



# TEST REPORT

According to ANSI/IES LM-80-15  
For

## Hongli Zhihui Group Co.,Ltd. Guangzhou Branch

Room 316, Building 2, No.1, Xianke Yi Road, Huadong Town, Huadu District, Guangzhou, China

**#Model: HL-A-4014HW-S1-PCT-HR3**

<b>Report Type:</b> 9000 Hours Test Report	<b>Product Type:</b> LED Package
<b>Test Engineer:</b>	Pote Wang <i>Pote Wang</i>
<b>Report Number:</b>	RSZ181020503-10-9000
<b>Test Date:</b>	2018-10-20 to 2019-11-18
<b>Report Date:</b>	2019-11-20
<b>Reviewed By:</b>	Blake Zhang / EE Engineer <i>Blake Zhang</i>
<b>Test Facility:</b>	Test facility was located at No.69, Pulongcun, Puxinhu Industrial Area, Tangxia, Dongguan, Guangdong, China.
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<b>Accreditation:</b>	The IAS Accreditation Number TL-460.

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## 1 - General Information

### 1.1 Description of LED Light Sources

#### Sample Size:

50 PCS samples were received on 2018-10-20. The samples were numbered from 1 to 25 and 26 to 50.

#Manufacturer:	Hongli Zhihui Group Co.,Ltd. Guangzhou Branch
#Part Number:	HL-A-4014HW-S1-PCT-HR3
#Part Type:	LED Package
#Drive Level:	DC 150mA
#Nominal CCT:	2700K
#Power:	0.51W
#Average Current Density per LED die:	861.11 mA/mm <sup>2</sup>
#Average Power Density per LED die:	2.93 W/mm <sup>2</sup>
#CRI:	80
#Die Spacing:	N/A

#### Sampling Method:

LED samples for IESNA LM-80 testing consist of units built from a minimum of three manufacturing lots with each manufacturing lot built from different wafer lots built on non-consecutive days.

These manufacturing lots are picked to represent a wide parametric distribution.

#### #Family products covered by this report:

According to *ENERGY STAR® Requirements for the Use of LM-80 Data*, the following products can be covered by this report base on the information and declaration provided by manufacturer. The information of these models shows that the covered products meet all section 4 requirements of *ENERGY STAR® Requirements for the Use of LM-80 Data* (September 28, 2017)

This report covers the following models:

Test Model Number	Multiple Models	Details
HL-A-4014HW-S1-PCT-HR3	HL-A-4014HW-S1-PCT-HR3(R9)	Only different Model name for different market.
	HL-A-4014HW-S1-PCT-HR3-HL	
	HL-A-4014HW-S1-PCT-HR3(R9)-HL	
	HL-A-4014DW-S1-PCT-HR3	
	HL-A-4014DW-S1-PCT-HR3(R9)	
	HL-A-4014DW-S1-PCT-HR3-HL	
	HL-A-4014DW-S1-PCT-HR3(R9)-HL	<ol style="list-style-type: none"> <li>Different Model name for different market.</li> <li>The symbol "***" is the letter, which represent the customer code</li> </ol>
	HL-A-4014HW-S1-PCT-HR3-**	
	HL-A-4014HW-S1-PCT-HR3(R9)-**	
	HL-A-4014HW-S1-PCT-HR3-HL-**	
	HL-A-4014HW-S1-PCT-HR3(R9)-HL-**	
	HL-A-4014DW-S1-PCT-HR3-**	
	HL-A-4014DW-S1-PCT-HR3(R9)-**	
	HL-A-4014DW-S1-PCT-HR3-HL-**	
	HL-A-4014DW-S1-PCT-HR3(R9)-HL-**	
	HL-A-4014DW-S1-PCT-HR3(R9)-HL-**	

Test Model Number	Multiple Models	Details
	SL-*B4014FTA-11EA*	<ol style="list-style-type: none"> <li>1. Different Model name for different market.</li> <li>2. The first * is the letters I, N, W representing CCT. I mean less than 3700K; N means 3700-4700K; W for more than 4700K.</li> <li>3. The second * is different product solutions (color coordination and application, special solutions, etc.)</li> </ol>
	SL-*B4014FTA-11EA*H	
	SL-*B4014FTA-11EA*-*	<ol style="list-style-type: none"> <li>1. Different Model name for different market.</li> <li>2. The first * is the letters I, N, W representing CCT. I means less than 3700K; N means 3700-4700K; W for more than 4700K.</li> <li>3. The second * is different product solutions (color coordination and application, special solutions, etc.).</li> <li>4. The third * and the fourth * and the fifth are different version numbers.</li> </ol>
	SL-*B4014FTA-11EA*H-*	
	SL-*B4014FTA-11EA*/*	
	SL-*B4014FTA-11EA*-**	
	SL-*B4014FTA-11EA*H-**	
	SL-*B4014FTA-11EA*H/*	
	SL-*B4014FTA-11EA*H-***	
	SL-*B4014FTA-11EA*-***	
	SL-**B4014FTA-11EA****-APH***	<ol style="list-style-type: none"> <li>1. Different Model name for different market.</li> <li>2. The first and second * of SL-**B2835FTA-11EA****-APH*** is a numbers 27, 30, 40, 50, 65, which stand for CCT.</li> <li>3. Number From three to six * is a different product solution (Color coordinate and applications and special solution etc...).</li> <li>4. From seven to nine * is Different version numbers.</li> </ol>

## 1.2 Standards and Reference Documentations

- ANSI/IES LM-80-15: IES Approved Method for Measuring Lumen Maintenance of LED Light Sources.
- CIE 127:2007: Measurement of LEDs
- ENERGY STAR® Requirements for the Use of LM-80 Data (This standard was not accredited by IAS)

## 1.3 Testing Equipment

Device	Manufacture	Model No	Serial No	Calibration date	Calibration due date
0.3m integrating sphere	EVERFINE	Diameter 0.3m	1011119	2019-03-18	2020-03-17
Programmable Test Power for LEDs	EVERFINE	LED300E	1008002	2019-03-26	2020-03-25
High accuracy array spectroradiometer	EVERFINE	HAAS-2000	1012016T	2019-03-18	2020-03-17
Standard Light Source	EVERFINE	D062	G100278CJ7351206	2018-12-24	2019-12-24
Precision digital stabilized DC power supply	EVERFINE	WY605-V110	G115987CJ7321114	2019-03-26	2020-03-25
Multilayer aging machine	BACL	B2-270	20023	2019-03-13	2020-03-12
DC Power Supply	BACL	B12001-12	90023	2018-12-17	2019-12-17

#### 1.4 Drive Level

Samples are driven with a constant direct current (DC) during maintenance test, photometric and electrical measurement. The current value was regulated to within  $\pm 3\%$  of the specified value of the manufacturer during maintenance test, and was within  $\pm 0.5\%$  during photometric and electrical measurement test.

#### 1.5 Ambient Conditions for Maintenance Test

For lumen maintenance test, samples within one data set, were installed on cooling boards in thermal chambers with minimal ambient airflow. The case temperature and ambient temperature was monitored by thermocouples which one was soldered to the coldest DUTs' case ( $TMP_{LED}$ ) location, while the other is mounted at a distance of 5 mm above the TMP location.

During life testing,  $TMP_{LED}$  of the coldest LEDs were maintained at a temperature that was greater than or equal to  $2^{\circ}\text{C}$  below the corresponding nominal case temperature. Surrounding air was maintained at a temperature that was greater than or equal to  $5^{\circ}\text{C}$  below the corresponding nominal case temperature. Thermocouples were shielded from direct DUT optical radiation and comply with ASTM E230 Table 1 "Special Limits".

Samples were connected to DC power supply in series circuits with a constant current. The forward current was regulated to within  $\pm 3\%$  of the specified value of the manufacturer.

The relative humidity within chamber was kept less than 65% during test.

For photometry measurement, the ambient temperature during test was set to  $25^{\circ}\text{C} \pm 2^{\circ}\text{C}$ , RH <65%.

#### 1.6 Photometric Measurement Method and Uncertainty

Integrating sphere and spectroradiometer is used to measure luminous flux and chromaticity coordinate  $u'v'$ .  $2\pi$  measurement was used and sample was driven by DC power supply. The forward current was regulated to within  $\pm 0.5\%$  of the nominal value. The test system was calibrated by halogen reference lamp. The ambient temperature during test was set to  $25^{\circ}\text{C} \pm 2^{\circ}\text{C}$ , RH <65%. The temperature measurement point was located in the sphere and the temperature was detected by a temperature probe.

The uncertainty of the light output measurements is  $U=1.59\%$  ( $K=2$ ), at the 95% confidence level. The uncertainty of the correlated color temperature measurements is  $U=21\text{K}$  ( $K=2$ ), at the 95% confidence level.

The uncertainty of the temperature is  $U=0.8671^{\circ}\text{C}$  ( $K=2$ ), at the 95% confidence level.

#### 1.7 Statement of Traceability

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

## 1.8 Sample Set

### Data Set 1: 85°C, 150mA

Part Number: HL-A-4014HW-S1-PCT-HR3  
Number of Units: 25  
Case Temperature: >83°C  
Ambient Temperature: >80°C  
Life Test Drive Current: 150mA  
Measurement Current: 150mA

### Data Set 2: 105°C, 150mA

Part Number: HL-A-4014HW-S1-PCT-HR3  
Number of Units: 25  
Case Temperature: >103°C  
Ambient Temperature: >100°C  
Life Test Drive Current: 150mA  
Measurement Current: 150mA

FINAL

## 2 - Summary of Test Result

Data Set:	Sample Size	Failures Observed:	Test Interval	Test Duration	$\alpha$	$\beta$	Reported TM-21 L <sub>70</sub> Lifetime
1	25	0	1000hrs	9000hrs	2.494E-06	1.004	>54000hrs
2	25	0	1000hrs	9000hrs	3.390E-06	1.004	>54000hrs

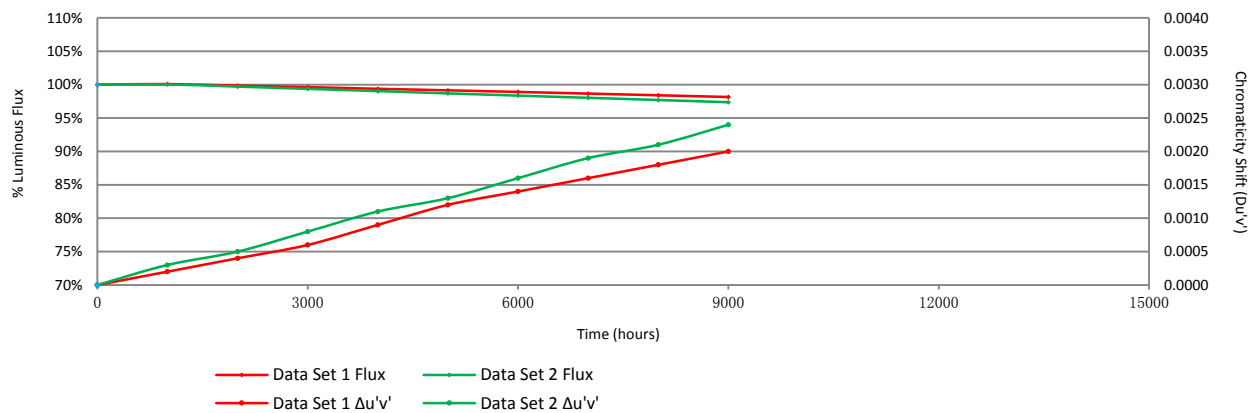
Average Lumen Maintenance (Percentage of Initial Luminous Flux)

Data Set:	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs	9000hrs
1	100.09%	99.85%	99.63%	99.38%	99.15%	98.91%	98.66%	98.41%	98.15%
2	100.03%	99.71%	99.37%	99.04%	98.69%	98.36%	98.03%	97.70%	97.37%

Average Chromaticity Shift

Data Set:	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs	9000hrs
1	0.0002	0.0004	0.0006	0.0009	0.0012	0.0014	0.0016	0.0018	0.0020
2	0.0003	0.0005	0.0008	0.0011	0.0013	0.0016	0.0019	0.0021	0.0024

Average Lumen Maintenance and Chromaticity Shift VS. Time



### 3 - Test Data

#### 3.1 Data Set 1, 85°C, 150mA (Lumen Maintenance)

No.	Φ(lm)	Lumen Maintenance (%)								
	Ohr(Initial)	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs	9000hrs
1	59.71	100.17	99.97	99.63	99.50	99.26	98.96	98.59	98.27	98.02
2	59.60	100.13	99.78	99.53	99.28	98.91	98.72	98.51	98.04	97.70
3	60.12	99.98	99.82	99.53	99.28	98.95	98.79	98.49	98.29	97.89
4	58.09	100.05	99.64	99.36	99.00	98.81	98.50	98.16	97.71	97.68
5	58.78	100.29	100.09	99.86	99.61	99.34	99.12	98.88	98.64	98.43
6	58.57	100.05	99.69	99.52	99.25	98.98	98.67	98.50	98.24	97.93
7	59.67	99.90	99.66	99.53	99.48	99.31	99.11	98.68	98.53	98.22
8	60.30	100.03	99.82	99.52	99.22	98.99	98.64	98.54	98.34	98.11
9	59.25	99.93	99.66	99.36	99.14	98.82	98.78	98.55	98.41	98.13
10	60.05	99.90	99.67	99.50	99.20	99.00	98.67	98.38	98.05	97.82
11	59.16	100.27	100.02	99.68	99.48	99.29	99.05	98.87	98.44	98.14
12	59.26	100.20	99.98	99.85	99.71	99.44	99.07	98.68	98.50	98.25
13	57.68	100.17	100.09	99.77	99.48	99.41	99.25	99.05	98.77	98.63
14	60.65	100.16	99.84	99.62	99.39	99.16	99.11	98.96	98.73	98.29
15	60.34	100.08	99.83	99.64	99.25	99.01	98.89	98.69	98.48	98.24
16	60.69	100.15	99.80	99.44	99.21	98.93	98.68	98.39	98.06	97.69
17	57.62	100.19	99.93	99.74	99.34	99.27	98.85	98.70	98.37	98.21
18	58.72	100.14	99.91	99.83	99.71	99.39	99.25	99.00	98.76	98.45
19	57.24	100.24	100.03	99.77	99.49	99.34	99.11	98.86	98.48	98.25
20	59.73	100.13	99.82	99.63	99.46	99.13	98.74	98.54	98.33	97.86
21	58.84	100.20	99.95	99.73	99.46	99.39	98.93	98.67	98.56	98.33
22	60.58	99.95	99.65	99.50	99.21	99.13	98.94	98.73	98.60	98.42
23	58.64	99.98	99.74	99.61	99.40	99.27	99.11	99.05	98.74	98.50
24	57.89	100.03	99.95	99.84	99.57	99.31	99.02	98.55	98.38	98.32
25	58.00	99.98	99.86	99.66	99.41	99.05	98.67	98.62	98.52	98.29
Avg.	59.17	100.09	99.85	99.63	99.38	99.15	98.91	98.66	98.41	98.15
Med.	59.25	100.13	99.83	99.63	99.40	99.16	98.93	98.67	98.44	98.22
st dev	1.03	0.12	0.14	0.15	0.18	0.20	0.21	0.22	0.26	0.27
Min.	57.24	99.90	99.64	99.36	99.00	98.81	98.50	98.16	97.71	97.68
Max.	60.69	100.29	100.09	99.86	99.71	99.44	99.25	99.05	98.77	98.63



**3.2 Data Set 1, 85°C, 150mA (Forward Voltage)**

No.	Forward Voltage (V)									
	0hr(Initial)	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs	9000hrs
1	3.267	3.223	3.222	3.223	3.224	3.222	3.225	3.223	3.202	3.184
2	3.221	3.179	3.176	3.178	3.179	3.176	3.180	3.178	3.224	3.181
3	3.243	3.208	3.207	3.209	3.210	3.207	3.210	3.207	3.211	3.212
4	3.283	3.246	3.247	3.247	3.245	3.246	3.247	3.243	3.211	3.203
5	3.265	3.234	3.233	3.233	3.232	3.233	3.233	3.231	3.205	3.193
6	3.275	3.251	3.251	3.252	3.251	3.251	3.249	3.251	3.213	3.213
7	3.319	3.296	3.295	3.295	3.295	3.296	3.294	3.296	3.263	3.249
8	3.312	3.291	3.288	3.291	3.292	3.288	3.290	3.290	3.247	3.244
9	3.264	3.238	3.237	3.238	3.239	3.238	3.238	3.239	3.231	3.195
10	3.232	3.201	3.200	3.201	3.204	3.203	3.201	3.200	3.176	3.162
11	3.205	3.186	3.184	3.185	3.185	3.183	3.185	3.185	3.163	3.171
12	3.236	3.212	3.206	3.212	3.209	3.212	3.208	3.211	3.188	3.195
13	3.281	3.252	3.256	3.256	3.255	3.254	3.251	3.257	3.237	3.212
14	3.227	3.191	3.192	3.191	3.189	3.191	3.191	3.193	3.172	3.185
15	3.314	3.287	3.287	3.287	3.287	3.287	3.287	3.285	3.246	3.243
16	3.310	3.289	3.287	3.289	3.290	3.285	3.285	3.289	3.246	3.247
17	3.224	3.198	3.198	3.201	3.200	3.197	3.199	3.202	3.205	3.205
18	3.277	3.254	3.254	3.254	3.255	3.255	3.252	3.256	3.209	3.247
19	3.209	3.174	3.175	3.176	3.175	3.176	3.175	3.179	3.183	3.188
20	3.231	3.202	3.200	3.202	3.200	3.201	3.198	3.203	3.204	3.203
21	3.245	3.212	3.211	3.209	3.209	3.210	3.208	3.212	3.183	3.170
22	3.237	3.212	3.211	3.210	3.212	3.210	3.209	3.209	3.218	3.205
23	3.259	3.232	3.230	3.233	3.234	3.231	3.228	3.236	3.200	3.187
24	3.224	3.191	3.189	3.191	3.191	3.191	3.192	3.193	3.197	3.195
25	3.296	3.269	3.271	3.272	3.270	3.270	3.268	3.273	3.281	3.225
Avg.	3.258	3.229	3.228	3.229	3.229	3.229	3.228	3.230	3.213	3.205
Med.	3.259	3.223	3.222	3.223	3.224	3.222	3.225	3.223	3.209	3.203
st dev	0.034	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.029	0.026
Min.	3.205	3.174	3.175	3.176	3.175	3.176	3.175	3.178	3.163	3.162
Max.	3.319	3.296	3.295	3.295	3.295	3.296	3.294	3.296	3.281	3.249

### 3.3 Data Set 1, 85°C, 150mA (Chromaticity Shift)

No.	u'	v'	CCT(K)	Chromaticity Shift ( $\Delta u'v'$ )								
				1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs	9000hrs
1	0.2571	0.5320	2793	0.0002	0.0003	0.0006	0.0010	0.0014	0.0018	0.0021	0.0024	0.0029
2	0.2558	0.5335	2814	0.0002	0.0004	0.0007	0.0008	0.0012	0.0013	0.0017	0.0019	0.0023
3	0.2549	0.5326	2839	0.0003	0.0005	0.0007	0.0011	0.0013	0.0015	0.0018	0.0020	0.0023
4	0.2607	0.5307	2723	0.0002	0.0004	0.0006	0.0008	0.0011	0.0015	0.0018	0.0021	0.0024
5	0.2551	0.5289	2851	0.0002	0.0004	0.0005	0.0008	0.0010	0.0012	0.0014	0.0017	0.0020
6	0.2542	0.5321	2855	0.0001	0.0004	0.0006	0.0009	0.0011	0.0012	0.0016	0.0017	0.0019
7	0.2550	0.5275	2861	0.0002	0.0004	0.0006	0.0009	0.0012	0.0012	0.0016	0.0018	0.0019
8	0.2574	0.5327	2783	0.0002	0.0006	0.0008	0.0009	0.0010	0.0011	0.0013	0.0014	0.0018
9	0.2566	0.5311	2809	0.0002	0.0004	0.0008	0.0009	0.0011	0.0013	0.0013	0.0014	0.0016
10	0.2544	0.5288	2868	0.0001	0.0004	0.0006	0.0009	0.0011	0.0013	0.0014	0.0016	0.0017
11	0.2572	0.5300	2801	0.0002	0.0004	0.0008	0.0011	0.0015	0.0016	0.0017	0.0018	0.0019
12	0.2582	0.5312	2774	0.0002	0.0004	0.0008	0.0012	0.0015	0.0018	0.0019	0.0020	0.0022
13	0.2577	0.5303	2788	0.0003	0.0006	0.0008	0.0011	0.0015	0.0019	0.0022	0.0023	0.0024
14	0.2541	0.5305	2866	0.0002	0.0004	0.0006	0.0009	0.0012	0.0014	0.0019	0.0024	0.0028
15	0.2559	0.5320	2820	0.0002	0.0005	0.0008	0.0011	0.0014	0.0015	0.0016	0.0020	0.0023
16	0.2551	0.5319	2837	0.0002	0.0005	0.0007	0.0009	0.0012	0.0014	0.0016	0.0017	0.0020
17	0.2549	0.5310	2845	0.0001	0.0003	0.0006	0.0008	0.0010	0.0012	0.0013	0.0016	0.0018
18	0.2578	0.5331	2774	0.0002	0.0005	0.0007	0.0008	0.0011	0.0014	0.0016	0.0016	0.0019
19	0.2572	0.5316	2793	0.0001	0.0004	0.0006	0.0009	0.0011	0.0012	0.0014	0.0016	0.0018
20	0.2571	0.5321	2793	0.0001	0.0003	0.0004	0.0006	0.0009	0.0013	0.0015	0.0016	0.0018
21	0.2553	0.5317	2834	0.0002	0.0004	0.0006	0.0007	0.0012	0.0014	0.0015	0.0017	0.0019
22	0.2596	0.5331	2737	0.0002	0.0004	0.0006	0.0008	0.0009	0.0011	0.0013	0.0016	0.0018
23	0.2576	0.5314	2786	0.0002	0.0004	0.0005	0.0007	0.0009	0.0011	0.0013	0.0017	0.0019
24	0.2562	0.5290	2828	0.0002	0.0004	0.0006	0.0007	0.0009	0.0011	0.0012	0.0013	0.0015
25	0.2601	0.5308	2736	0.0003	0.0004	0.0007	0.0009	0.0011	0.0013	0.0015	0.0016	0.0018
Avg.	0.2566	0.5312	2808	0.0002	0.0004	0.0006	0.0009	0.0012	0.0014	0.0016	0.0018	0.0020
Med.	0.2566	0.5314	2809	0.0002	0.0004	0.0006	0.0009	0.0011	0.0013	0.0016	0.0017	0.0019
st dev	0.0018	0.0015	41	0.0001	0.0001	0.0001	0.0001	0.0002	0.0002	0.0003	0.0003	0.0004
Min.	0.2541	0.5275	2723	0.0001	0.0003	0.0004	0.0006	0.0009	0.0011	0.0012	0.0013	0.0015
Max.	0.2607	0.5335	2868	0.0003	0.0006	0.0008	0.0012	0.0015	0.0019	0.0022	0.0024	0.0029

**3.4 Data Set 2, 105°C, 150mA (Lumen Maintenance)**

No.	Φ(lm)	Lumen Maintenance (%)								
	Ohr(Initial)	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs	9000hrs
26	59.13	100.10	99.97	99.66	99.27	98.93	98.85	98.63	98.43	98.17
27	60.79	99.88	99.54	99.28	99.00	98.65	98.35	97.99	97.66	97.29
28	60.45	99.97	99.52	99.21	98.92	98.59	98.31	97.93	97.45	97.11
29	60.08	100.07	99.90	99.55	99.15	98.69	98.34	97.97	97.65	97.34
30	57.52	100.14	99.90	99.53	99.36	98.99	98.73	98.42	98.11	97.39
31	59.54	100.02	99.68	99.50	99.19	98.77	98.40	98.03	97.75	97.46
32	59.32	99.95	99.71	99.43	99.16	98.87	98.60	98.31	97.86	97.54
33	58.11	99.88	99.54	99.16	98.85	98.47	97.99	97.81	97.59	97.14
34	59.27	99.97	99.70	99.44	99.26	98.67	98.19	97.87	97.45	97.27
35	58.35	99.85	99.50	99.21	98.94	98.70	98.34	97.93	97.74	97.53
36	56.31	100.09	99.88	99.43	99.08	98.60	98.21	98.14	98.03	97.67
37	58.73	99.88	99.54	99.22	98.83	98.40	98.04	97.68	97.29	96.97
38	59.56	100.02	99.50	99.08	98.79	98.51	98.17	97.70	97.25	96.83
39	59.03	99.90	99.66	99.25	98.76	98.63	98.31	98.05	97.68	97.36
40	60.14	100.18	99.92	99.63	99.25	98.70	98.27	97.87	97.54	97.34
41	58.26	100.24	100.00	99.54	99.31	99.02	98.75	98.47	98.27	97.89
42	59.74	100.10	99.75	99.55	99.11	98.74	98.49	98.01	97.64	97.27
43	58.06	100.03	99.60	99.28	98.91	98.71	98.28	98.09	97.73	97.35
44	56.85	100.26	100.12	99.84	99.49	99.24	98.87	98.43	98.26	97.87
45	57.84	99.98	99.69	99.29	98.96	98.60	98.34	98.08	97.72	97.48
46	58.64	99.88	99.39	99.08	98.70	98.24	97.90	97.56	97.37	97.19
47	59.61	100.02	99.55	99.08	98.67	98.31	97.87	97.38	96.96	96.64
48	60.15	99.97	99.68	99.20	98.90	98.70	98.45	98.27	97.84	97.56
49	60.53	100.21	99.83	99.42	99.12	98.93	98.63	98.25	97.84	97.47
50	59.50	100.13	99.61	99.38	98.97	98.55	98.20	97.85	97.48	97.18
Avg.	59.02	100.03	99.71	99.37	99.04	98.69	98.36	98.03	97.70	97.37
Med.	59.27	100.02	99.68	99.38	99.00	98.69	98.34	98.01	97.68	97.35
st dev	1.15	0.12	0.19	0.20	0.22	0.23	0.27	0.30	0.34	0.33
Min.	56.31	99.85	99.39	99.08	98.67	98.24	97.87	97.38	96.96	96.64
Max.	60.79	100.26	100.12	99.84	99.49	99.24	98.87	98.63	98.43	98.17

**3.5 Data Set 2, 105°C, 150mA (Forward Voltage)**

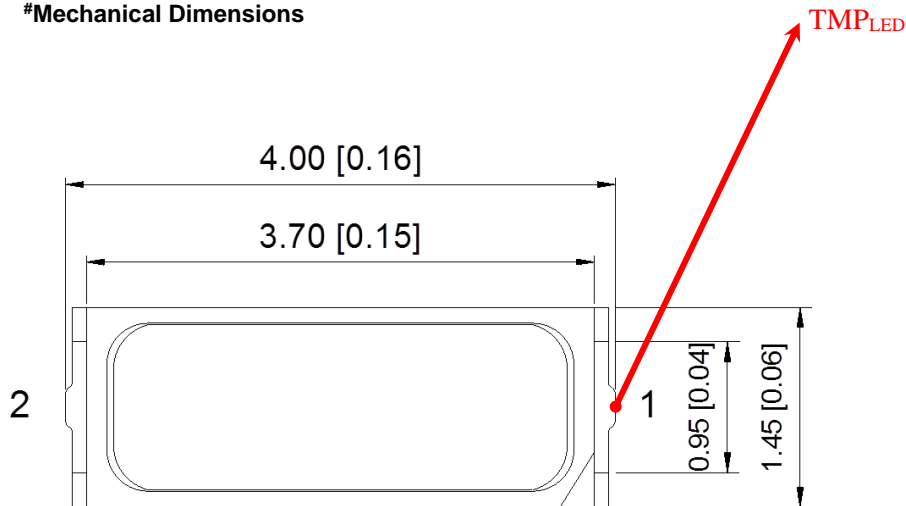
No.	Forward Voltage (V)									
	0hr(Initial)	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs	9000hrs
26	3.302	3.277	3.278	3.279	3.281	3.277	3.277	3.281	3.286	3.282
27	3.281	3.258	3.258	3.260	3.258	3.257	3.254	3.260	3.266	3.260
28	3.310	3.285	3.288	3.287	3.293	3.288	3.287	3.285	3.295	3.293
29	3.217	3.187	3.187	3.188	3.193	3.187	3.186	3.186	3.193	3.190
30	3.246	3.218	3.223	3.223	3.228	3.221	3.220	3.221	3.227	3.231
31	3.229	3.199	3.202	3.203	3.208	3.203	3.200	3.204	3.205	3.207
32	3.239	3.213	3.213	3.214	3.214	3.212	3.212	3.212	3.218	3.217
33	3.285	3.265	3.263	3.266	3.267	3.262	3.262	3.262	3.264	3.269
34	3.251	3.217	3.217	3.220	3.219	3.217	3.219	3.218	3.224	3.222
35	3.296	3.268	3.271	3.275	3.270	3.269	3.269	3.270	3.277	3.272
36	3.211	3.178	3.177	3.180	3.179	3.178	3.179	3.179	3.186	3.181
37	3.262	3.235	3.234	3.238	3.236	3.237	3.237	3.236	3.247	3.239
38	3.224	3.195	3.195	3.199	3.197	3.197	3.199	3.200	3.207	3.199
39	3.222	3.196	3.196	3.192	3.195	3.192	3.195	3.196	3.201	3.196
40	3.232	3.208	3.210	3.209	3.210	3.208	3.208	3.218	3.220	3.211
41	3.212	3.180	3.181	3.182	3.181	3.181	3.180	3.187	3.189	3.183
42	3.252	3.215	3.215	3.216	3.220	3.219	3.216	3.219	3.225	3.218
43	3.236	3.197	3.199	3.200	3.197	3.199	3.200	3.202	3.206	3.202
44	3.252	3.221	3.218	3.223	3.224	3.222	3.221	3.230	3.226	3.221
45	3.234	3.197	3.200	3.200	3.200	3.199	3.200	3.203	3.203	3.202
46	3.281	3.251	3.252	3.254	3.254	3.258	3.250	3.252	3.262	3.256
47	3.293	3.271	3.272	3.272	3.269	3.274	3.266	3.274	3.275	3.273
48	3.265	3.233	3.235	3.238	3.235	3.236	3.235	3.241	3.251	3.239
49	3.255	3.220	3.222	3.223	3.224	3.225	3.222	3.235	3.231	3.224
50	3.244	3.211	3.209	3.209	3.209	3.210	3.207	3.217	3.213	3.209
Avg.	3.253	3.224	3.225	3.226	3.226	3.225	3.224	3.228	3.232	3.228
Med.	3.251	3.217	3.217	3.220	3.220	3.219	3.219	3.219	3.225	3.221
st dev	0.029	0.032	0.032	0.032	0.032	0.032	0.031	0.031	0.032	0.032
Min.	3.211	3.178	3.177	3.180	3.179	3.178	3.179	3.179	3.186	3.181
Max.	3.310	3.285	3.288	3.287	3.293	3.288	3.287	3.285	3.295	3.293

**3.6 Data Set 2, 105°C, 150mA (Chromaticity Shift)**

No.	u'	v'	CCT(K)	Chromaticity Shift ( $\Delta u'v'$ )								
	Ohr(Initial)			1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs	9000hrs
26	0.2575	0.5320	2785	0.0001	0.0004	0.0005	0.0009	0.0011	0.0012	0.0013	0.0016	0.0018
27	0.2565	0.5310	2811	0.0003	0.0005	0.0009	0.0010	0.0011	0.0012	0.0013	0.0015	0.0016
28	0.2548	0.5311	2848	0.0001	0.0005	0.0012	0.0015	0.0018	0.0021	0.0023	0.0025	0.0028
29	0.2549	0.5303	2848	0.0001	0.0004	0.0007	0.0013	0.0018	0.0020	0.0023	0.0024	0.0027
30	0.2588	0.5338	2750	0.0004	0.0005	0.0009	0.0011	0.0014	0.0022	0.0025	0.0029	0.0032
31	0.2561	0.5305	2823	0.0002	0.0006	0.0008	0.0011	0.0014	0.0017	0.0022	0.0025	0.0029
32	0.2549	0.5297	2852	0.0002	0.0005	0.0008	0.0011	0.0014	0.0017	0.0021	0.0024	0.0028
33	0.2604	0.5321	2723	0.0004	0.0005	0.0006	0.0008	0.0011	0.0014	0.0018	0.0021	0.0023
34	0.2600	0.5349	2720	0.0006	0.0008	0.0009	0.0011	0.0013	0.0016	0.0019	0.0022	0.0024
35	0.2569	0.5315	2801	0.0006	0.0008	0.0010	0.0011	0.0014	0.0017	0.0019	0.0022	0.0027
36	0.2606	0.5301	2728	0.0004	0.0007	0.0008	0.0010	0.0012	0.0015	0.0019	0.0022	0.0023
37	0.2582	0.5332	2765	0.0004	0.0006	0.0009	0.0011	0.0012	0.0014	0.0019	0.0020	0.0022
38	0.2565	0.5317	2807	0.0004	0.0008	0.0011	0.0012	0.0013	0.0014	0.0017	0.0020	0.0022
39	0.2581	0.5317	2773	0.0002	0.0006	0.0009	0.0013	0.0015	0.0017	0.0018	0.0019	0.0022
40	0.2566	0.5327	2801	0.0002	0.0005	0.0008	0.0011	0.0016	0.0017	0.0017	0.0019	0.0021
41	0.2564	0.5306	2815	0.0001	0.0003	0.0008	0.0011	0.0015	0.0017	0.0018	0.0019	0.0021
42	0.2572	0.5330	2788	0.0003	0.0005	0.0007	0.0010	0.0016	0.0019	0.0023	0.0023	0.0024
43	0.2595	0.5312	2746	0.0004	0.0008	0.0009	0.0012	0.0015	0.0018	0.0024	0.0026	0.0028
44	0.2570	0.5311	2799	0.0001	0.0003	0.0004	0.0006	0.0011	0.0014	0.0015	0.0017	0.0022
45	0.2591	0.5307	2756	0.0002	0.0001	0.0005	0.0006	0.0010	0.0014	0.0018	0.0019	0.0022
46	0.2576	0.5306	2788	0.0001	0.0002	0.0003	0.0005	0.0011	0.0015	0.0018	0.0021	0.0023
47	0.2569	0.5312	2801	0.0004	0.0006	0.0006	0.0008	0.0009	0.0013	0.0017	0.0020	0.0024
48	0.2573	0.5313	2794	0.0004	0.0006	0.0009	0.0012	0.0014	0.0015	0.0018	0.0021	0.0026
49	0.2585	0.5319	2765	0.0004	0.0008	0.0009	0.0013	0.0014	0.0015	0.0017	0.0019	0.0020
50	0.2569	0.5311	2803	0.0003	0.0008	0.0011	0.0013	0.0016	0.0018	0.0022	0.0026	0.0028
Avg.	0.2575	0.5316	2788	0.0003	0.0005	0.0008	0.0011	0.0013	0.0016	0.0019	0.0021	0.0024
Med.	0.2572	0.5312	2794	0.0003	0.0005	0.0008	0.0011	0.0014	0.0016	0.0018	0.0021	0.0023
st dev	0.0016	0.0012	37	0.0001	0.0002	0.0002	0.0002	0.0002	0.0003	0.0003	0.0003	0.0004
Min.	0.2548	0.5297	2720	0.0001	0.0001	0.0003	0.0005	0.0009	0.0012	0.0013	0.0015	0.0016
Max.	0.2606	0.5349	2852	0.0006	0.0008	0.0012	0.0015	0.0018	0.0022	0.0025	0.0029	0.0032

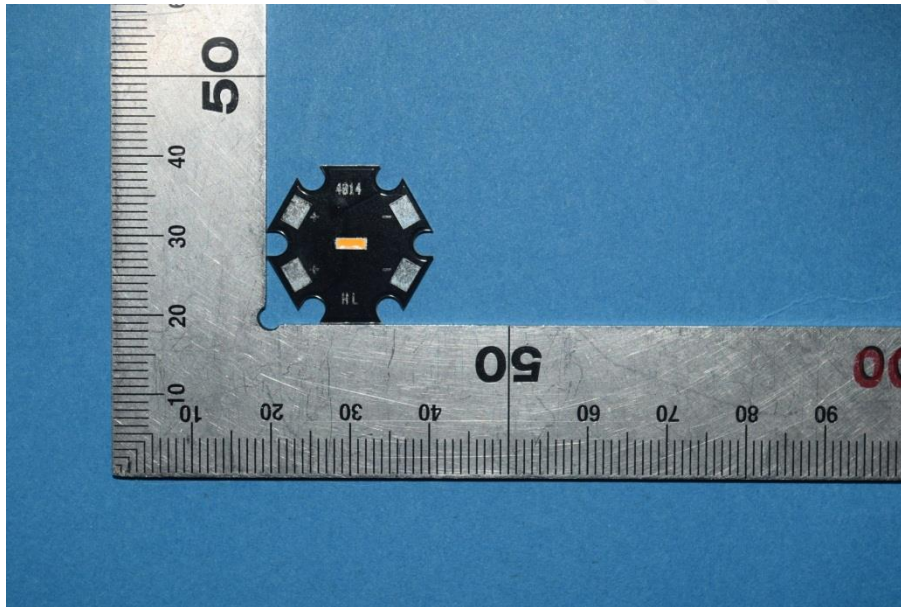
#### 4 - DUT Photo

##### 4.1 #Mechanical Dimensions



All dimensions are in millimeter

##### 4.2 DUT Photo



## Directions

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1. The information marked “superscript #” is provided by the applicant, the laboratory is not responsible for its authenticity and this information can affect the validity of the result in the test report.
2. Unless otherwise stated the results shown in this test report refer only to the sample(s) tested.
3. Otherwise required by the applicant or Product Regulations, Decision Rule in this report did not consider the uncertainty.
4. The extended uncertainty given in this report is obtained by combining the standard uncertainty times the coverage factor K with the 95% confidence interval.
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\*\*\*\*\*END OF REPORT\*\*\*\*\*