

TEST REPORT

ANSI/IES LM-80-15

MEASURING LUMEN MAINTENANCE OF LED LIGHT SOURCES

SHENZHEN LEDWORKER LIGHTING CO. LTD

5th Floor, Building A, Baitong Technology Innovation Industrial Park, 150 Shasong Road, Shenzhen,
518104, China

Report No.: BL201017006-9

Product Description: LED Array

Model No.: LW-COB003

Test Initiation Date: 2020-10-13

Test Completion Date: 2020-10-14-2021-07-10

Report Issue Date: 2021-07-12

Test Standard: ANSI/IES LM-80-15

Test Laboratory: Shenzhen Belling Efficiency Testing Lab Co., Ltd

Tested by

Hunter Ou 

Reviewed by

Jason Zhou 

Note: The test data was only valid for the test sample(s). This test report is prepared for the customer shown above and for the device described herein. It may not be duplicated or use in part without prior written consent from Shenzhen Belling Efficiency Testing Lab Co., Ltd. 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. Government.

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1-GENERAL INFORMATION

1.1 Product Description for Equipment under Test (EUT)

Manufacturer: SHENZHEN LEDWORKER LIGHTING CO. LTD

Brand name: LEDWORKER

Part Number: LW-COB003

Part Type: LED Array

Product Description: DC24V, 30mA, CCT: 2700K

Product name: COB LED Strip

Number of LED Light Source tested: See tables

Case temperature (test point temperature): See tables.

Drive current of the LED light source during lifetime test: See tables.

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

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

Observation of LED light source failure including the failure conditions and time of failure.: See tables.

LED light source monitoring interval: The LED array are inspected at regular interval (24 hours) throughout the 6000 hours test.

Photometric measurement uncertainty: 1.8% on flux measurements for LM-80 testing.

Chromaticity shift reported over the Measurement time: See tables.

LED Light Source Test interval: At regular intervals(1000 hours) throughout the 6000 hours test.

Date of Receiving Sample: 2020-10-13

Test Duration: 2020-10-14-2021-07-10

1.2 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.

1.3 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°C below the corresponding nominal case temperature.

Surrounding air was maintained at a temperature that was greater than or equal to 5°C below the corresponding nominal case temperature. Thermocouples were shielded from direct DUT optical radiation and comply with Type K.

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.

Surrounding Air temperature for life test : controlled to within -5°C of the case temperature (T_s)

Humidity : $< 65\%$ RH

Ambient temperature for Photometry measurement : maintained at $25^{\circ}\text{C} \pm 2^{\circ}\text{C}$

1.4 Photometric measurement uncertainty

The uncertainty of the light output measurements is $U=1.8\%$ ($K=2$)

Long term measurement uncertainty is based on reproducibility tests done over a period of one year, calculated to $K=2$ coverage (i.e. 95% coverage).

1.5 Standards Used:

- ANSI/IES LM-80-15: IES Approved Method for Measuring Lumen Maintenance of LED Light Sources.
- 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 NVLAP)
- CIE 127:2007: Measurement of LEDs(This test method was not accredited by NVLAP)

1.6 Test Facility Description

The test facility used by Shenzhen Belling Efficiency Testing Lab Co., Ltd is located at 1Floor, No.1 Building, Meibaohe Industrial Park, Dalang Street, Longhua District, Shenzhen, Guangdong Prov.518101 China.

1.7 Statement of Traceability

Shenzhen Belling Efficiency Testing Lab Co., Ltd attested that all calibration has been performed using suitable standards traceable to National Primary Standards and International System of Units (SI).

1.8 Test Equipment List

Device	Manufacture	Model No.	Serial No.	Calibration due date
Digital Power Meter	YOKOGAWA	WT210	91L929742	2022-03-31
Integral Sphere(0.5M)	SENSING	Ball0516	N.A	2022-03-21
Optical Color and Electrical Measurement System	SENSING	SPR-3000	S1101108	2022-03-21
Stop watch	KISLO	K610	N/A	2022-04-22
LED aging equipment	Guangzhou CK	Box0516	N.A	2022-04-13
DC Power Supply	Hong Duo Yuan	APS300-5	N/A	2022-03-21
Thermocouple K	Type K	OMEGA	23736-1	2022-04-21

1.9 Sample Set

Sampling Method:

LED samples for ANSI/IES LM-80-15 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. Each Sample is soldered to all of the reliability stress boards for a given set of ANSI/IES LM-80-15 tests.

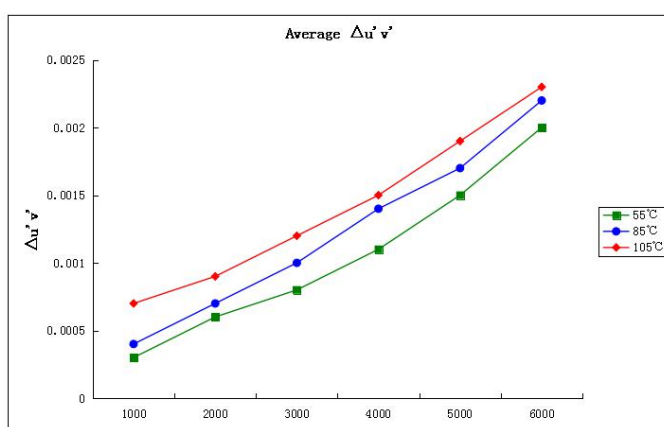
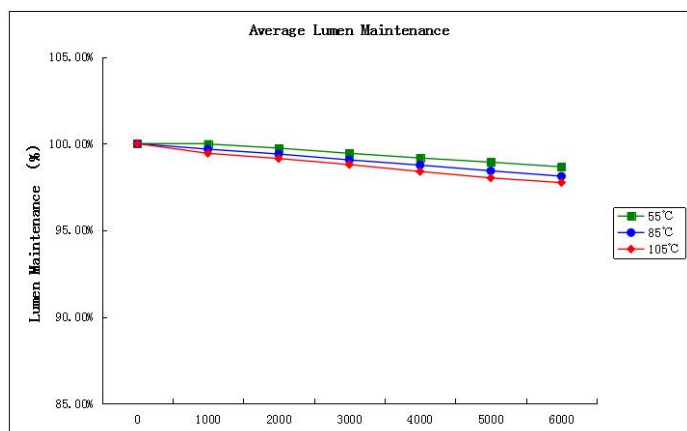
Sample Size:

Total 45Pcs; Each Ts test condition 15Pcs, The samples tested at T_s 55°C, T_s 85°C and T_s 105°C were received at 2020-10-13 and tested during 2020-10-14 to 2021-07-10. The samples were numbered from 1 to 15, 16 to 30 and 31 to 45.

2-Summary of Test Result

Data Set	1	2	3
Nominal case temperatures	55°C	85°C	105°C
Drive Current	30 mA	30 mA	30 mA
Condition	Ts=53.9°C Ta=54.6°C R.H.<65%	Ts=84.4°C Ta=83.7°C R.H.<65%	Ts=104.3°C Ta=103.8°C R.H.<65%
Sample size	15	15	15
Duration (in Hours)	6000	6000	6000
Intervals (in Hours)	1000	1000	1000
Failure	0	0	0
α	2.675E-06	3.181E-06	3.539E-06
β	1.003	1.000	0.998
Calculated L ₇₀ (6000h)	>33000	>33000	>33000
Lumen Maintenance at 6000 hours	98.66%	98.12%	97.75%
Chromaticity Shift at 6000 hours ($\Delta u'v'$):	0.0020	0.0022	0.0023

Table 1: Report at each LM-80 Test Condition			
Description of LED Light Source Tested (manufacturer, model, catalog number)	SHENZHEN LEDWORKER LIGHTING CO. LTD LW-COB003		
	Test Condition 1 - 55° C Case Temp	Test Condition 2 - 85° C Case Temp	Test Condition 3 - 105° C Case Temp
Sample size	15	15	15
Number of failures	0	0	0
DUT drive current used in the test (mA)	30	30	30
Test duration (hours)	6,000	6,000	6,000
Test duration used for projection (hour to hour)	1,000 - 6,000	1,000 - 6,000	1,000 - 6,000
Tested case temperature (° C)	55	85	105
α	2.675E-06	3.181E-06	3.539E-06
B	1.003	1.000	0.998
Reported L70(6k) (hours)	>33000	>33000	>33000



3-Test Data

3.1 Data Set 1: 55°C; 30mA

Description of Light Sources tested :	1.0W
Case Temperature :	53.9°C
Ambient Temperature :	54.6°C
Drive Current :	30mA
Measure Current :	30mA
Failures Observed :	None
Number of Units:	15

Lumen Maintenance (%)								
Sample No.	V _F (V)	Φ(lm)	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs
	0hr(Initial)							
L1	24.0	56.8	99.96	99.67	99.36	99.16	98.92	98.52
L2	24.0	55.9	99.92	99.65	99.42	99.22	99.05	98.81
L3	24.0	55.6	99.91	99.71	99.47	99.20	98.81	98.53
L4	24.0	56.1	100.04	99.84	99.55	99.24	98.93	98.75
L5	24.0	58.2	100.05	99.83	99.43	99.18	98.80	98.58
L6	24.0	56.6	99.86	99.58	99.35	99.10	98.89	98.67
L7	24.0	58.2	100.11	99.87	99.39	99.09	98.80	98.52
L8	24.0	57.5	99.99	99.78	99.48	99.15	98.88	98.53
L9	24.0	58.6	99.90	99.65	99.39	99.11	98.77	98.57
L10	24.0	55.4	99.98	99.73	99.40	99.21	99.09	98.78
L11	24.0	56.9	99.86	99.56	99.35	99.07	98.92	98.62
L12	24.0	58.3	100.13	99.90	99.67	99.26	99.10	98.88
L13	24.0	57.6	100.00	99.82	99.51	99.20	99.01	98.71
L14	24.0	58.2	100.05	99.84	99.42	99.28	99.13	98.82
L15	24.0	55.7	99.97	99.69	99.37	99.14	98.82	98.64
Ave.	24.0	57.0	99.98	99.74	99.44	99.17	98.93	98.66
Med.	24.0	56.9	99.98	99.73	99.42	99.18	98.92	98.64
st dev	0	1.1211	0.0834	0.1073	0.0875	0.0639	0.1211	0.1228
Min.	24.0	55.4	99.86	99.56	99.35	99.07	98.77	98.52
Max.	24.0	58.6	100.13	99.90	99.67	99.28	99.13	98.88

Description of Light Sources tested :	1.0W
Case Temperature :	53.9°C
Ambient Temperature :	54.6°C
Drive Current :	30mA
Measure Current :	30mA
Failures Observed :	None
Number of Units:	15

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

Sample No.	u'	v'	CCT(K)	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs
	0hr(Initial)								
L1	0.2628	0.5327	2673	0.0002	0.0006	0.0007	0.0011	0.0013	0.0018
L2	0.2627	0.5322	2678	0.0004	0.0007	0.0008	0.001	0.0015	0.0021
L3	0.2616	0.5307	2705	0.0002	0.0006	0.0009	0.0013	0.0017	0.0019
L4	0.2634	0.5309	2667	0.0004	0.0006	0.0007	0.0010	0.0016	0.0020
L5	0.2620	0.5312	2695	0.0003	0.0007	0.0007	0.0009	0.0012	0.0018
L6	0.2598	0.5294	2749	0.0003	0.0005	0.0009	0.0009	0.0014	0.0019
L7	0.2645	0.5333	2639	0.0005	0.0006	0.0009	0.0013	0.0013	0.0017
L8	0.2614	0.5298	2714	0.0005	0.0005	0.001	0.0012	0.0018	0.0021
L9	0.2654	0.5330	2622	0.0004	0.0006	0.0008	0.001	0.0015	0.002
L10	0.2636	0.5339	2654	0.0003	0.0005	0.0007	0.0011	0.0014	0.0019
L11	0.2635	0.5325	2660	0.0005	0.0005	0.0011	0.0014	0.002	0.0024
L12	0.2618	0.5298	2704	0.0001	0.0003	0.0008	0.0013	0.0016	0.0023
L13	0.2637	0.5336	2652	0.0003	0.0006	0.0007	0.0009	0.0014	0.0021
L14	0.2619	0.5327	2692	0.0003	0.0007	0.0010	0.0010	0.0016	0.0022
L15	0.2643	0.5331	2643	0.0004	0.0004	0.001	0.0015	0.0017	0.0020
Ave.	0.2628	0.5319	2676	0.0003	0.0006	0.0008	0.0011	0.0015	0.0020
Med.	0.2628	0.5325	2673	0.0003	0.0006	0.0008	0.0011	0.0015	0.0020
st dev	0.0014	0.0015	34	0.0001	0.0001	0.0001	0.0002	0.0002	0.0002
Min.	0.2598	0.5294	2622	0.0001	0.0003	0.0007	0.0009	0.0012	0.0017
Max.	0.2654	0.5339	2749	0.0005	0.0007	0.0011	0.0015	0.0020	0.0024

3.2 Data Set 2: 85°C; 30mA

Description of Light Sources tested :	1.0W
Case Temperature :	84.4°C
Ambient Temperature :	83.7°C
Drive Current :	30mA
Measure Current :	30mA
Failures Observed :	None
Number of Units:	15

Lumen Maintenance (%)								
Sample No.	V_F(V)	Φ(lm)	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs
	0hr(Initial)							
L16	24.0	55.9	99.73	99.42	99.06	98.73	98.45	98.10
L17	24.0	57.1	99.68	99.32	99.10	98.70	98.30	98.16
L18	24.0	56.2	99.62	99.28	99.03	98.81	98.46	98.21
L19	24.0	57.8	99.58	99.24	98.93	98.58	98.31	98.09
L20	24.0	58.2	99.68	99.39	99.03	98.79	98.50	98.11
L21	24.0	56.9	99.82	99.53	99.17	98.73	98.35	98.04
L22	24.0	55.8	99.70	99.54	99.11	98.89	98.44	98.12
L23	24.0	58.1	99.68	99.41	99.08	98.70	98.36	98.09
L24	24.0	56.6	99.76	99.51	99.09	98.86	98.47	98.10
L25	24.0	57.2	99.61	99.29	98.99	98.70	98.32	98.00
L26	24.0	56.4	99.65	99.34	99.01	98.81	98.49	98.01
L27	24.0	55.7	99.63	99.36	99.10	98.73	98.55	98.19
L28	24.0	58.3	99.76	99.47	99.14	98.76	98.43	98.15
L29	24.0	56.9	99.55	99.34	99.02	98.84	98.53	98.21
L30	24.0	57.3	99.75	99.54	99.03	98.71	98.45	98.19
Ave.	24.0	57.0	99.68	99.40	99.06	98.76	98.43	98.12
Med.	24.0	56.9	99.68	99.39	99.06	98.73	98.45	98.11
st dev	0	0.8708	0.0751	0.1003	0.0622	0.0790	0.0806	0.0676
Min.	24.0	55.7	99.55	99.24	98.93	98.58	98.30	98.00
Max.	24.0	58.3	99.82	99.54	99.17	98.89	98.55	98.21

Description of Light Sources tested :	1.0W
Case Temperature :	84.4°C
Ambient Temperature :	83.7°C
Drive Current :	30mA
Measure Current :	30mA
Failures Observed :	None
Number of Units:	15

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

Sample No.	u'	v'	CCT(K)	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs
	0hr(Initial)								
L16	0.2634	0.5322	2663	0.0002	0.0006	0.0008	0.0011	0.0015	0.0019
L17	0.2619	0.5313	2697	0.0006	0.0008	0.0009	0.0013	0.0018	0.0022
L18	0.2640	0.5321	2651	0.0004	0.0008	0.0012	0.0016	0.0019	0.0023
L19	0.2630	0.5304	2677	0.0002	0.0005	0.0009	0.0013	0.0017	0.0020
L20	0.2631	0.5298	2679	0.0003	0.0007	0.0011	0.0015	0.0020	0.0024
L21	0.2651	0.5322	2630	0.0005	0.0009	0.0013	0.0016	0.0017	0.0023
L22	0.2643	0.5336	2640	0.0006	0.0006	0.0009	0.0013	0.0014	0.0019
L23	0.2626	0.5313	2682	0.0004	0.0009	0.0010	0.0015	0.0017	0.0021
L24	0.2618	0.5301	2704	0.0005	0.0007	0.0008	0.0012	0.0015	0.0020
L25	0.2632	0.5328	2664	0.0007	0.0008	0.0009	0.0011	0.0018	0.0022
L26	0.2615	0.5300	2711	0.0003	0.0006	0.0007	0.0011	0.0014	0.0019
L27	0.2646	0.5319	2641	0.0006	0.0009	0.0011	0.0016	0.0018	0.0024
L28	0.2603	0.5294	2738	0.0004	0.0009	0.0010	0.0015	0.0020	0.0025
L29	0.2646	0.5319	2640	0.0003	0.0008	0.0012	0.0015	0.0017	0.0022
L30	0.2643	0.5322	2645	0.0002	0.0004	0.0007	0.0014	0.0017	0.0023
Ave.	0.2632	0.5314	2671	0.0004	0.0007	0.0010	0.0014	0.0017	0.0022
Med.	0.2632	0.5319	2664	0.0004	0.0008	0.0009	0.0014	0.0017	0.0022
st dev	0.0014	0.0012	31	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002
Min.	0.2603	0.5294	2630	0.0002	0.0004	0.0007	0.0011	0.0014	0.0019
Max.	0.2651	0.5336	2738	0.0007	0.0009	0.0013	0.0016	0.0020	0.0025

3.3 Data Set 3: 105°C; 30mA

Description of Light Sources tested :	1.0W
Case Temperature :	104.3°C
Ambient Temperature :	103.8°C
Drive Current :	30mA
Measure Current :	30mA
Failures Observed :	None
Number of Units:	15

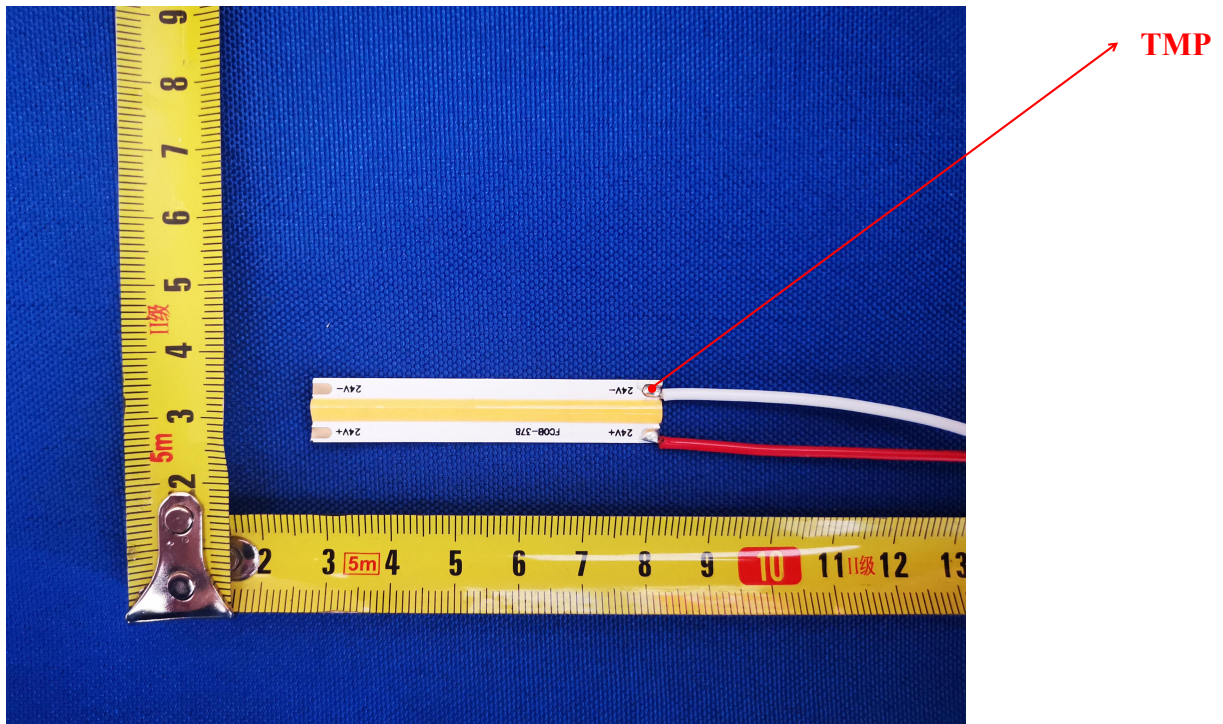
Lumen Maintenance (%)								
Sample No.	V _F (V)	Φ(lm)	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs
	0hr(Initial)							
L31	24.0	57.5	99.56	99.21	98.93	98.56	98.10	97.82
L32	24.0	56.4	99.45	99.16	98.79	98.38	98.04	97.78
L33	24.0	58.1	99.37	99.09	98.80	98.36	97.89	97.67
L34	24.0	57.3	99.67	99.30	98.86	98.46	98.20	97.95
L35	24.0	56.9	99.54	99.24	98.75	98.32	97.94	97.79
L36	24.0	56.1	99.30	99.02	98.85	98.47	98.13	97.81
L37	24.0	56.7	99.49	99.10	98.79	98.36	98.05	97.78
L38	24.0	57.6	99.28	99.01	98.69	98.31	97.98	97.63
L39	24.0	55.8	99.26	99.09	98.75	98.34	98.01	97.79
L40	24.0	58.1	99.57	99.14	98.80	98.46	98.03	97.74
L41	24.0	56.7	99.28	99.08	98.81	98.43	98.00	97.80
L42	24.0	56.3	99.34	99.04	98.76	98.38	97.98	97.62
L43	24.0	57.4	99.53	99.18	98.71	98.34	98.01	97.80
L44	24.0	55.6	99.47	99.11	98.74	98.30	97.95	97.61
L45	24.0	58.2	99.53	99.28	98.81	98.45	98.02	97.73
Ave.	24.0	57.0	99.44	99.14	98.79	98.39	98.02	97.75
Med.	24.0	56.9	99.47	99.11	98.79	98.38	98.01	97.78
st dev	0	0.8436	0.1287	0.0904	0.0610	0.0739	0.0776	0.0910
Min.	24.0	55.6	99.26	99.01	98.69	98.30	97.89	97.61
Max.	24.0	58.2	99.67	99.30	98.93	98.56	98.20	97.95

Description of Light Sources tested :	1.0W
Case Temperature :	104.3°C
Ambient Temperature :	103.8°C
Drive Current :	30mA
Measure Current :	30mA
Failures Observed :	None
Number of Units:	15

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

Sample No.	u'	v'	CCT(K)	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs
	0hr(Initial)								
L31	0.2642	0.5313	2650	0.0004	0.0007	0.0010	0.0013	0.0017	0.0019
L32	0.2622	0.5307	2693	0.0007	0.0011	0.0014	0.0014	0.0015	0.0020
L33	0.2654	0.5328	2621	0.0007	0.0008	0.0010	0.0012	0.0019	0.0022
L34	0.2639	0.5327	2651	0.0004	0.0008	0.0011	0.0013	0.0018	0.0023
L35	0.2664	0.5334	2601	0.0006	0.0010	0.0013	0.0015	0.0020	0.0022
L36	0.2623	0.5309	2690	0.0008	0.0011	0.0012	0.0014	0.0018	0.0021
L37	0.2630	0.5316	2674	0.0007	0.0009	0.0012	0.0013	0.0019	0.0020
L38	0.2643	0.5324	2645	0.0005	0.0008	0.0010	0.0015	0.0019	0.0023
L39	0.2638	0.5306	2661	0.0009	0.0011	0.0015	0.0018	0.0021	0.0024
L40	0.2615	0.5294	2712	0.0006	0.0010	0.0013	0.0017	0.0022	0.0025
L41	0.2639	0.5321	2655	0.0009	0.0011	0.0014	0.0016	0.0020	0.0023
L42	0.2630	0.5295	2682	0.0007	0.0010	0.0015	0.0019	0.0023	0.0026
L43	0.2626	0.5292	2691	0.0005	0.0007	0.0010	0.0013	0.0019	0.0023
L44	0.2625	0.5306	2687	0.0005	0.0009	0.0011	0.0015	0.0020	0.0024
L45	0.2630	0.5312	2674	0.0009	0.0010	0.0012	0.0017	0.0021	0.0025
Ave.	0.2635	0.5312	2666	0.0007	0.0009	0.0012	0.0015	0.0019	0.0023
Med.	0.2630	0.5312	2674	0.0007	0.0010	0.0012	0.0015	0.0019	0.0023
st dev	0.0013	0.0013	30	0.0002	0.0001	0.0002	0.0002	0.0002	0.0002
Min.	0.2615	0.5292	2601	0.0004	0.0007	0.0010	0.0012	0.0015	0.0019
Max.	0.2664	0.5334	2712	0.0009	0.0011	0.0015	0.0019	0.0023	0.0026

4-EUT Photos



----End of report----