

# TEST REPORT

## IES LM-80-15

For

Shenzhen Refond Optoelectronic Co., Ltd.

1 to 8th Floor, Building #1, 10th Industrial Zone, Tian Liao Community, Gong Ming Area,  
Guang Ming New District, SHENZHEN, CHINA.

**Report No.:** SZANL181106007-01-M1

**Product Description:** 2835

**Model No.:** RF-W2HV32DS-FF-N2

**Test Initiation Date:** 2017-11-09

**Test Completion Date:** 2018-11-21

**Report Issue Date:** 2018-12-05

**Test Standard:** IES LM-80-15

**Test Laboratory:** Shenzhen Anbotek Pengcheng Compliance Laboratory Limited

**Tested by**

**Reviewed by**

Dick Xiao



Helen Li



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Note: The report (#SZANL181106007-01-M1) replaced the previous report (#SZANL181106007-01).

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# 1 General Information

## 1.1 Description of LED Light Sources

Tested Model:

Part Number: RF-W2HV32DS-FF-N2

Part Type: 2835

Nominal CCT: 2700K

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:

Testing Model	Multiple Model	Difference	Details
RF-W2HV32DS-FF-N2	R*-***32DS-**-**(-Y)-**	1. CCT:2200-8200 2. Internal management code.	See below

Note:

1. The first \* can be F or T, It is an internal Market code which does not affect property.
2. The second \* represent customer name, it can be C, D, H, K, L, M, P, S, T, W, Y, which also can be excluded.
3. The third to fourth \* represent CCT, it can be 22, 24, 27, 30, 35, 40, 45, 50, 57, 60, 62, 65, 82; \*\* don't mean only two numbers, it maybe also as mentioned 2, 3, 4, 5, 6, 7, 8.
4. The fifth \* represent Chromogenic index, it can be R, M, H, T, or Q&S which does not affect product property.
5. The sixth \* it can be V, I or P, it is an internal Market code of Leadframe.
6. The seventh to eighth \* can be AF, BF, CF, DF, EF, FF, FD or FH, it is an internal Market code which does not affect product property.
7. The ninth to tenth \*\* can be N, J, T, N2, F2, 2J, or 2N, it is an internal Market code which does not affect product property.
8. The letter "Y" on behalf of the centrifugal power equipment is not used, No "Y" on behalf of using centrifugal power equipment.
9. The last letter -\*\* represent project code, not specified, it can be blank, \* or \*\* and number or letter.

Disclaimer:

The truthfulness and accuracy of all the technical information above for the covered LED products is ensured by manufacturer of LED light source. Shenzhen Anbotek Pengcheng Compliance Laboratory Limited isn't responsible or gives any guarantees for the truthfulness of the technical information.

## 1.2 Product Description for Device under Test (DUT)

**Manufacturer:** Shenzhen Refond Optoelectronic Co., Ltd.

**Tested Model:** RF-W2HV32DS-FF-N2

**Part Type:** 2835

**Nominal CCT:** 2700K

**Nominal Ra:** 80

**Number of LED tested:** See tables

**Case Temperature (Test Point Temperature):** See tables

**Drive Current of the LED During Lifetime Test:** See tables

**Initial luminous flux and forward voltage at photometric measurement current:** See tables

**Lumen maintenance data for each individual LED along with median value, standard deviation, minimum and maximum lumen maintenance value for all of the LED:** See tables

**Observation of LED failure including the failure conditions and time of failure:** See tables

**LED monitoring interval:** The LED light source is inspected at regular interval (24 hours) throughout the 9000 hours test.

**Photometric measurement uncertainty:** 1.5% on flux measurements for LM-80 testing.

**Chromaticity shift reported over the Measurement time:** See tables

**LED Test interval:** At regular intervals (1000 hours) throughout the 9000 hours test.

**Date of Receiving Sample:** 2017-11-08

**Test Duration:** 2017-11-09 to 2018-11-21

### 1.3 Standards Used

IESNA LM-80-15: IES Approved Method for Measuring Luminous Flux and Color Maintenance of LED, Arrays and Modules.

ENERGY STAR® Program Guidance Regarding LED Package, LED Array and LED Module Lumen Maintenance Performance Data Supporting Qualification of Lighting Products (This test method was not accredited by IAS)

### 1.4 Test Facility Description

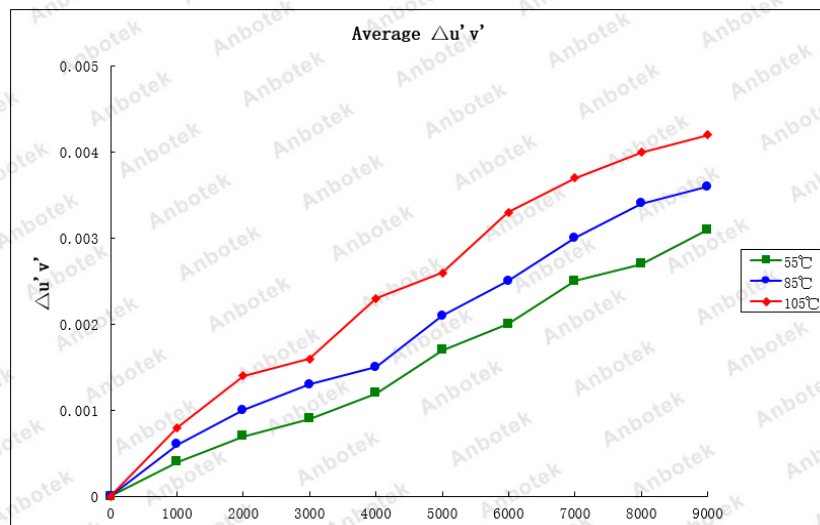
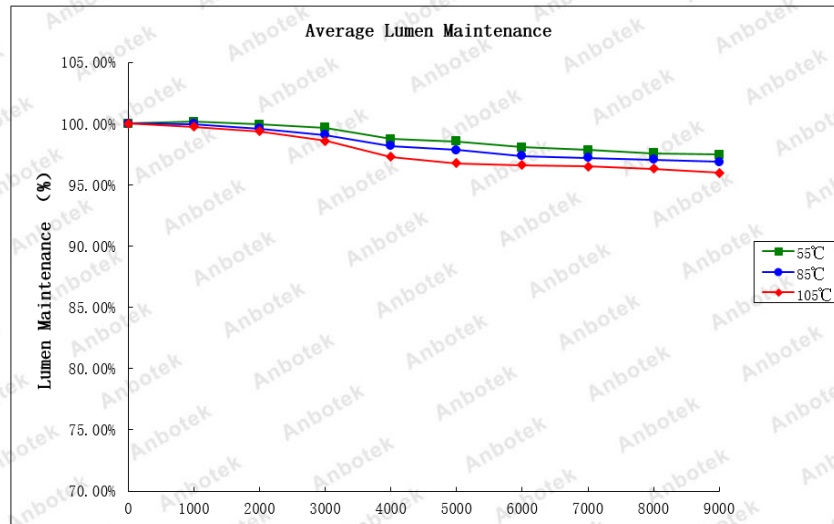
The test facility used by Shenzhen Anbotek Pengcheng Compliance Laboratory Limited is located at Floor 1, Building C, Gold Power Industrial Park, Julongshan Grand Industrial Zone, Pingshan District, Shenzhen, Guangdong, China.

### 1.5 Test Equipment List

Device	Manufacture	Model No.	Serial No.	Calibration Date	Calibration Due Date
Digital Power Meter	YOKOGAWA	WT210	SE-074	2018-06-06	2019-06-05
LM-80 Aging Test System	KEYI	KY-3X-LH60	SE-564	2018-06-06	2019-06-05
DC Power Supply	EVERFINE	WY605	SE-605	2018-06-06	2019-06-05
Standard Lamp	EVERFINE	D062	SE-606	2018-06-06	2019-06-05
Spectrum Analyzer	EVERFINE	HAAS-2000	SE-607	2018-06-06	2019-06-05
Integrating Sphere (0.5m)	EVERFINE	AIS-2	SE-608	Before use	Before use

## 2 Summary of Test Result

Data Set	1	2	3
Nominal case temperatures	55°C	85°C	105°C
Drive Current	60 mA	60 mA	60 mA
Condition	Ts=54.5°C Ta=53.5°C R.H. < 65% IF=59.9 mA	Ts=84.6°C Ta=83.4°C R.H. < 65% IF=59.9 mA	Ts=104.5°C Ta=103.5°C R.H. < 65% IF=59.9 mA
sample size	30	30	30
Duration (in Hours)	9000	9000	9000
Intervals (in Hours)	1000	1000	1000
Failure	0	0	0
L <sub>70</sub> (9000h)	>54000	>54000	>54000
L <sub>90</sub> (9000h)	>36000	>36000	>36000



## 3 Test Method

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### 3.1 Photometric and Electrical Measurement

Total light output (luminous flux) for the  $25^{\circ}\text{C}\pm 1^{\circ}\text{C}$  ambient temperature conditions is measured using an integrating sphere. Each LED is operated at rated drive current (CC Mode).

The total uncertainty of the light output measurements is estimated, at the 95% confidence level, not to exceed  $\pm 1.6\%$  over the wavelength range 380-800nm.

### 3.2 Season the LED from 0 hours to 9000 hours

Three LM-80 aging measurement system Temperature Chambers are using for Seasoning, and the temperature is set to  $55^{\circ}\text{C}$ ,  $85^{\circ}\text{C}$ ,  $105^{\circ}\text{C}$  (manufacture defined), the airflow is minimum to keep the uniformity to temperature. LED are operated steady state (no cycling) for a period of 9000 hours, checked the lumen flux and Chromaticity Shift every 1000 hours. The samples are inspected at regular intervals (24 hours) throughout the 9000 hours. The time and date of failure of each lamp is recorded. The actual elapsed time for each light LED is in hour.

**4 Data Set 1: 55°C, 60 mA**

Description of Light Sources Tested:	RF-W2HV32DS-FF-N2
Case Temperature:	54.5°C
Ambient Temperature:	53.5°C
Drive Current:	60 mA
Measure Current:	59.9 mA
Failures Observed:	None

**Lumen Maintenance (%)**

Sample No.	VF(V)	Φ(lm)	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs	9000hrs
L1	18.56	120.2	100.02%	99.78%	99.57%	98.94%	98.72%	97.92%	97.71%	97.55%	97.42%
L2	18.40	123.0	100.22%	99.99%	99.82%	98.96%	98.80%	98.44%	98.19%	97.81%	97.72%
L3	18.33	119.8	100.22%	99.92%	99.68%	98.86%	98.50%	98.10%	97.97%	97.76%	97.69%
L4	18.32	121.0	100.17%	99.89%	99.74%	98.57%	98.40%	98.27%	97.99%	97.52%	97.43%
L5	18.40	120.2	100.08%	100.00%	99.82%	98.92%	98.76%	98.01%	97.93%	97.75%	97.66%
L6	18.40	121.1	100.10%	100.03%	99.91%	98.97%	98.74%	98.33%	98.10%	97.78%	97.65%
L7	18.39	122.2	100.24%	99.92%	99.67%	98.61%	98.45%	97.80%	97.56%	97.27%	97.10%
L8	18.44	120.6	100.17%	99.82%	99.52%	98.93%	98.82%	98.19%	97.90%	97.55%	97.44%
L9	18.30	122.4	100.16%	100.03%	99.74%	98.86%	98.53%	97.93%	97.70%	97.53%	97.35%
L10	18.44	120.5	100.01%	99.76%	99.61%	98.28%	98.12%	97.88%	97.65%	97.39%	97.30%
L11	18.29	122.4	100.24%	100.07%	99.85%	98.86%	98.59%	97.79%	97.62%	97.47%	97.31%
L12	18.38	124.9	100.24%	100.06%	99.76%	98.57%	98.33%	98.04%	97.89%	97.51%	97.45%
L13	18.29	121.1	100.21%	99.95%	99.82%	98.58%	98.48%	98.26%	97.97%	97.66%	97.43%
L14	18.23	120.9	100.20%	99.78%	99.62%	98.72%	98.59%	97.83%	97.55%	97.41%	97.38%
L15	18.26	123.3	100.03%	99.87%	99.56%	98.71%	98.62%	98.35%	98.06%	97.79%	97.61%
L16	18.39	122.8	100.01%	99.76%	99.35%	98.86%	98.59%	97.82%	97.63%	97.45%	97.38%
L17	18.33	122.5	100.24%	99.93%	99.78%	98.95%	98.77%	97.94%	97.73%	97.49%	97.25%
L18	18.26	123.8	100.22%	99.99%	99.71%	98.93%	98.80%	98.36%	98.11%	97.81%	97.75%
L19	18.39	119.7	100.19%	99.92%	99.41%	98.60%	98.33%	98.11%	97.88%	97.52%	97.30%
L20	18.26	122.5	100.16%	100.05%	99.77%	98.63%	98.58%	98.03%	97.85%	97.45%	97.28%
L21	18.30	123.3	100.09%	100.01%	99.89%	98.45%	98.26%	98.20%	97.96%	97.69%	97.50%
L22	18.50	122.5	100.23%	100.00%	99.64%	98.77%	98.43%	98.12%	97.90%	97.71%	97.62%
L23	18.34	123.2	100.23%	99.95%	99.67%	98.84%	98.57%	98.06%	97.98%	97.63%	97.46%
L24	18.34	120.9	100.17%	100.02%	99.63%	98.86%	98.69%	98.05%	97.83%	97.39%	97.29%
L25	18.46	121.7	100.07%	99.90%	99.72%	98.77%	98.66%	97.89%	97.66%	97.58%	97.31%
L26	18.53	121.5	100.00%	99.83%	99.35%	98.71%	98.63%	97.82%	97.60%	97.25%	97.09%
L27	18.30	119.6	100.28%	100.08%	99.90%	98.57%	98.34%	97.95%	97.73%	97.60%	97.46%
L28	18.42	127.1	100.07%	99.89%	99.61%	98.59%	98.51%	97.79%	97.65%	97.56%	97.38%
L29	18.50	122.2	100.19%	99.86%	99.55%	98.70%	98.47%	98.28%	98.08%	97.88%	97.78%
L30	18.30	120.7	100.09%	99.80%	99.43%	98.66%	98.52%	98.37%	98.02%	97.71%	97.61%
AV	18.37	121.9	<b>100.15%</b>	<b>99.93%</b>	<b>99.67%</b>	<b>98.74%</b>	<b>98.55%</b>	<b>98.06%</b>	<b>97.85%</b>	<b>97.58%</b>	<b>97.45%</b>
Median	18.36	122.0	100.17%	99.93%	99.68%	98.75%	98.58%	98.05%	97.89%	97.56%	97.43%
MIN	18.23	119.6	100.00%	99.76%	99.35%	98.28%	98.12%	97.79%	97.55%	97.25%	97.09%
MAX	18.56	127.1	100.28%	100.08%	99.91%	98.97%	98.82%	98.44%	98.19%	97.88%	97.78%
STDEV	0.0862	1.6477	0.0008	0.0010	0.0016	0.0017	0.0017	0.0020	0.0018	0.0016	0.0018
N	30	30	30	30	30	30	30	30	30	30	30



Description of Light Sources Tested:	RF-W2HV32DS-FF-N2
Case Temperature:	54.5°C
Ambient Temperature:	53.5°C
Drive Current:	60 mA
Measure Current:	59.9 mA
Failures Observed:	None

**Chromaticity Shift ( $\Delta u'v'$ )**

Sample No.	$u'$	$v'$	CCT(K)	1000 hrs	2000 hrs	3000 hrs	4000 hrs	5000 hrs	6000 hrs	7000 hrs	8000 hrs	9000 hrs
L1	0.2648	0.5326	2634	0.0002	0.0004	0.0005	0.0011	0.0019	0.0016	0.0026	0.0024	0.0035
L2	0.2626	0.5310	2683	0.0004	0.0007	0.0007	0.0013	0.0022	0.0018	0.0018	0.0027	0.0028
L3	0.2621	0.5319	2691	0.0006	0.0005	0.0011	0.0016	0.0019	0.0014	0.0026	0.0028	0.0035
L4	0.2632	0.5309	2673	0.0007	0.0003	0.0006	0.0016	0.0019	0.0020	0.0019	0.0024	0.0029
L5	0.2623	0.5329	2682	0.0007	0.0008	0.0006	0.0018	0.0013	0.0016	0.0018	0.0031	0.0026
L6	0.2628	0.5307	2682	0.0004	0.0008	0.0005	0.0014	0.0021	0.0017	0.0027	0.0030	0.0032
L7	0.2625	0.5339	2674	0.0006	0.0010	0.0011	0.0011	0.0012	0.0016	0.0030	0.0024	0.0032
L8	0.2623	0.5324	2684	0.0004	0.0008	0.0011	0.0008	0.0013	0.0025	0.0029	0.0026	0.0027
L9	0.2618	0.5312	2698	0.0006	0.0003	0.0013	0.0010	0.0013	0.0022	0.0027	0.0032	0.0029
L10	0.2638	0.5321	2655	0.0007	0.0005	0.0014	0.0009	0.0015	0.0021	0.0023	0.0029	0.0033
L11	0.2626	0.5312	2683	0.0002	0.0004	0.0009	0.0008	0.0016	0.0015	0.0019	0.0024	0.0026
L12	0.2605	0.5336	2717	0.0003	0.0008	0.0013	0.0007	0.0021	0.0018	0.0029	0.0024	0.0027
L13	0.2638	0.5311	2659	0.0005	0.0006	0.0010	0.0014	0.0022	0.0016	0.0019	0.0027	0.0031
L14	0.2621	0.5323	2688	0.0006	0.0003	0.0007	0.0016	0.0019	0.0020	0.0024	0.0026	0.0032
L15	0.2633	0.5349	2656	0.0001	0.0007	0.0004	0.0016	0.0014	0.0023	0.0018	0.0026	0.0026
L16	0.2621	0.5326	2687	0.0006	0.0008	0.0012	0.0008	0.0020	0.0019	0.0025	0.0030	0.0028
L17	0.2623	0.5321	2686	0.0005	0.0010	0.0007	0.0012	0.0013	0.0025	0.0029	0.0024	0.0032
L18	0.2606	0.5323	2720	0.0005	0.0010	0.0011	0.0015	0.0013	0.0019	0.0030	0.0024	0.0035
L19	0.2595	0.5289	2756	0.0004	0.0005	0.0011	0.0015	0.0013	0.0025	0.0029	0.0028	0.0028
L20	0.2607	0.5325	2717	0.0007	0.0004	0.0014	0.0009	0.0015	0.0022	0.0023	0.0031	0.0032
L21	0.2615	0.5313	2704	0.0005	0.0005	0.0012	0.0010	0.0018	0.0018	0.0029	0.0027	0.0027
L22	0.2612	0.5321	2707	0.0002	0.0003	0.0007	0.0015	0.0021	0.0020	0.0024	0.0027	0.0033
L23	0.2629	0.5325	2672	0.0006	0.0007	0.0006	0.0016	0.0017	0.0018	0.0017	0.0026	0.0031
L24	0.2631	0.5306	2675	0.0007	0.0005	0.0009	0.0017	0.0022	0.0024	0.0030	0.0027	0.0033
L25	0.2626	0.5318	2681	0.0003	0.0009	0.0005	0.0010	0.0017	0.0018	0.0025	0.0030	0.0026
L26	0.2624	0.5318	2685	0.0002	0.0006	0.0007	0.0012	0.0017	0.0020	0.0029	0.0030	0.0032
L27	0.2622	0.5288	2700	0.0004	0.0010	0.0014	0.0016	0.0012	0.0020	0.0028	0.0030	0.0034
L28	0.2608	0.5338	2709	0.0001	0.0010	0.0014	0.0009	0.0013	0.0019	0.0021	0.0024	0.0035
L29	0.2604	0.5324	2723	0.0002	0.0009	0.0006	0.0011	0.0017	0.0022	0.0029	0.0027	0.0027
L30	0.2623	0.5303	2693	0.0003	0.0008	0.0013	0.0009	0.0012	0.0019	0.0023	0.0026	0.0034
AV	0.2622	0.5319	2689	<b>0.0004</b>	<b>0.0007</b>	<b>0.0009</b>	<b>0.0012</b>	<b>0.0017</b>	<b>0.0020</b>	<b>0.0025</b>	<b>0.0027</b>	<b>0.0031</b>
Median	0.2623	0.5321	2686	0.0005	0.0007	0.0010	0.0012	0.0017	0.0019	0.0026	0.0027	0.0032
MIN	0.2595	0.5288	2634	0.0001	0.0003	0.0004	0.0007	0.0012	0.0014	0.0017	0.0024	0.0026
MAX	0.2648	0.5349	2756	<b>0.0007</b>	<b>0.0010</b>	<b>0.0014</b>	<b>0.0018</b>	<b>0.0022</b>	<b>0.0025</b>	<b>0.0030</b>	<b>0.0032</b>	<b>0.0035</b>
STDEV	0.0011	0.0013	24	0.0002	0.0002	0.0003	0.0003	0.0003	0.0003	0.0004	0.0003	0.0003
N	30	30	30	30	30	30	30	30	30	30	30	30

**5 Data Set 2: 85°C, 60 mA**

Description of Light Sources Tested:	RF-W2HV32DS-FF-N2
Case Temperature:	84.6°C
Ambient Temperature:	83.4°C
Drive Current:	60 mA
Measure Current:	59.9 mA
Failures Observed:	None

**Lumen Maintenance (%)**

Sample No.	VF(V)	Φ(lm)	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs	9000hrs
L31	18.55	122.9	99.99%	99.25%	99.04%	98.35%	97.93%	97.01%	96.87%	96.75%	96.63%
L32	18.46	119.5	100.09%	99.59%	99.21%	98.22%	97.68%	97.19%	97.00%	96.83%	96.59%
L33	18.39	119.6	99.95%	99.53%	99.04%	98.46%	97.89%	97.28%	97.21%	97.00%	96.89%
L34	18.47	119.6	100.00%	99.74%	99.10%	98.05%	97.64%	97.47%	97.30%	97.19%	97.00%
L35	18.32	122.0	99.82%	99.73%	98.72%	97.66%	97.24%	97.00%	96.92%	96.81%	96.65%
L36	18.17	118.8	99.97%	99.69%	98.63%	98.36%	97.86%	97.04%	96.95%	96.84%	96.67%
L37	18.45	119.9	99.86%	99.51%	98.86%	98.18%	98.00%	97.55%	97.42%	97.25%	97.10%
L38	18.29	122.1	99.91%	99.70%	99.38%	98.27%	97.74%	97.40%	97.22%	97.16%	96.89%
L39	18.35	120.4	99.99%	99.68%	99.02%	97.71%	97.48%	97.76%	97.58%	97.37%	97.23%
L40	18.16	120.3	99.99%	99.86%	99.05%	98.38%	98.05%	97.17%	97.01%	96.86%	96.57%
L41	18.21	119.5	99.83%	99.23%	98.93%	97.63%	97.31%	97.01%	96.92%	96.70%	96.55%
L42	18.40	121.9	99.97%	99.55%	99.04%	97.79%	97.32%	97.15%	96.99%	96.78%	96.59%
L43	18.32	123.6	99.95%	99.42%	99.04%	98.14%	97.77%	97.26%	97.89%	97.65%	97.49%
L44	18.20	121.2	100.00%	99.62%	99.06%	98.04%	97.75%	97.35%	97.15%	97.00%	96.80%
L45	18.22	120.6	99.91%	99.73%	98.93%	97.70%	97.58%	97.43%	97.29%	97.21%	96.96%
L46	18.18	118.0	100.01%	99.56%	99.06%	97.90%	97.79%	97.23%	97.18%	97.01%	96.88%
L47	18.43	122.4	99.95%	99.51%	99.00%	98.39%	97.95%	97.27%	97.20%	97.00%	96.90%
L48	18.45	120.3	100.02%	99.75%	99.58%	98.68%	98.29%	97.44%	97.30%	97.23%	97.03%
L49	18.22	123.3	99.91%	99.36%	99.15%	98.25%	97.85%	97.68%	97.46%	97.32%	97.19%
L50	18.34	118.5	99.85%	99.47%	99.05%	98.38%	98.08%	97.64%	97.43%	97.36%	97.15%
L51	18.26	123.1	99.97%	99.20%	99.09%	98.63%	98.20%	97.70%	97.29%	96.88%	96.68%
L52	18.26	117.6	100.05%	99.76%	99.46%	98.71%	98.49%	97.43%	97.17%	96.85%	96.72%
L53	18.45	122.2	100.02%	99.82%	99.21%	97.71%	97.55%	97.14%	96.95%	96.86%	96.72%
L54	18.26	123.7	100.00%	99.46%	98.91%	98.12%	97.98%	97.48%	97.19%	96.97%	96.81%
L55	18.43	119.4	100.07%	99.50%	98.88%	97.97%	97.76%	97.03%	96.88%	96.65%	96.51%
L56	18.18	117.6	99.93%	99.74%	99.13%	98.54%	98.29%	97.69%	97.56%	97.38%	97.25%
L57	18.36	119.3	100.14%	99.78%	99.28%	98.16%	97.88%	97.53%	97.22%	97.08%	96.94%
L58	18.23	125.6	100.10%	99.83%	99.21%	98.75%	98.11%	97.73%	97.61%	97.51%	97.29%
L59	18.32	120.6	100.07%	99.54%	99.04%	98.07%	97.64%	97.43%	97.17%	97.11%	96.92%
L60	18.31	123.1	100.01%	99.48%	99.16%	98.17%	97.70%	97.35%	97.27%	96.92%	96.79%
AV	18.32	120.9	<b>99.98%</b>	<b>99.59%</b>	<b>99.08%</b>	<b>98.18%</b>	<b>97.83%</b>	<b>97.36%</b>	<b>97.22%</b>	<b>97.05%</b>	<b>96.88%</b>
Median	18.32	120.5	99.99%	99.58%	99.05%	98.18%	97.82%	97.38%	97.21%	97.00%	96.89%
MIN	18.16	117.6	99.82%	99.20%	98.63%	97.63%	97.24%	97.00%	96.87%	96.65%	96.51%
MAX	18.55	125.6	100.14%	99.86%	99.58%	98.75%	98.49%	97.76%	97.89%	97.65%	97.49%
STDEV	0.1079	2.0253	0.0008	0.0018	0.0020	0.0032	0.0030	0.0023	0.0024	0.0025	0.0025
N	30	30	30	30	30	30	30	30	30	30	30

Description of Light Sources Tested:	RF-W2HV32DS-FF-N2
Case Temperature:	84.6°C
Ambient Temperature:	83.4°C
Drive Current:	60 mA
Measure Current:	59.9 mA
Failures Observed:	None

**Chromaticity Shift ( $\Delta u'v'$ )**

Sample No.	$u'$	$v'$	CCT(K)	1000 hrs	2000 hrs	3000 hrs	4000 hrs	5000 hrs	6000 hrs	7000 hrs	8000 hrs	9000 hrs
L31	0.2623	0.5342	2678	0.0006	0.0014	0.0017	0.0016	0.0026	0.0028	0.0027	0.0037	0.0033
L32	0.2634	0.5319	2665	0.0007	0.0004	0.0018	0.0009	0.0020	0.0030	0.0034	0.0032	0.0033
L33	0.2639	0.5324	2652	0.0008	0.0008	0.0014	0.0016	0.0024	0.0023	0.0030	0.0033	0.0034
L34	0.2625	0.5321	2681	0.0008	0.0013	0.0008	0.0008	0.0025	0.0023	0.0026	0.0029	0.0033
L35	0.2622	0.5311	2692	0.0004	0.0012	0.0007	0.0017	0.0020	0.0030	0.0030	0.0036	0.0035
L36	0.2636	0.5325	2657	0.0007	0.0014	0.0015	0.0012	0.0027	0.0022	0.0027	0.0030	0.0038
L37	0.2627	0.5323	2677	0.0009	0.0014	0.0016	0.0016	0.0025	0.0025	0.0034	0.0036	0.0040
L38	0.2606	0.5334	2715	0.0003	0.0006	0.0012	0.0010	0.0019	0.0022	0.0030	0.0035	0.0039
L39	0.2613	0.5318	2707	0.0004	0.0011	0.0013	0.0018	0.0027	0.0029	0.0027	0.0033	0.0034
L40	0.2645	0.5318	2643	0.0006	0.0005	0.0018	0.0019	0.0016	0.0021	0.0034	0.0030	0.0037
L41	0.2614	0.5307	2709	0.0002	0.0005	0.0014	0.0012	0.0016	0.0021	0.0026	0.0033	0.0041
L42	0.2632	0.5342	2660	0.0006	0.0013	0.0016	0.0010	0.0025	0.0029	0.0033	0.0036	0.0033
L43	0.2590	0.5334	2747	0.0007	0.0007	0.0015	0.0014	0.0023	0.0024	0.0032	0.0033	0.0034
L44	0.2628	0.5327	2673	0.0008	0.0009	0.0012	0.0009	0.0024	0.0023	0.0029	0.0030	0.0034
L45	0.2606	0.5313	2724	0.0006	0.0012	0.0008	0.0017	0.0025	0.0026	0.0026	0.0035	0.0035
L46	0.2643	0.5311	2648	0.0006	0.0014	0.0012	0.0016	0.0020	0.0023	0.0028	0.0032	0.0036
L47	0.2628	0.5310	2680	0.0007	0.0014	0.0015	0.0013	0.0026	0.0025	0.0033	0.0034	0.0038
L48	0.2611	0.5288	2724	0.0008	0.0010	0.0013	0.0020	0.0023	0.0024	0.0032	0.0036	0.0036
L49	0.2591	0.5336	2746	0.0003	0.0009	0.0012	0.0011	0.0019	0.0025	0.0028	0.0033	0.0041
L50	0.2625	0.5320	2681	0.0005	0.0008	0.0016	0.0019	0.0018	0.0027	0.0028	0.0037	0.0035
L51	0.2617	0.5349	2687	0.0006	0.0004	0.0011	0.0020	0.0016	0.0025	0.0035	0.0034	0.0036
L52	0.2612	0.5327	2706	0.0007	0.0015	0.0011	0.0019	0.0018	0.0022	0.0034	0.0038	0.0039
L53	0.2611	0.5319	2711	0.0003	0.0007	0.0018	0.0017	0.0022	0.0019	0.0033	0.0038	0.0040
L54	0.2615	0.5344	2693	0.0006	0.0015	0.0013	0.0013	0.0015	0.0019	0.0033	0.0036	0.0034
L55	0.2625	0.5321	2682	0.0007	0.0007	0.0016	0.0016	0.0019	0.0030	0.0028	0.0032	0.0033
L56	0.2628	0.5340	2668	0.0008	0.0013	0.0007	0.0019	0.0018	0.0024	0.0033	0.0034	0.0037
L57	0.2623	0.5330	2683	0.0009	0.0011	0.0018	0.0014	0.0021	0.0021	0.0033	0.0034	0.0033
L58	0.2604	0.5352	2711	0.0008	0.0011	0.0006	0.0013	0.0024	0.0021	0.0032	0.0037	0.0031
L59	0.2621	0.5309	2693	0.0008	0.0012	0.0014	0.0018	0.0019	0.0025	0.0032	0.0030	0.0032
L60	0.2623	0.5343	2678	0.0008	0.0008	0.0010	0.0012	0.0021	0.0029	0.0027	0.0030	0.0033
AV	0.2621	0.5325	2689	<b>0.0006</b>	<b>0.0010</b>	<b>0.0013</b>	<b>0.0015</b>	<b>0.0021</b>	<b>0.0025</b>	<b>0.0030</b>	<b>0.0034</b>	<b>0.0036</b>
Median	0.2623	0.5324	2683	0.0007	0.0011	0.0014	0.0016	0.0021	0.0024	0.0031	0.0034	0.0035
MIN	0.2590	0.5288	2643	0.0002	0.0004	0.0006	0.0008	0.0015	0.0019	0.0026	0.0029	0.0031
MAX	0.2645	0.5352	2747	<b>0.0009</b>	<b>0.0015</b>	<b>0.0018</b>	<b>0.0020</b>	<b>0.0027</b>	<b>0.0030</b>	<b>0.0035</b>	<b>0.0038</b>	<b>0.0041</b>
STDEV	0.0013	0.0014	27	0.0002	0.0003	0.0004	0.0004	0.0004	0.0003	0.0003	0.0003	0.0003
N	30	30	30	30	30	30	30	30	30	30	30	30

**6 Data Set 3: 105°C, 60 mA**

Description of Light Sources Tested:	RF-W2HV32DS-FF-N2
Case Temperature:	104.5°C
Ambient Temperature:	103.5°C
Drive Current:	60 mA
Measure Current:	59.9 mA
Failures Observed:	None

**Lumen Maintenance (%)**

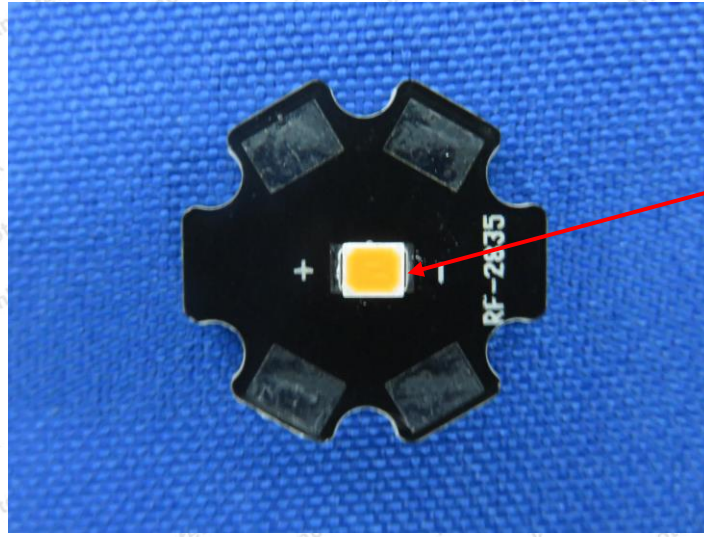
Sample No.	VF(V)	Φ(lm)	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs	9000hrs
L61	18.49	119.9	99.87%	99.27%	98.75%	97.29%	96.90%	96.58%	96.52%	96.48%	95.86%
L62	18.44	121.6	99.68%	99.51%	98.22%	97.08%	96.79%	96.65%	96.56%	96.50%	95.65%
L63	18.17	122.8	99.63%	99.55%	98.39%	97.11%	96.98%	96.89%	96.75%	96.69%	95.53%
L64	18.33	125.7	99.95%	99.26%	98.34%	97.29%	96.95%	96.77%	96.65%	96.45%	96.02%
L65	18.40	121.7	99.73%	99.57%	98.52%	97.86%	96.39%	96.22%	96.10%	96.00%	96.35%
L66	18.41	122.5	99.84%	99.34%	98.88%	97.43%	96.99%	96.81%	96.74%	96.58%	96.47%
L67	18.30	121.4	99.57%	99.03%	98.74%	97.09%	96.80%	96.69%	96.61%	95.99%	95.78%
L68	18.44	120.4	99.78%	99.33%	98.25%	97.02%	96.75%	96.62%	96.59%	96.46%	95.50%
L69	18.21	118.8	99.87%	99.59%	98.75%	97.03%	96.63%	96.58%	96.50%	96.31%	95.68%
L70	18.22	124.2	99.82%	99.55%	98.47%	97.17%	96.31%	96.10%	95.99%	95.89%	95.73%
L71	18.18	120.9	99.35%	99.15%	98.79%	97.22%	96.82%	96.58%	96.50%	96.37%	95.72%
L72	18.25	122.0	99.65%	99.22%	98.31%	97.11%	96.85%	96.59%	96.49%	96.25%	95.59%
L73	18.31	123.2	99.67%	99.40%	98.38%	97.23%	96.79%	96.60%	96.51%	96.39%	95.98%
L74	18.27	120.7	99.80%	99.26%	98.45%	97.29%	96.81%	96.66%	96.62%	96.55%	96.25%
L75	18.40	123.9	99.84%	99.49%	98.72%	97.59%	97.12%	96.75%	96.62%	96.34%	96.02%
L76	18.23	120.5	99.68%	99.29%	98.79%	97.27%	96.77%	96.59%	96.50%	96.38%	96.10%
L77	18.43	122.3	99.68%	99.30%	98.33%	97.05%	96.79%	96.67%	96.59%	96.28%	95.98%
L78	18.35	122.8	99.83%	99.57%	98.48%	97.03%	96.76%	96.55%	96.46%	96.33%	96.01%
L79	18.30	123.4	99.84%	99.49%	98.63%	97.16%	96.51%	96.43%	96.32%	96.21%	95.90%
L80	18.28	120.3	99.75%	99.24%	98.59%	97.22%	96.69%	96.58%	96.47%	96.18%	95.87%
L81	18.13	119.8	99.92%	99.39%	98.40%	97.47%	96.98%	96.84%	96.75%	96.46%	96.23%
L82	18.23	123.7	99.62%	99.48%	98.80%	97.30%	96.95%	96.80%	96.69%	96.53%	96.46%
L83	18.41	121.4	99.84%	99.71%	98.47%	97.76%	96.97%	96.78%	96.71%	96.57%	96.37%
L84	18.20	122.0	99.69%	99.05%	98.80%	97.05%	96.58%	96.33%	96.25%	96.06%	95.89%
L85	18.42	122.6	99.89%	99.28%	98.89%	97.31%	96.72%	96.57%	96.48%	96.17%	95.88%
L86	18.38	123.7	99.62%	99.14%	98.38%	97.51%	96.69%	96.52%	96.42%	96.22%	96.05%
L87	18.26	124.5	99.67%	99.09%	98.19%	97.28%	96.89%	96.71%	96.66%	96.51%	96.35%
L88	18.24	121.7	99.80%	99.22%	98.70%	97.45%	96.76%	96.66%	96.61%	96.39%	95.49%
L89	18.40	125.5	99.95%	99.31%	98.82%	97.36%	96.34%	96.11%	96.00%	95.89%	95.85%
L90	18.36	121.9	99.65%	99.41%	99.05%	97.41%	96.80%	96.63%	96.52%	96.36%	96.28%
AV	18.31	122.2	<b>99.75%</b>	<b>99.35%</b>	<b>98.58%</b>	<b>97.28%</b>	<b>96.77%</b>	<b>96.60%</b>	<b>96.51%</b>	<b>96.33%</b>	<b>95.96%</b>
Median	18.31	122.0	99.77%	99.32%	98.56%	97.28%	96.79%	96.61%	96.52%	96.37%	95.94%
MIN	18.13	118.8	99.35%	99.03%	98.19%	97.02%	96.31%	96.10%	95.99%	95.89%	95.49%
MAX	18.49	125.7	99.95%	99.71%	99.05%	97.86%	97.12%	96.89%	96.75%	96.69%	96.47%
STDEV	0.0967	1.6799	0.0013	0.0017	0.0023	0.0021	0.0019	0.0019	0.0020	0.0021	0.0029
N	30	30	30	30	30	30	30	30	30	30	30

Description of Light Sources Tested:	RF-W2HV32DS-FF-N2
Case Temperature:	104.5°C
Ambient Temperature:	103.5°C
Drive Current:	60 mA
Measure Current:	59.9 mA
Failures Observed:	None

**Chromaticity Shift ( $\Delta u'v'$ )**

Sample No.	$u'$	$v'$	CCT(K)	1000 hrs	2000 hrs	3000 hrs	4000 hrs	5000 hrs	6000 hrs	7000 hrs	8000 hrs	9000 hrs
L61	0.2659	0.5333	2611	0.0004	0.0013	0.0013	0.0028	0.0032	0.0036	0.0041	0.0044	0.0044
L62	0.2606	0.5319	2721	0.0009	0.0017	0.0018	0.0018	0.0028	0.0033	0.0035	0.0044	0.0040
L63	0.2616	0.5328	2698	0.0008	0.0015	0.0013	0.0019	0.0026	0.0036	0.0036	0.0037	0.0041
L64	0.2629	0.5385	2650	0.0004	0.0012	0.0022	0.0022	0.0025	0.0036	0.0031	0.0043	0.0044
L65	0.2642	0.5331	2644	0.0007	0.0019	0.0023	0.0022	0.0023	0.0030	0.0039	0.0034	0.0045
L66	0.2617	0.5338	2692	0.0009	0.0015	0.0011	0.0018	0.0033	0.0030	0.0041	0.0038	0.0040
L67	0.2611	0.5307	2715	0.0012	0.0011	0.0014	0.0027	0.0022	0.0028	0.0040	0.0043	0.0042
L68	0.2633	0.5338	2660	0.0008	0.0017	0.0014	0.0023	0.0031	0.0035	0.0035	0.0035	0.0040
L69	0.2634	0.5304	2671	0.0010	0.0010	0.0014	0.0024	0.0031	0.0033	0.0039	0.0044	0.0044
L70	0.2614	0.5338	2698	0.0005	0.0014	0.0020	0.0024	0.0030	0.0032	0.0036	0.0043	0.0042
L71	0.2613	0.5328	2702	0.0003	0.0012	0.0012	0.0026	0.0022	0.0035	0.0041	0.0041	0.0042
L72	0.2611	0.5356	2696	0.0009	0.0016	0.0015	0.0025	0.0029	0.0035	0.0039	0.0044	0.0043
L73	0.2615	0.5333	2697	0.0009	0.0016	0.0016	0.0018	0.0027	0.0034	0.0035	0.0039	0.0040
L74	0.2631	0.5302	2677	0.0007	0.0013	0.0015	0.0021	0.0025	0.0036	0.0038	0.0043	0.0044
L75	0.2600	0.5325	2730	0.0005	0.0017	0.0023	0.0022	0.0023	0.0033	0.0035	0.0036	0.0045
L76	0.2615	0.5320	2702	0.0008	0.0016	0.0012	0.0022	0.0031	0.0030	0.0040	0.0044	0.0041
L77	0.2630	0.5327	2668	0.0009	0.0012	0.0013	0.0022	0.0028	0.0030	0.0040	0.0038	0.0040
L78	0.2608	0.5332	2712	0.0012	0.0014	0.0014	0.0023	0.0022	0.0028	0.0039	0.0042	0.0041
L79	0.2621	0.5364	2674	0.0009	0.0014	0.0014	0.0024	0.0031	0.0034	0.0041	0.0036	0.0042
L80	0.2629	0.5279	2690	0.0008	0.0010	0.0015	0.0024	0.0031	0.0033	0.0036	0.0043	0.0043
L81	0.2617	0.5314	2700	0.0010	0.0012	0.0021	0.0027	0.0021	0.0027	0.0035	0.0038	0.0042
L82	0.2620	0.5336	2685	0.0003	0.0012	0.0021	0.0020	0.0021	0.0037	0.0033	0.0043	0.0043
L83	0.2617	0.5326	2696	0.0009	0.0021	0.0013	0.0028	0.0021	0.0027	0.0040	0.0037	0.0038
L84	0.2607	0.5297	2728	0.0008	0.0009	0.0018	0.0021	0.0031	0.0037	0.0030	0.0041	0.0040
L85	0.2619	0.5331	2690	0.0003	0.0014	0.0013	0.0027	0.0023	0.0029	0.0039	0.0036	0.0039
L86	0.2597	0.5333	2734	0.0011	0.0020	0.0020	0.0019	0.0025	0.0030	0.0035	0.0040	0.0046
L87	0.2626	0.5349	2669	0.0010	0.0015	0.0018	0.0021	0.0022	0.0037	0.0036	0.0035	0.0046
L88	0.2627	0.5331	2675	0.0007	0.0018	0.0021	0.0028	0.0030	0.0037	0.0031	0.0035	0.0039
L89	0.2605	0.5352	2711	0.0010	0.0017	0.0011	0.0021	0.0020	0.0036	0.0032	0.0037	0.0044
L90	0.2619	0.5356	2680	0.0010	0.0012	0.0022	0.0026	0.0029	0.0035	0.0035	0.0038	0.0045
AV	0.2620	0.5330	2689	<b>0.0008</b>	<b>0.0014</b>	<b>0.0016</b>	<b>0.0023</b>	<b>0.0026</b>	<b>0.0033</b>	<b>0.0037</b>	<b>0.0040</b>	<b>0.0042</b>
Median	0.2617	0.5331	2694	0.0009	0.0014	0.0015	0.0023	0.0027	0.0034	0.0036	0.0040	0.0042
MIN	0.2639	0.5285	2669	0.0003	0.0009	0.0011	0.0018	0.0020	0.0027	0.0030	0.0034	0.0038
MAX	0.2659	0.5385	2734	<b>0.0012</b>	<b>0.0021</b>	<b>0.0023</b>	<b>0.0028</b>	<b>0.0033</b>	<b>0.0037</b>	<b>0.0041</b>	<b>0.0044</b>	<b>0.0046</b>
STDEV	0.0013	0.0021	27	0.0003	0.0003	0.0004	0.0003	0.0004	0.0003	0.0003	0.0003	0.0002
N	30	30	30	30	30	30	30	30	30	30	30	30

## 7 Product Photo



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\*\*\*\*\*END OF TEST REPORT\*\*\*\*\*