

Measuring Lumen Maintenance of LED Light Sources

Manufacturer : LG Innotek Co., Ltd.

Wollong Industry complex, Naepo-ri, Munsan-eup, Paju-city
Gyeonggi-Province, 413-901 Korea

Product Type : LED package

Model Name : LGIT 5630HE Package

Model Number : LEMWS59R Series

Tested Part Number : LEMWS59R80LZ3BB0 (Nominal CCT : 3000 K)

Report Number : KILT1401-U00009-6 (Revision_2.0)

Test Date : November 25th, 2013 through April 14th, 2015

Report Date : April 16th, 2015

Testing Laboratory : Korea Institute of Lighting Technology

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Test Summary

Required Temperature	Number of LED Packages	Drive Current	Actual Ts	Actual Ta	Average Lumen Maintenance at 12,000 H'rs	Average Chromaticity Shift at 12,000 H'rs
55.0 °C	25	0.2 A	54.9 °C	54.7 °C	97.79 %	0.0012
85.0 °C	25	0.2 A	85.0 °C	84.8 °C	97.08 %	0.0018
105.0 °C	25	0.2 A	105.2 °C	104.9 °C	93.78 %	0.0029

IES TM-21-11 Report (Rev. 08.28.14) : Calculator results have been validated by NIST

Table 1 : Report at each LM-80 Test Condition

Test Condition 1 - 54.9°C Case Temp		Test Condition 2 - 85°C Case Temp		Test Condition 3 - 105.2°C Case Temp	
Sample size	25	Sample size	25	Sample size	25
DUT drive current used in the test (mA)	200	DUT drive current used in the test (mA)	200	DUT drive current used in the test (mA)	200
Test duration (hours)	12,000	Test duration (hours)	12,000	Test duration (hours)	12,000
Test duration used for projection (hour to hour)	6,000 - 12,000	Test duration used for projection (hour to hour)	6,000 - 12,000	Test duration used for projection (hour to hour)	6,000 - 12,000
Tested case temperature (°C)	54.9	Tested case temperature (°C)	85.0	Tested case temperature (°C)	105.2
Reported L70(12k) (hours)	>72000	Reported L70(12k) (hours)	>72000	Reported L70(12k) (hours)	45,000



General Information : IES LM-80-08 Test Report Requirement

1. Number of LED light sources tested

- 25 Packages tested at actual case temperature 54.9 °C
- 25 Packages tested at actual case temperature 85.0 °C
- 25 Packages tested at actual case temperature 105.2 °C

Samples have been selected to be representative of the overall population being tested.

2. Applicable LEMWS59R Series part numbers

Part Number	Nominal CCT	Part Number	Nominal CCT
LEMWS59R**MZ****	2700 K	LEMWS59R**HZ****	5000 K
LEMWS59R**LZ****	3000 K	LEMWS59R**GZ****	5700 K
LEMWS59R**KZ****	3500 K	LEMWS59R**FZ****	6500 K
LEMWS59R**JZ****	4000 K		

3. Description of LED light sources

- LG Innotek LED Package : LGIT 5630HE Package

$I_f = 0.2 \text{ A}$ CCT (Nominal) = 3000 K

- Package Dimension : 5.6 mm X 5.0 mm

4. Description of auxiliary equipment

- Temperature controlling chamber for LED package/array/module

This chamber consists of the water cooling heat-sink plates to control the case temperature of each device and the power supply required by LM-80 test conditions.

- Photometric measurement tester for LED package/array/module

This test equipment consists of the integrating sphere in conjunction with the temperature controlling plate and programmable current-source meter.

5. Operating Cycle

- Number of units : 25 at 54.9 °C / 25 at 85.0 °C / 25 at 105.2 °C
- Drive current : 0.2 A
- Typical Voltage : 3.1 V

LED packages are driven with a constant direct current.

6. Ambient Conditions including airflow, temperature and relative humidity

- Case temperature: controlled to -2 °C
- Surrounding air temperature: controlled to -5 °C
- Relative humidity: < 65 RH

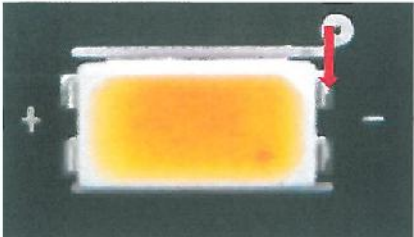
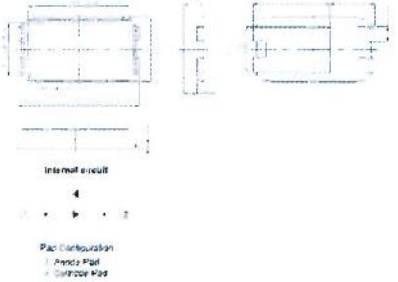
The minimal airflow is maintained in chamber. The ambient temperature around the LED packages inside chamber is controlled by air flowing and the thermocouple readings are monitored.

7. Standards Used

- IESNA LM-80-08 : IES Approved Method for Measuring Lumen Maintenance of LED Lights Sources.
- ENERGY STAR Program Guidance Regarding LED package, LED Array and Module Lumen Maintenance Performance Data Supporting Qualification of Lighting Products.

8. Case Temperature (Test Point Temperature)

- LED temperature measurement point is shown in the picture below.

TEST POINT	PKG DIMENSION
	

9. Drive Current of the LED light source during lifetime test

- See sub-clause Test Data 1, 2 and 3

10. Lumen Maintenance data and Chromaticity shift reported over the measurement

- See each table.

During the test of luminous flux and chromaticity, ambient temperature was set to 25 °C ± 2 °C.

11. Observation of Failures

- No optical, electrical or mechanical failure of any LED Package was seen during the lifetime testing

12. LED Light source monitoring interval

- Measurements have been taken after the following durations:

T_s = 54.9 °C

0, 500, 1000, 2000, 3000, 4000, 5000, 6000, 7000, 8000, 9000, 10000, 11000 and 12000 hours

T_s = 85.0 °C

0, 500, 1000, 2000, 3000, 4000, 5000, 6000, 7000, 8000, 9000, 10000, 11000 and 12000 hours

T_s = 105.2 °C

0, 500, 1000, 2000, 3000, 4000, 5000, 6000, 7000, 8000, 9000, 10000, 11000 and 12000 hours

13. Photometric Measurement Uncertainty

- The testers are calibrated monthly and the calibration data ensures ±2 % uncertainty of measurement.

Test Data

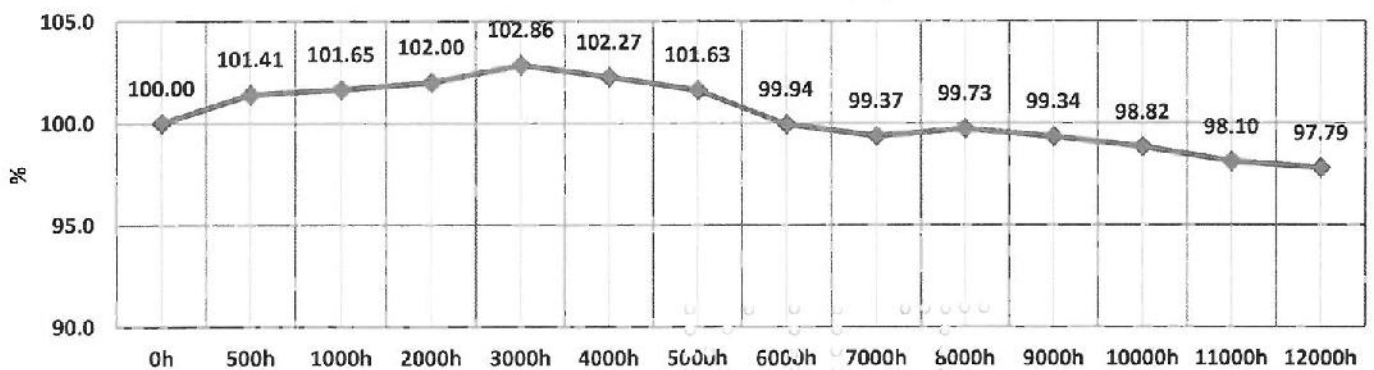
1. TEST CONDITION 1 [54.9 °C , If = 0.2 A]

- Measurement Current : 0.2 A

[LUMEN MAINTENANCE]

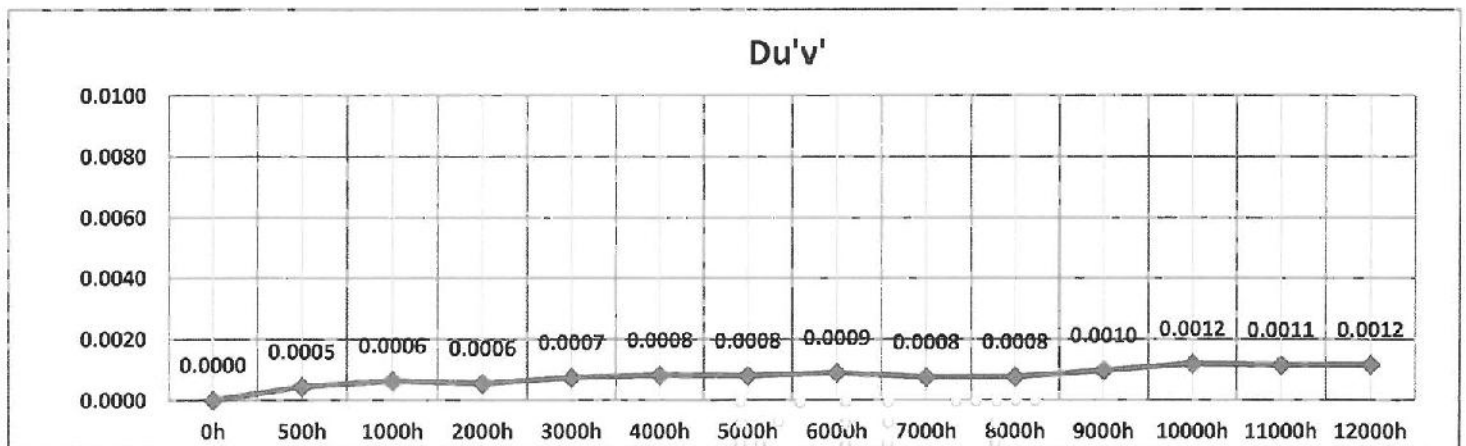
No.	Φ_v	V_f	Lumen Maintenance [%]														
	[lm]	[V]	0h (Initial)	0h	500h	1000h	2000h	3000h	4000h	5000h	6000h	7000h	8000h	9000h	10000h	11000h	12000h
1	77.4	3.3	100.00	101.26	101.54	101.93	102.79	102.15	101.59	99.90	99.47	99.95	99.61	99.11	98.39	98.07	
2	76.6	3.3	100.00	101.49	101.62	101.94	102.76	102.21	101.38	99.88	99.18	99.59	99.15	98.61	97.88	97.55	
3	76.2	3.4	100.00	101.43	101.83	102.00	102.94	102.28	101.75	100.09	99.53	99.95	99.41	98.88	98.22	97.97	
4	75.1	3.3	100.00	101.55	101.78	102.22	103.15	102.46	101.84	100.08	99.48	99.79	99.44	98.93	98.04	97.89	
5	77.1	3.3	100.00	101.23	101.36	101.79	102.76	102.03	101.30	99.83	99.05	99.44	99.04	98.49	97.97	97.60	
6	76.4	3.4	100.00	101.30	101.61	102.05	102.92	102.41	101.89	100.29	99.89	100.38	99.89	99.36	98.87	98.53	
7	75.4	3.3	100.00	101.63	101.76	101.79	103.10	102.71	101.98	100.22	99.61	99.88	99.63	99.14	98.54	98.08	
8	76.9	3.3	100.00	101.47	101.61	102.00	103.05	102.49	101.98	100.24	99.71	99.91	99.54	99.03	98.47	98.07	
9	76.9	3.3	100.00	101.42	101.74	102.17	102.97	102.35	101.72	99.97	99.47	99.90	99.58	99.07	98.36	98.01	
10	76.4	3.4	100.00	101.37	101.50	101.91	102.95	102.39	101.56	99.95	99.26	99.67	99.23	98.73	98.08	97.71	
11	76.5	3.4	100.00	101.30	101.54	102.06	102.95	102.47	101.95	100.14	99.78	100.10	99.66	99.23	98.70	98.29	
12	76.7	3.3	100.00	101.67	101.85	102.24	101.71	101.24	100.65	98.96	98.42	98.84	98.55	98.05	97.39	96.99	
13	77.1	3.3	100.00	101.04	101.34	101.55	102.48	101.87	101.07	99.49	98.71	99.11	98.41	97.87	97.15	96.85	
14	74.7	3.3	100.00	101.59	101.90	102.33	103.25	102.68	102.11	100.43	99.74	100.09	99.53	98.94	98.28	97.88	
15	74.6	3.4	100.00	101.57	101.74	102.18	103.20	102.49	101.94	100.22	99.70	100.01	99.71	99.10	98.43	98.08	
16	76.4	3.4	100.00	101.59	101.92	102.32	103.01	102.43	101.80	100.06	99.60	99.95	99.70	99.19	98.42	98.16	
17	76.8	3.3	100.00	101.55	101.72	102.13	102.98	102.29	101.58	100.09	99.46	99.89	99.56	99.12	98.38	98.09	
18	75.4	3.3	100.00	101.50	101.79	102.21	102.98	102.41	101.90	100.23	99.73	100.19	99.69	99.23	98.53	98.32	
19	77.0	3.3	100.00	101.27	101.40	101.77	102.72	102.35	101.52	99.73	99.28	99.64	99.33	98.82	98.01	97.80	
20	76.4	3.3	100.00	101.22	101.38	101.75	102.65	102.00	101.43	99.64	99.09	99.25	98.89	98.34	97.53	97.31	
21	76.3	3.3	100.00	101.45	101.78	102.17	102.91	102.25	101.65	99.88	99.36	99.78	99.44	98.85	97.79	97.71	
22	77.0	3.3	100.00	101.52	101.77	102.07	103.01	102.38	101.55	99.72	99.14	99.45	99.08	98.56	97.71	97.42	
23	77.5	3.3	100.00	100.95	101.40	101.57	102.51	101.88	101.40	99.61	99.07	99.27	98.89	98.37	97.59	97.34	
24	76.8	3.3	100.00	101.41	101.63	102.02	102.77	102.19	101.50	99.73	99.24	99.59	99.25	98.77	97.83	97.55	
25	75.5	3.4	100.00	101.37	101.63	101.95	102.91	102.34	101.66	100.16	99.36	99.70	99.33	98.78	97.85	97.56	
Ave.	76.4	3.3	100.00	101.41	101.65	102.00	102.86	102.27	101.63	99.94	99.37	99.73	99.34	98.82	98.10	97.79	
Med.	76.5	3.3	100.00	101.43	101.63	102.02	102.94	102.35	101.65	99.97	99.46	99.79	99.44	98.88	98.08	97.88	
σ	0.8	0.0	0.00	0.17	0.17	0.21	0.30	0.30	0.32	0.31	0.34	0.35	0.36	0.37	0.42	0.40	
Min.	74.6	3.3	100.00	100.95	101.34	101.55	101.71	101.24	100.65	98.96	98.42	98.84	98.41	97.87	97.15	96.85	
Max	77.5	3.4	100.00	101.67	101.92	102.33	103.25	102.71	102.11	100.43	99.89	100.38	99.89	99.36	98.87	98.53	

Lumen Maintenance (%)



[CHROMATICITY SHIFT]

No.	CCT [K]	Chromaticity Shift $\Delta u'v'$													
		0h (Initial)	0h	500h	1000h	2000h	3000h	4000h	5000h	6000h	7000h	8000h	9000h	10000h	11000h
1	2914	0.0000	0.0004	0.0006	0.0005	0.0007	0.0008	0.0008	0.0009	0.0008	0.0008	0.0011	0.0013	0.0012	0.0012
2	2897	0.0000	0.0005	0.0006	0.0005	0.0007	0.0009	0.0009	0.0010	0.0007	0.0007	0.0010	0.0011	0.0011	0.0011
3	2940	0.0000	0.0004	0.0007	0.0005	0.0008	0.0008	0.0009	0.0009	0.0008	0.0008	0.0010	0.0012	0.0012	0.0013
4	2922	0.0000	0.0004	0.0006	0.0006	0.0008	0.0009	0.0009	0.0010	0.0008	0.0009	0.0011	0.0014	0.0013	0.0014
5	2910	0.0000	0.0004	0.0006	0.0005	0.0008	0.0008	0.0008	0.0009	0.0007	0.0007	0.0010	0.0012	0.0012	0.0012
6	2902	0.0000	0.0004	0.0006	0.0006	0.0007	0.0009	0.0009	0.0010	0.0009	0.0009	0.0011	0.0013	0.0014	0.0014
7	2927	0.0000	0.0005	0.0006	0.0007	0.0007	0.0009	0.0008	0.0009	0.0008	0.0009	0.0011	0.0013	0.0013	0.0013
8	2921	0.0000	0.0006	0.0007	0.0006	0.0009	0.0010	0.0009	0.0010	0.0008	0.0008	0.0010	0.0012	0.0012	0.0012
9	2922	0.0000	0.0004	0.0006	0.0006	0.0008	0.0008	0.0008	0.0009	0.0008	0.0008	0.0011	0.0013	0.0012	0.0012
10	2892	0.0000	0.0004	0.0005	0.0005	0.0007	0.0008	0.0007	0.0009	0.0007	0.0007	0.0009	0.0012	0.0011	0.0011
11	2919	0.0000	0.0004	0.0007	0.0006	0.0008	0.0009	0.0009	0.0010	0.0009	0.0008	0.0010	0.0012	0.0013	0.0013
12	2920	0.0000	0.0006	0.0007	0.0006	0.0007	0.0007	0.0006	0.0007	0.0005	0.0006	0.0008	0.0010	0.0009	0.0009
13	2933	0.0000	0.0004	0.0007	0.0005	0.0007	0.0008	0.0007	0.0008	0.0006	0.0006	0.0007	0.0009	0.0008	0.0008
14	2892	0.0000	0.0004	0.0006	0.0005	0.0007	0.0008	0.0009	0.0010	0.0008	0.0009	0.0010	0.0012	0.0013	0.0013
15	2899	0.0000	0.0004	0.0005	0.0005	0.0007	0.0007	0.0008	0.0008	0.0008	0.0008	0.0010	0.0012	0.0012	0.0012
16	2901	0.0000	0.0004	0.0006	0.0006	0.0007	0.0007	0.0007	0.0008	0.0007	0.0007	0.0009	0.0012	0.0011	0.0011
17	2928	0.0000	0.0005	0.0007	0.0006	0.0009	0.0009	0.0008	0.0010	0.0008	0.0008	0.0010	0.0013	0.0012	0.0012
18	2892	0.0000	0.0005	0.0007	0.0006	0.0008	0.0008	0.0009	0.0010	0.0008	0.0009	0.0010	0.0012	0.0012	0.0013
19	2943	0.0000	0.0007	0.0009	0.0008	0.0007	0.0009	0.0008	0.0009	0.0007	0.0007	0.0010	0.0012	0.0011	0.0012
20	2912	0.0000	0.0004	0.0005	0.0004	0.0007	0.0008	0.0008	0.0009	0.0008	0.0007	0.0010	0.0012	0.0011	0.0011
21	2911	0.0000	0.0005	0.0007	0.0006	0.0008	0.0008	0.0008	0.0008	0.0007	0.0007	0.0010	0.0012	0.0011	0.0011
22	2899	0.0000	0.0005	0.0006	0.0005	0.0008	0.0009	0.0008	0.0008	0.0007	0.0007	0.0009	0.0011	0.0011	0.0011
23	2922	0.0000	0.0004	0.0006	0.0005	0.0007	0.0007	0.0008	0.0008	0.0007	0.0007	0.0009	0.0011	0.0010	0.0010
24	2947	0.0000	0.0005	0.0007	0.0006	0.0007	0.0008	0.0008	0.0009	0.0007	0.0007	0.0010	0.0011	0.0010	0.0010
25	2893	0.0000	0.0004	0.0006	0.0005	0.0007	0.0008	0.0007	0.0009	0.0007	0.0007	0.0010	0.0012	0.0011	0.0011
Ave.	2914	0.0000	0.0005	0.0006	0.0006	0.0007	0.0008	0.0008	0.0009	0.0008	0.0008	0.0010	0.0012	0.0011	0.0012
Med.	2914	0.0000	0.0004	0.0006	0.0006	0.0007	0.0008	0.0008	0.0009	0.0008	0.0007	0.0010	0.0012	0.0012	0.0012
σ	16	0.0000	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Min.	2892	0.0000	0.0004	0.0005	0.0004	0.0007	0.0007	0.0006	0.0007	0.0005	0.0006	0.0007	0.0009	0.0008	0.0008
Max	2947	0.0000	0.0007	0.0009	0.0008	0.0009	0.0010	0.0009	0.0010	0.0009	0.0009	0.0011	0.0014	0.0014	0.0014



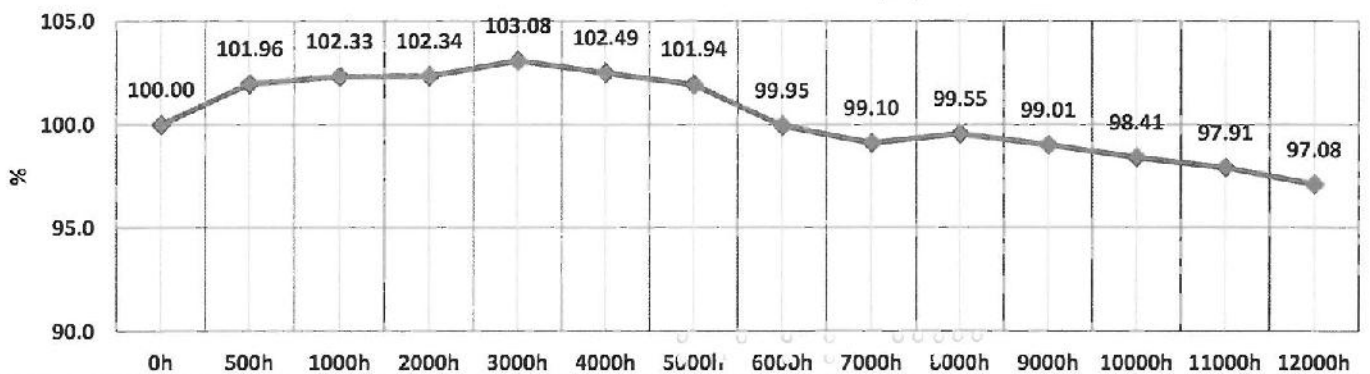
2. TEST CONDITION 2 [85.0 °C , If = 0.2 A]

- Measurement Current : 0.2 A

[LUMEN MAINTENANCE]

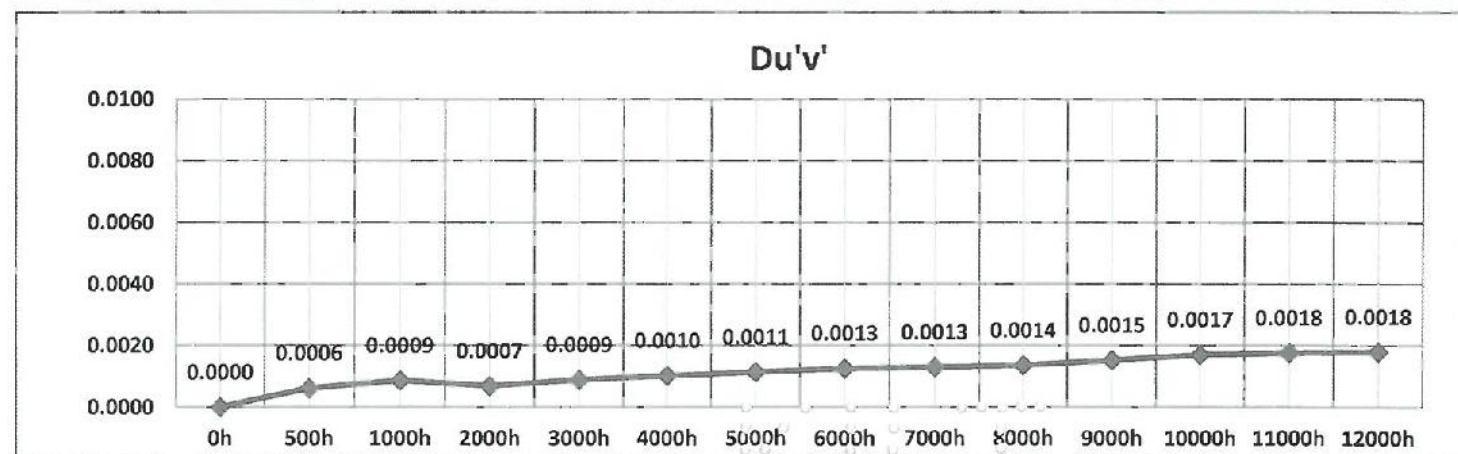
No.	Φv	Vf	Lumen Maintenance [%]														
	[lm]	[V]	0h (Initial)	0h	500h	1000h	2000h	3000h	4000h	5000h	6000h	7000h	8000h	9000h	10000h	11000h	12000h
1	76.7	3.3	100.00	102.07	102.37	102.35	102.98	102.40	101.87	99.82	99.14	99.36	98.90	98.48	97.88	97.03	
2	76.2	3.4	100.00	102.04	102.49	102.54	103.31	102.74	102.25	100.36	99.47	99.93	99.37	98.84	98.03	97.45	
3	76.7	3.3	100.00	101.96	102.31	102.61	103.18	102.60	102.00	100.13	99.26	99.76	99.33	98.70	98.26	97.76	
4	75.8	3.3	100.00	102.01	102.42	102.35	103.13	102.54	102.01	99.98	99.14	99.58	98.99	98.50	97.81	97.02	
5	76.7	3.4	100.00	101.98	102.34	102.29	103.03	102.60	101.92	100.03	99.17	99.59	99.03	98.45	98.18	97.40	
6	77.2	3.3	100.00	101.98	102.32	102.21	102.83	102.26	101.79	99.73	98.86	99.26	98.84	98.13	97.85	96.92	
7	77.1	3.3	100.00	101.96	102.35	102.33	103.12	102.57	102.03	99.89	99.23	99.65	99.02	98.54	98.10	97.01	
8	76.1	3.4	100.00	102.21	102.42	102.56	103.33	102.73	102.07	100.19	99.33	99.73	99.17	98.60	98.22	97.05	
9	76.5	3.3	100.00	101.69	102.00	102.02	102.78	102.21	101.73	99.61	98.90	99.16	98.72	98.27	97.67	96.71	
10	75.7	3.4	100.00	101.62	102.08	102.06	102.88	102.24	101.71	99.89	98.91	99.43	98.83	98.23	97.73	96.67	
11	76.2	3.3	100.00	101.93	102.30	102.24	103.02	102.43	101.77	99.85	98.89	99.35	98.74	98.08	97.54	96.54	
12	77.7	3.3	100.00	101.70	102.09	102.10	102.83	102.31	101.89	99.68	98.98	99.44	98.86	98.31	97.77	97.33	
13	76.6	3.4	100.00	101.81	102.08	102.13	102.88	102.16	101.63	99.63	98.82	99.29	98.74	98.12	97.59	96.87	
14	76.3	3.4	100.00	102.21	102.52	102.44	103.19	102.70	102.00	100.06	99.25	99.63	99.22	98.45	97.98	97.40	
15	75.9	3.4	100.00	101.50	101.81	101.89	102.45	101.91	101.34	99.33	98.46	98.94	98.33	97.75	97.07	96.45	
16	76.1	3.3	100.00	102.21	102.67	102.60	103.34	102.78	102.30	100.26	99.53	100.05	99.11	98.53	97.98	96.84	
17	75.5	3.3	100.00	102.06	102.46	102.37	103.15	102.56	102.04	100.08	99.13	99.61	99.00	98.39	97.99	97.07	
18	75.3	3.3	100.00	102.32	102.44	102.49	103.25	102.66	102.01	100.12	99.20	99.72	99.31	98.49	98.16	97.32	
19	77.3	3.4	100.00	101.84	102.22	102.13	102.89	102.28	101.78	99.70	99.00	99.49	98.91	98.33	97.86	96.95	
20	77.0	3.4	100.00	101.80	102.25	102.42	103.19	102.65	102.05	99.98	99.14	99.71	99.15	98.55	98.14	97.60	
21	76.0	3.3	100.00	102.14	102.52	102.42	103.17	102.52	102.05	100.00	99.00	99.52	99.09	98.49	97.95	97.30	
22	77.8	3.4	100.00	101.88	102.31	102.36	103.10	102.56	102.08	100.15	99.21	99.73	99.18	98.54	98.10	97.43	
23	75.0	3.3	100.00	102.42	102.85	102.79	103.60	102.96	102.28	100.39	99.38	99.88	99.26	98.51	97.96	96.81	
24	76.1	3.3	100.00	102.05	102.41	102.51	103.32	102.75	102.30	100.25	99.45	99.78	99.49	98.88	98.30	97.44	
25	77.5	3.4	100.00	101.71	102.08	102.22	102.93	102.12	101.59	99.67	98.70	99.22	98.70	98.02	97.55	96.77	
Ave.	76.4	3.3	100.00	101.96	102.33	102.34	103.08	102.49	101.94	99.95	99.10	99.55	99.01	98.41	97.91	97.08	
Med.	76.3	3.3	100.00	101.98	102.34	102.35	103.12	102.56	102.00	99.98	99.14	99.59	99.02	98.48	97.96	97.03	
σ	0.7	0.0	0.00	0.22	0.22	0.21	0.23	0.25	0.23	0.26	0.25	0.26	0.26	0.25	0.27	0.34	
Min.	75.0	3.3	100.00	101.50	101.81	101.89	102.45	101.91	101.34	99.33	98.46	98.94	98.33	97.75	97.07	96.45	
Max	77.8	3.4	100.00	102.42	102.85	102.79	103.60	102.96	102.30	100.39	99.53	100.05	99.49	98.88	98.30	97.76	

Lumen Maintenance (%)



[CHROMATICITY SHIFT]

No.	CCT [K]	Chromaticity Shift $\Delta u'v'$													
		0h (Initial)	0h	500h	1000h	2000h	3000h	4000h	5000h	6000h	7000h	8000h	9000h	10000h	11000h
1	2936	0.0000	0.0006	0.0009	0.0007	0.0009	0.0010	0.0012	0.0013	0.0012	0.0013	0.0015	0.0016	0.0014	0.0015
2	2907	0.0000	0.0006	0.0009	0.0007	0.0009	0.0010	0.0011	0.0012	0.0009	0.0009	0.0013	0.0015	0.0016	0.0016
3	2930	0.0000	0.0006	0.0008	0.0008	0.0008	0.0010	0.0010	0.0013	0.0001	0.0003	0.0004	0.0006	0.0005	0.0006
4	2929	0.0000	0.0006	0.0008	0.0006	0.0007	0.0009	0.0010	0.0011	0.0006	0.0007	0.0009	0.0011	0.0012	0.0013
5	2914	0.0000	0.0005	0.0008	0.0007	0.0010	0.0011	0.0013	0.0014	0.0007	0.0007	0.0009	0.0011	0.0014	0.0013
6	2938	0.0000	0.0006	0.0008	0.0007	0.0008	0.0009	0.0011	0.0011	0.0006	0.0007	0.0009	0.0009	0.0008	0.0008
7	2898	0.0000	0.0006	0.0008	0.0006	0.0009	0.0010	0.0010	0.0012	0.0004	0.0004	0.0006	0.0009	0.0011	0.0011
8	2925	0.0000	0.0006	0.0008	0.0008	0.0008	0.0009	0.0010	0.0012	0.0010	0.0011	0.0014	0.0016	0.0018	0.0018
9	2900	0.0000	0.0007	0.0010	0.0007	0.0009	0.0010	0.0013	0.0013	0.0023	0.0023	0.0026	0.0029	0.0030	0.0029
10	2936	0.0000	0.0006	0.0009	0.0006	0.0009	0.0010	0.0011	0.0011	0.0015	0.0016	0.0018	0.0021	0.0021	0.0024
11	2924	0.0000	0.0006	0.0009	0.0007	0.0009	0.0011	0.0012	0.0014	0.0020	0.0021	0.0023	0.0026	0.0028	0.0029
12	2952	0.0000	0.0006	0.0009	0.0007	0.0008	0.0010	0.0013	0.0014	0.0013	0.0014	0.0011	0.0009	0.0007	0.0008
13	2910	0.0000	0.0006	0.0009	0.0008	0.0009	0.0011	0.0012	0.0014	0.0015	0.0016	0.0018	0.0021	0.0020	0.0021
14	2942	0.0000	0.0006	0.0008	0.0008	0.0007	0.0009	0.0009	0.0011	0.0017	0.0017	0.0014	0.0012	0.0015	0.0014
15	2937	0.0000	0.0007	0.0009	0.0006	0.0009	0.0010	0.0011	0.0011	0.0005	0.0005	0.0002	0.0001	0.0004	0.0003
16	2940	0.0000	0.0007	0.0009	0.0007	0.0009	0.0010	0.0011	0.0011	0.0022	0.0024	0.0026	0.0029	0.0029	0.0029
17	2904	0.0000	0.0005	0.0008	0.0006	0.0010	0.0011	0.0012	0.0014	0.0003	0.0002	0.0001	0.0003	0.0006	0.0005
18	2939	0.0000	0.0007	0.0009	0.0009	0.0011	0.0013	0.0014	0.0016	0.0006	0.0006	0.0009	0.0011	0.0013	0.0012
19	2941	0.0000	0.0006	0.0008	0.0006	0.0007	0.0009	0.0010	0.0010	0.0008	0.0010	0.0011	0.0014	0.0012	0.0012
20	2908	0.0000	0.0006	0.0009	0.0008	0.0012	0.0013	0.0014	0.0016	0.0021	0.0022	0.0025	0.0027	0.0028	0.0029
21	2912	0.0000	0.0007	0.0010	0.0009	0.0011	0.0012	0.0014	0.0015	0.0025	0.0026	0.0030	0.0033	0.0033	0.0034
22	2919	0.0000	0.0006	0.0008	0.0006	0.0009	0.0010	0.0010	0.0011	0.0030	0.0032	0.0034	0.0037	0.0036	0.0037
23	2938	0.0000	0.0007	0.0009	0.0009	0.0009	0.0010	0.0011	0.0013	0.0022	0.0023	0.0025	0.0028	0.0027	0.0031
24	2934	0.0000	0.0006	0.0009	0.0006	0.0008	0.0009	0.0011	0.0012	0.0003	0.0003	0.0007	0.0009	0.0009	0.0010
25	2940	0.0000	0.0006	0.0009	0.0007	0.0009	0.0010	0.0010	0.0011	0.0016	0.0018	0.0020	0.0022	0.0021	0.0022
Ave.	2926	0.0000	0.0006	0.0009	0.0007	0.0009	0.0010	0.0011	0.0013	0.0013	0.0014	0.0015	0.0017	0.0018	0.0018
Med.	2930	0.0000	0.0006	0.0009	0.0007	0.0009	0.0010	0.0011	0.0012	0.0012	0.0013	0.0014	0.0015	0.0015	0.0015
σ	15	0.0000	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0002	0.0008	0.0008	0.0009	0.0009	0.0009	0.0010
Min.	2898	0.0000	0.0005	0.0008	0.0006	0.0007	0.0009	0.0009	0.0010	0.0001	0.0002	0.0001	0.0001	0.0004	0.0003
Max	2952	0.0000	0.0007	0.0010	0.0009	0.0012	0.0013	0.0014	0.0016	0.0030	0.0032	0.0034	0.0037	0.0036	0.0037

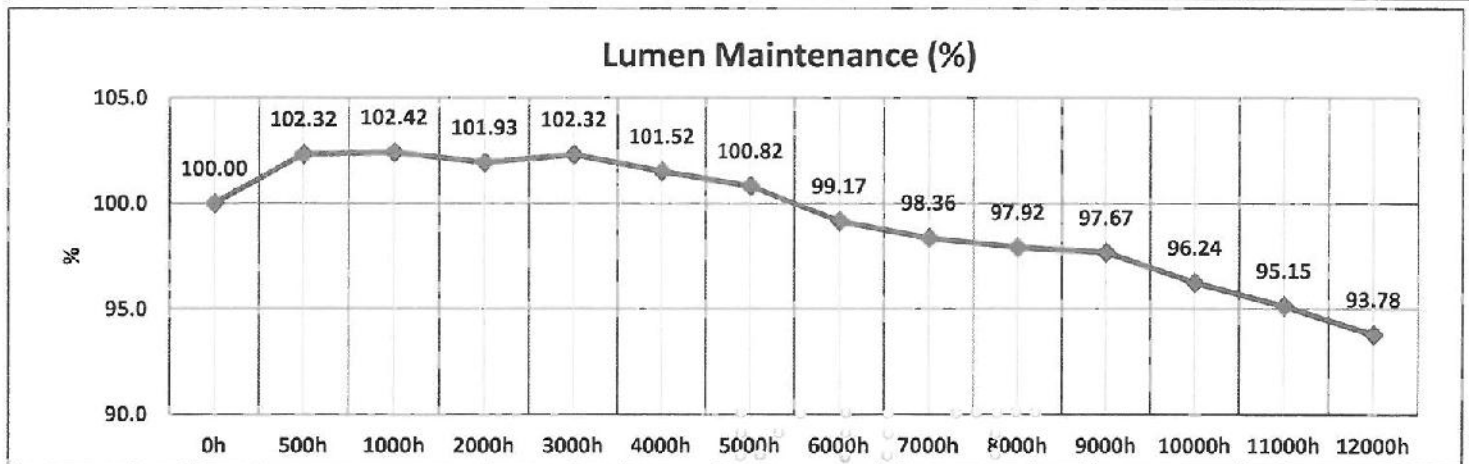


3. TEST CONDITION 3 [105.2 °C , If = 0.2 A]

- Measurement Current : 0.2 A

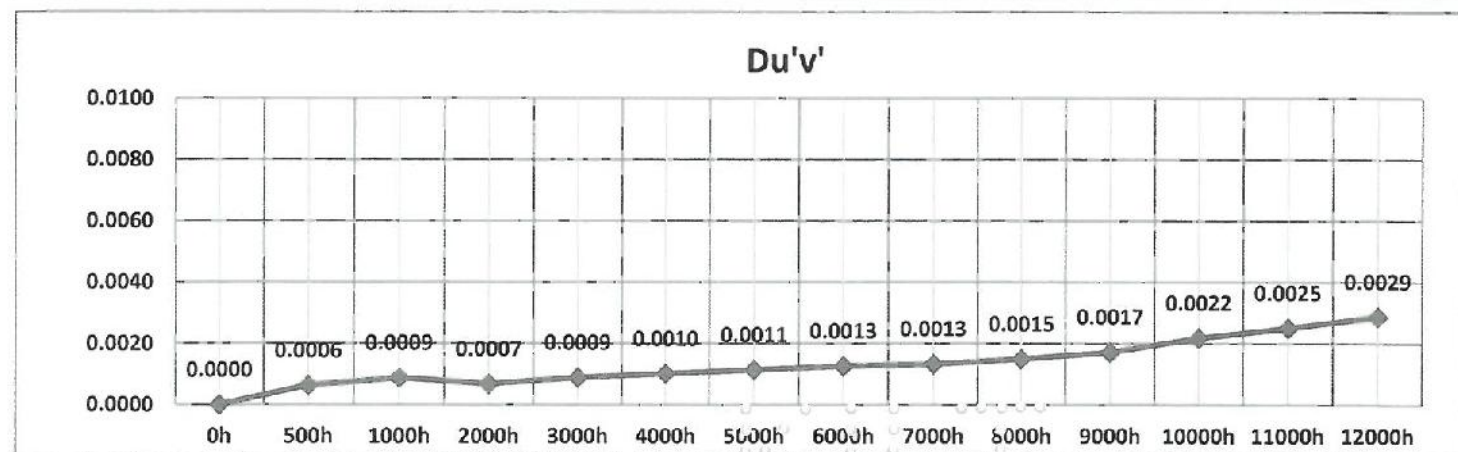
[LUMEN MAINTENANCE]

No.	Φv	Vf	Lumen Maintenance [%]														
	[lm]	[V]	0h (Initial)	0h	500h	1000h	2000h	3000h	4000h	5000h	6000h	7000h	8000h	9000h	10000h	11000h	12000h
1	76.4	3.4	100.00	102.17	102.35	102.01	102.37	101.63	101.05	99.37	98.69	98.42	98.19	97.01	95.60	94.34	
2	77.3	3.3	100.00	102.10	102.32	101.91	102.50	101.74	101.03	99.47	98.71	98.39	98.21	97.20	95.93	94.37	
3	75.3	3.3	100.00	102.55	102.62	102.10	102.54	101.73	101.01	99.55	98.70	98.30	98.05	96.43	95.58	94.15	
4	76.4	3.4	100.00	102.52	102.64	101.97	102.24	101.61	100.77	99.07	98.26	97.75	97.52	96.08	94.97	93.54	
5	76.7	3.3	100.00	101.96	102.19	101.81	102.31	101.55	100.88	99.18	98.43	98.08	97.88	96.41	95.51	94.07	
6	77.4	3.3	100.00	101.78	101.97	101.63	101.98	101.17	100.64	98.87	98.19	97.84	97.62	96.71	95.38	93.88	
7	76.9	3.4	100.00	102.27	102.37	101.83	102.44	101.54	100.73	99.07	98.31	97.90	97.75	96.19	94.98	93.43	
8	77.4	3.3	100.00	102.07	102.26	101.76	102.23	101.36	100.70	99.14	98.52	98.05	97.96	96.90	95.74	94.21	
9	75.5	3.3	100.00	102.23	102.33	101.76	102.08	101.26	100.68	98.94	98.08	97.39	97.26	95.98	94.51	93.15	
10	76.8	3.4	100.00	102.32	102.04	101.49	102.03	101.26	100.49	98.89	98.17	97.88	97.69	96.28	95.16	93.91	
11	76.5	3.3	100.00	101.97	102.13	101.80	102.13	101.36	100.64	99.12	98.43	98.13	98.05	96.36	95.35	94.11	
12	74.6	3.4	100.00	102.89	102.80	102.29	102.60	101.81	101.21	99.64	98.65	98.04	97.71	96.40	95.35	94.12	
13	74.7	3.4	100.00	102.76	102.86	102.45	102.73	102.00	101.27	99.56	98.69	98.37	98.19	96.54	95.37	94.11	
14	76.6	3.3	100.00	102.33	102.42	101.75	102.09	101.31	100.51	98.96	98.24	97.91	97.73	96.00	95.17	93.66	
15	74.9	3.3	100.00	102.39	102.47	101.93	102.44	101.74	100.99	99.24	98.50	98.33	98.24	96.85	95.93	94.44	
16	76.6	3.3	100.00	102.82	102.64	102.00	102.30	101.38	100.84	98.96	98.03	97.59	97.18	95.55	94.46	93.10	
17	74.8	3.4	100.00	102.18	102.37	101.90	102.45	101.53	100.85	99.15	98.14	97.67	97.41	95.99	95.06	93.71	
18	73.7	3.3	100.00	102.72	102.75	102.44	102.80	101.97	101.23	99.70	98.46	97.77	97.50	95.99	95.32	94.04	
19	77.2	3.3	100.00	102.40	102.47	101.78	101.93	101.30	100.48	98.71	97.83	97.07	96.76	95.15	94.03	92.61	
20	76.4	3.3	100.00	102.53	102.71	102.32	102.81	101.98	101.27	99.75	98.92	98.28	98.05	96.62	95.51	94.34	
21	75.9	3.3	100.00	102.68	102.69	102.40	102.70	101.85	101.31	99.61	98.80	98.30	97.30	95.94	94.70	93.47	
22	77.3	3.4	100.00	101.93	102.00	101.42	101.78	100.89	100.09	98.36	97.62	97.17	96.89	95.30	94.17	92.94	
23	77.5	3.3	100.00	101.90	102.09	101.71	102.00	101.20	100.42	98.88	98.13	97.70	97.48	95.80	94.58	93.25	
24	76.6	3.3	100.00	102.24	102.36	101.71	101.97	101.18	100.56	98.82	98.04	97.47	97.29	95.96	94.99	93.84	
25	76.6	3.4	100.00	102.57	102.68	102.10	102.42	101.64	100.88	99.16	98.48	98.09	97.93	96.46	95.36	93.96	
Ave.	76.2	3.3	100.00	102.32	102.42	101.93	102.32	101.52	100.82	99.17	98.36	97.92	97.67	96.24	95.15	93.78	
Med.	76.6	3.3	100.00	102.32	102.37	101.90	102.31	101.54	100.84	99.14	98.43	97.91	97.71	96.28	95.32	93.91	
σ	1.0	0.0	0.00	0.29	0.26	0.28	0.29	0.29	0.31	0.34	0.31	0.37	0.40	0.49	0.50	0.48	
Min.	73.7	3.3	100.00	101.78	101.97	101.42	101.78	100.89	100.09	98.36	97.62	97.07	96.76	95.15	94.03	92.61	
Max	77.5	3.4	100.00	102.82	102.86	102.45	102.81	102.00	101.31	99.75	98.92	98.42	98.24	97.20	95.93	94.44	



[CHROMATICITY SHIFT]

No.	CCT [K]	Chromaticity Shift $\Delta u'v'$													
		0h (Initial)	0h	500h	1000h	2000h	3000h	4000h	5000h	6000h	7000h	8000h	9000h	10000h	11000h
1	2908	0.0000	0.0006	0.0008	0.0007	0.0009	0.0010	0.0012	0.0013	0.0014	0.0015	0.0017	0.0022	0.0025	0.0029
2	2905	0.0000	0.0006	0.0009	0.0007	0.0010	0.0010	0.0012	0.0013	0.0013	0.0015	0.0017	0.0021	0.0025	0.0028
3	2907	0.0000	0.0007	0.0008	0.0006	0.0009	0.0010	0.0011	0.0013	0.0014	0.0016	0.0018	0.0022	0.0027	0.0030
4	2920	0.0000	0.0007	0.0009	0.0008	0.0008	0.0009	0.0010	0.0011	0.0012	0.0014	0.0016	0.0021	0.0024	0.0028
5	2910	0.0000	0.0006	0.0009	0.0007	0.0010	0.0011	0.0013	0.0014	0.0015	0.0017	0.0019	0.0024	0.0028	0.0032
6	2910	0.0000	0.0006	0.0008	0.0006	0.0008	0.0009	0.0010	0.0011	0.0011	0.0012	0.0014	0.0015	0.0018	0.0020
7	2884	0.0000	0.0006	0.0008	0.0006	0.0009	0.0010	0.0010	0.0011	0.0012	0.0013	0.0016	0.0019	0.0022	0.0024
8	2912	0.0000	0.0006	0.0008	0.0006	0.0008	0.0009	0.0010	0.0013	0.0013	0.0013	0.0015	0.0018	0.0021	0.0023
9	2921	0.0000	0.0006	0.0009	0.0006	0.0009	0.0010	0.0012	0.0013	0.0014	0.0016	0.0019	0.0025	0.0029	0.0033
10	2931	0.0000	0.0006	0.0009	0.0007	0.0009	0.0010	0.0011	0.0012	0.0013	0.0014	0.0016	0.0020	0.0023	0.0027
11	2938	0.0000	0.0006	0.0009	0.0008	0.0009	0.0011	0.0011	0.0014	0.0015	0.0016	0.0019	0.0023	0.0026	0.0031
12	2899	0.0000	0.0006	0.0009	0.0006	0.0008	0.0010	0.0013	0.0013	0.0014	0.0016	0.0019	0.0025	0.0028	0.0032
13	2899	0.0000	0.0007	0.0009	0.0008	0.0009	0.0011	0.0013	0.0013	0.0015	0.0017	0.0019	0.0025	0.0029	0.0034
14	2911	0.0000	0.0005	0.0008	0.0005	0.0007	0.0008	0.0009	0.0011	0.0012	0.0014	0.0016	0.0020	0.0024	0.0027
15	2911	0.0000	0.0007	0.0009	0.0006	0.0009	0.0010	0.0011	0.0011	0.0012	0.0013	0.0015	0.0019	0.0022	0.0026
16	2945	0.0000	0.0008	0.0009	0.0007	0.0009	0.0010	0.0011	0.0012	0.0012	0.0014	0.0016	0.0022	0.0025	0.0028
17	2878	0.0000	0.0005	0.0007	0.0007	0.0010	0.0012	0.0013	0.0014	0.0015	0.0018	0.0020	0.0026	0.0029	0.0033
18	2934	0.0000	0.0006	0.0008	0.0009	0.0011	0.0012	0.0013	0.0016	0.0017	0.0019	0.0022	0.0026	0.0030	0.0034
19	2921	0.0000	0.0006	0.0008	0.0006	0.0007	0.0009	0.0010	0.0011	0.0011	0.0013	0.0015	0.0021	0.0023	0.0027
20	2925	0.0000	0.0006	0.0009	0.0008	0.0011	0.0013	0.0014	0.0016	0.0016	0.0017	0.0019	0.0024	0.0027	0.0032
21	2941	0.0000	0.0007	0.0009	0.0009	0.0012	0.0013	0.0014	0.0015	0.0016	0.0018	0.0020	0.0026	0.0029	0.0033
22	2929	0.0000	0.0006	0.0008	0.0006	0.0008	0.0009	0.0010	0.0010	0.0011	0.0012	0.0014	0.0019	0.0022	0.0026
23	2919	0.0000	0.0007	0.0009	0.0009	0.0009	0.0011	0.0011	0.0013	0.0014	0.0015	0.0017	0.0021	0.0023	0.0027
24	2910	0.0000	0.0006	0.0009	0.0006	0.0008	0.0009	0.0011	0.0012	0.0012	0.0015	0.0017	0.0022	0.0025	0.0029
25	2935	0.0000	0.0006	0.0009	0.0006	0.0009	0.0009	0.0010	0.0011	0.0011	0.0012	0.0014	0.0019	0.0022	0.0026
Ave.	2916	0.0000	0.0006	0.0009	0.0007	0.0009	0.0010	0.0011	0.0013	0.0013	0.0015	0.0017	0.0022	0.0025	0.0029
Med.	2912	0.0000	0.0006	0.0009	0.0006	0.0009	0.0010	0.0011	0.0013	0.0013	0.0015	0.0017	0.0022	0.0025	0.0028
σ	16	0.0000	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0002	0.0002	0.0002	0.0002	0.0003	0.0003	0.0004
Min.	2878	0.0000	0.0005	0.0007	0.0005	0.0007	0.0008	0.0009	0.0010	0.0011	0.0012	0.0014	0.0015	0.0018	0.0020
Max	2945	0.0000	0.0008	0.0009	0.0009	0.0012	0.0013	0.0014	0.0016	0.0017	0.0019	0.0022	0.0026	0.0030	0.0034



Revision History

No.	Issue Date	Report Number	Contents
0	2014.08.22	KILT1401-U00009-6	Issued after the completion of 6000 hours
1	2014.12.23	KILT1401-U00009-6 (Revision_1.0)	Issued after the completion of 9000 hours
2	2015.05.16	KILT1401-U00009-6 (Revision_2.0)	Issued after the completion of 12000 hours

