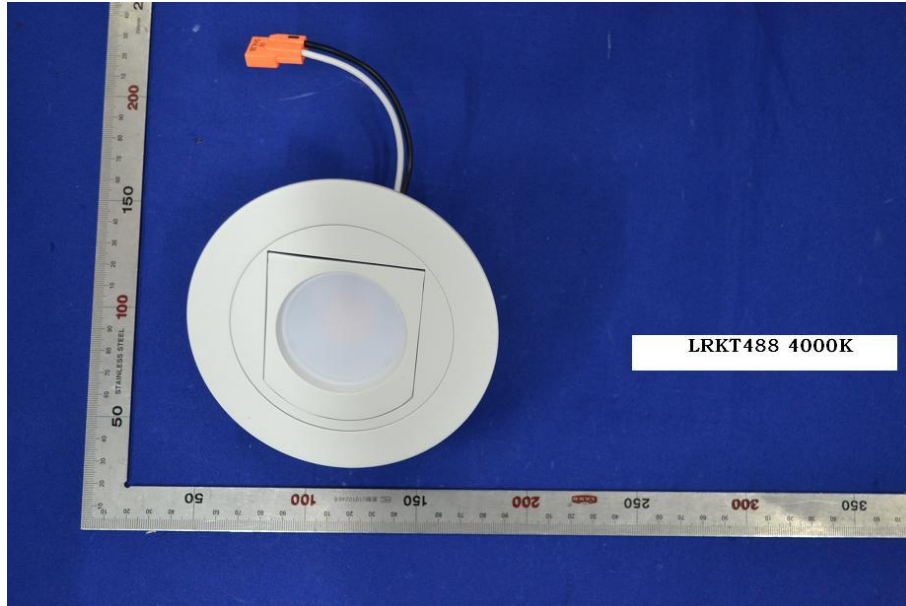
C Y	180°	202.5°	225°	247.5°	270°	292.5°	315°	337.5°
0.0°	300	300	300	300	300	300	300	300
5.0°	298	298	299	298	299	299	299	299
10.0°	292	293	293	294	294	295	294	294
15.0°	283	284	285	286	286	286	286	286
20.0°	270	271	273	274	275	275	274	274
25.0°	254	256	257	259	260	260	260	259
30.0°	235	237	239	240	241	242	241	241
35.0°	213	215	218	219	221	221	221	220
40.0°	190	192	195	197	198	198	198	197
45.0°	166	168	171	173	174	175	174	173
50.0°	141	143	146	148	150	150	150	149
55.0°	116	118	120	122	124	124	124	123
60.0°	92	94	96	98	100	100	100	99
65.0°	70	71	73	75	76	77	77	76
70.0°	48	49	51	53	54	54	55	54
75.0°	28	30	31	32	33	34	34	34
80.0°	13	14	14	15	16	16	16	16
85.0°	3	3	3	3	3	3	4	4
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°	0	0	0	0	0	0	0	0
125.0°	0	0	0	0	0	0	0	0
130.0°	0	0	0	0	0	0	0	0
135.0°	0	0	0	0	0	0	0	0
140.0°	0	0	0	0	0	0	0	0
145.0°	0	0	0	0	0	0	0	0
150.0°	0	0	0	0	0	0	0	0
155.0°	0	0	0	0	0	0	0	0
160.0°	0	0	0	0	0	0	0	0
165.0°	0	0	0	0	0	0	0	0
170.0°	0	0	0	0	0	0	0	0
175.0°	0	0	0	0	0	0	0	0
180.0°	0	0	0	0	0	0	0	0

Zonal Lumen Density Measurement

Deg	Flux (lm)	%
0-5	7.1	1.02
5-10	21.1	3.00
10-15	34.2	4.86
15-20	45.7	6.49
20-25	55.2	7.85
25-30	62.2	8.85
30-35	66.5	9.45
35-40	67.9	9.65
40-45	66.6	9.47
45-50	62.9	8.94
50-55	56.9	8.09
55-60	49.1	6.99
60-65	40.3	5.72
65-70	30.6	4.35
70-75	20.6	2.92
75-80	11.3	1.60
80-85	4.2	0.59
85-90	0.4	0.06
90-95	0.0	0.00
95-100	0.0	0.00
100-105	0.0	0.00
105-110	0.0	0.01
110-115	0.0	0.00
115-120	0.0	0.01
120-125	0.0	0.00
125-130	0.0	0.01
130-135	0.1	0.01
135-140	0.1	0.00
140-145	0.1	0.01
145-150	0.1	0.01
150-155	0.1	0.01
155-160	0.1	0.01
160-165	0.1	0.01
165-170	0.0	0.01
170-175	0.0	0.00
175-180	0.0	0.00

Deg	Flux (lm)	%
0-5	7.1	1.02
0-10	28.3	4.02
0-15	62.4	8.88
0-20	108.1	15.37
0-25	163.3	23.22
0-30	225.6	32.07
0-35	292.0	41.52
0-40	359.9	51.17
0-45	426.5	60.64
0-50	489.4	69.58
0-55	546.3	77.67
0-60	595.4	84.66
0-65	635.7	90.38
0-70	666.2	94.73
0-75	686.8	97.65
0-80	698.1	99.25
0-85	702.2	99.84
0-90	702.6	99.90
0-95	702.6	99.90
0-100	702.6	99.90
0-105	702.7	99.90
0-110	702.7	99.91
0-115	702.7	99.91
0-120	702.8	99.92
0-125	702.8	99.92
0-130	702.8	99.93
0-135	702.9	99.94
0-140	703.0	99.94
0-145	703.0	99.95
0-150	703.1	99.96
0-155	703.2	99.97
0-160	703.2	99.98
0-165	703.3	99.99
0-170	703.3	100.00
0-175	703.3	100.00
0-180	703.3	100.00

Product Photo



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