

LM-80 Report No.  
LM1103501Original  
Copy

# 69510

## CLL050 series LM-80 Report

Customer Name : CITIZEN ELECTRONICS CO.,LTD.

### 1. Number of LED sources

20 randomly selected samples for each Tc

Test report must specifically indicate that the LED sources were tested to the test method outlined in IES LM-80-08.

### 2. Description of LED sources

LED array InGaN dies are mounted on a MCPCB and overlaid with one common phosphor layer.

The report is applied to the following series

CLL010series、CLL020series、CLL030series、CLL040series、CLL050series

### 3. Description of Auxiliary Equipment.

LED+Thermal grease+Heat sink+Water cooling system

Heat sink size: 40 x 50 x t10mm

### 4. Operating Cycle.

DC driving.

### 5. Ambient Conditions including airflow temperature and relative humidity.

Minimal airflow.

Ta= 26.3 deg C during photometric testing .

See Table-1 for relative humidity.

### 6. Case Temperature (Tc) / 7. Drive Current

Table-1 LM-80 Test condition

| Nominal Tc (deg C) | Actual Tc (deg C) | Actual Ta (deg C) | Tc -Ta (deg C) | Turget CCT(K) | Actual CTT(K) | Drive current (mA) | Relative humidity | Average Lumen Maintenance @6000h | Average Δu'v' @6000h |
|--------------------|-------------------|-------------------|----------------|---------------|---------------|--------------------|-------------------|----------------------------------|----------------------|
| 55                 | 53.8              | 53.4              | 0.4            | 2725          | 2606          | 3000               | 3%                | 100.3%                           | 0.0006               |
| 85                 | 84.1              | 83.3              | 0.8            | 2725          | 2603          | 3000               | 2%                | 100.3%                           | 0.0005               |
| 105                | 103.8             | 103.5             | 0.3            | 2725          | 2606          | 3000               | 2%                | 100.1%                           | 0.0008               |

See last page for the Tc measurement point

### 8. Initial Luminous flux and forward voltage and CCT

See table.

### 9. Lumen Maintenance DATA

See table.

### 10. Observation of LED Light Source failures

No failures observed.

### 11. LED light source monitoring interval

1000h

### 12. Photometric measurement uncertainty

±1.9% lumens

### 13. Chromaticity shift reported over the measurement time .

See table.

### 14.Sampling Method/Sample size

20 samples to be randomly taken from 3 manufacturing lots. Total 60samples to be made.

Make 3 units from 60 samples.

Each unit is made with 20 samples that are randomly taken from 60 samples of 3 manufacturing lots.

3 units are tested for LM-80 under three different temperature conditions for measurement.

| Test conditions |        | Tc=53.8 deg C Ta=53.4 deg C IFDC=3000mA |                   |       |       |       |       |       |       |
|-----------------|--------|---|-------------------|-------|-------|-------|-------|-------|-------|
|                 | CCT(K) | Vf(V)                                   | Luminous Flux(lm) |       |       |       |       |       |       |
|                 | 0H     | 0H                                      | 0H                | 1000H | 2000H | 3000H | 4000H | 5000H | 6000H |
| 1               | 2606   | 85.0                                    | 15859             | 16129 | 16003 | 15918 | 16152 | 16090 | 16139 |
| 2               | 2597   | 86.0                                    | 15994             | 16051 | 15888 | 15868 | 16094 | 15919 | 16003 |
| 3               | 2629   | 84.0                                    | 16114             | 16256 | 16161 | 15937 | 16198 | 16049 | 16089 |
| 4               | 2626   | 85.0                                    | 15912             | 16029 | 16077 | 15744 | 16088 | 15907 | 15936 |
| 5               | 2587   | 85.0                                    | 15933             | 16087 | 16102 | 15932 | 16149 | 15980 | 16031 |
| 6               | 2580   | 86.0                                    | 15346             | 15427 | 15365 | 15263 | 15402 | 15319 | 15365 |
| 7               | 2639   | 85.0                                    | 16194             | 16257 | 16227 | 16117 | 16360 | 16288 | 16191 |
| 8               | 2618   | 85.0                                    | 16038             | 16058 | 16133 | 15562 | 16160 | 16063 | 16087 |
| 9               | 2592   | 85.0                                    | 15535             | 15565 | 15560 | 15434 | 15591 | 15536 | 15537 |
| 10              | 2612   | 85.0                                    | 15461             | 15505 | 15530 | 15312 | 15562 | 15444 | 15562 |
| 11              | 2625   | 85.0                                    | 15606             | 15475 | 15653 | 15504 | 15765 | 15475 | 15712 |
| 12              | 2610   | 86.0                                    | 15417             | 15481 | 15520 | 15361 | 15636 | 15526 | 15593 |
| 13              | 2586   | 84.0                                    | 15904             | 16021 | 15838 | 15862 | 16129 | 15937 | 15996 |
| 14              | 2589   | 85.0                                    | 16155             | 16250 | 16241 | 16116 | 16345 | 16219 | 16279 |
| 15              | 2607   | 83.0                                    | 16123             | 16286 | 16268 | 16119 | 16339 | 16189 | 16214 |
| 16              | 2586   | 85.0                                    | 15624             | 15716 | 15803 | 15593 | 15803 | 15661 | 15574 |
| 17              | 2605   | 85.0                                    | 16108             | 16208 | 16309 | 15743 | 15963 | 15961 | 15953 |
| 18              | 2617   | 87.0                                    | 15421             | 15534 | 15581 | 15520 | 15538 | 15485 | 15477 |
| 19              | 2594   | 84.0                                    | 15967             | 16144 | 16237 | 16046 | 16075 | 15942 | 15932 |
| 20              | 2614   | 86.0                                    | 15756             | 15923 | 15935 | 15835 | 15897 | 15750 | 15768 |
| Max.            | 2639   | 87.0                                    | 16194             | 16286 | 16309 | 16119 | 16360 | 16288 | 16279 |
| Ave.            | 2606   | 85.1                                    | 15823             | 15920 | 15922 | 15739 | 15962 | 15837 | 15872 |
| Min.            | 2580   | 83.0                                    | 15346             | 15427 | 15365 | 15263 | 15402 | 15319 | 15365 |
| Sigma           | 16.2   | 0.9                                     | 272.7             | 304.5 | 291.2 | 271.5 | 287.5 | 283.3 | 268.8 |
| Median          | 2606   | 85.0                                    | 15908             | 16040 | 15969 | 15790 | 16082 | 15928 | 15945 |

| Lumen Maintenance(%) |    |       |       |       |       |       |       |
|----------------------|----|-------|-------|-------|-------|-------|-------|
|                      | 0H | 1000H | 2000H | 3000H | 4000H | 5000H | 6000H |
| 1                    | -  | 101.7 | 100.9 | 100.4 | 101.8 | 101.5 | 101.8 |
| 2                    | -  | 100.4 | 99.3  | 99.2  | 100.6 | 99.5  | 100.1 |
| 3                    | -  | 100.9 | 100.3 | 98.9  | 100.5 | 99.6  | 99.8  |
| 4                    | -  | 100.7 | 101.0 | 98.9  | 101.1 | 100.0 | 100.2 |
| 5                    | -  | 101.0 | 101.1 | 100.0 | 101.4 | 100.3 | 100.6 |
| 6                    | -  | 100.5 | 100.1 | 99.5  | 100.4 | 99.8  | 100.1 |
| 7                    | -  | 100.4 | 100.2 | 99.5  | 101.0 | 100.6 | 100.0 |
| 8                    | -  | 100.1 | 100.6 | 97.0  | 100.8 | 100.2 | 100.3 |
| 9                    | -  | 100.2 | 100.2 | 99.3  | 100.4 | 100.0 | 100.0 |
| 10                   | -  | 100.3 | 100.4 | 99.0  | 100.7 | 99.9  | 100.7 |
| 11                   | -  | 99.2  | 100.3 | 99.3  | 101.0 | 99.2  | 100.7 |
| 12                   | -  | 100.4 | 100.7 | 99.6  | 101.4 | 100.7 | 101.1 |
| 13                   | -  | 100.7 | 99.6  | 99.7  | 101.4 | 100.2 | 100.6 |
| 14                   | -  | 100.6 | 100.5 | 99.8  | 101.2 | 100.4 | 100.8 |
| 15                   | -  | 101.0 | 100.9 | 100.0 | 101.3 | 100.4 | 100.6 |
| 16                   | -  | 100.6 | 101.1 | 99.8  | 101.1 | 100.2 | 99.7  |
| 17                   | -  | 100.6 | 101.2 | 97.7  | 99.1  | 99.1  | 99.0  |
| 18                   | -  | 100.7 | 101.0 | 100.6 | 100.8 | 100.4 | 100.4 |
| 19                   | -  | 101.1 | 101.7 | 100.5 | 100.7 | 99.8  | 99.8  |
| 20                   | -  | 101.1 | 101.1 | 100.5 | 100.9 | 100.0 | 100.1 |
| Max.                 | -  | 101.7 | 101.7 | 100.6 | 101.8 | 101.5 | 101.8 |
| Ave.                 | -  | 100.6 | 100.6 | 99.5  | 100.9 | 100.1 | 100.3 |
| Min.                 | -  | 99.2  | 99.3  | 97.0  | 99.1  | 99.1  | 99.0  |
| Sigma                | -  | 0.5   | 0.6   | 0.9   | 0.6   | 0.5   | 0.6   |
| Median               | -  | 100.6 | 100.6 | 99.6  | 101.0 | 100.1 | 100.2 |

|                 |   |
|-----------------|---|
| Test conditions | Tc=53.8 deg C Ta=53.4 deg C IFDC=3000mA |
|-----------------|---|

| Chromaticity u' |        |        |        |        |        |        |        |
|-----------------|--------|--------|--------|--------|--------|--------|--------|
|                 | 0H     | 1000H  | 2000H  | 3000H  | 4000H  | 5000H  | 6000H  |
| 1               | 0.2577 | 0.2578 | 0.2578 | 0.2580 | 0.2578 | 0.2580 | 0.2580 |
| 2               | 0.2579 | 0.2583 | 0.2581 | 0.2583 | 0.2582 | 0.2587 | 0.2581 |
| 3               | 0.2568 | 0.2569 | 0.2568 | 0.2568 | 0.2568 | 0.2572 | 0.2567 |
| 4               | 0.2589 | 0.2591 | 0.2590 | 0.2590 | 0.2590 | 0.2594 | 0.2590 |
| 5               | 0.2585 | 0.2588 | 0.2586 | 0.2588 | 0.2589 | 0.2592 | 0.2587 |
| 6               | 0.2586 | 0.2589 | 0.2587 | 0.2588 | 0.2589 | 0.2594 | 0.2590 |
| 7               | 0.2565 | 0.2568 | 0.2567 | 0.2568 | 0.2567 | 0.2571 | 0.2569 |
| 8               | 0.2571 | 0.2575 | 0.2573 | 0.2579 | 0.2575 | 0.2577 | 0.2574 |
| 9               | 0.2581 | 0.2587 | 0.2585 | 0.2585 | 0.2584 | 0.2588 | 0.2586 |
| 10              | 0.2574 | 0.2578 | 0.2574 | 0.2576 | 0.2577 | 0.2581 | 0.2578 |
| 11              | 0.2569 | 0.2575 | 0.2569 | 0.2571 | 0.2570 | 0.2574 | 0.2572 |
| 12              | 0.2573 | 0.2578 | 0.2575 | 0.2577 | 0.2577 | 0.2582 | 0.2579 |
| 13              | 0.2581 | 0.2586 | 0.2584 | 0.2586 | 0.2586 | 0.2588 | 0.2586 |
| 14              | 0.2582 | 0.2587 | 0.2584 | 0.2586 | 0.2584 | 0.2589 | 0.2587 |
| 15              | 0.2577 | 0.2580 | 0.2578 | 0.2579 | 0.2579 | 0.2582 | 0.2581 |
| 16              | 0.2584 | 0.2588 | 0.2584 | 0.2585 | 0.2585 | 0.2588 | 0.2588 |
| 17              | 0.2577 | 0.2579 | 0.2577 | 0.2581 | 0.2579 | 0.2584 | 0.2582 |
| 18              | 0.2570 | 0.2575 | 0.2572 | 0.2575 | 0.2575 | 0.2579 | 0.2577 |
| 19              | 0.2580 | 0.2580 | 0.2576 | 0.2580 | 0.2581 | 0.2582 | 0.2579 |
| 20              | 0.2573 | 0.2576 | 0.2572 | 0.2575 | 0.2576 | 0.2577 | 0.2573 |
| Max.            | 0.2589 | 0.2591 | 0.2590 | 0.2590 | 0.2590 | 0.2594 | 0.2590 |
| Ave.            | 0.2577 | 0.2580 | 0.2578 | 0.2580 | 0.2579 | 0.2583 | 0.2580 |
| Min.            | 0.2565 | 0.2568 | 0.2567 | 0.2568 | 0.2567 | 0.2571 | 0.2567 |
| Sigma           | 0.0006 | 0.0006 | 0.0007 | 0.0006 | 0.0007 | 0.0007 | 0.0007 |
| Median          | 0.2577 | 0.2579 | 0.2577 | 0.2580 | 0.2579 | 0.2582 | 0.2580 |

| Chromaticity v' |        |        |        |        |        |        |        |
|-----------------|--------|--------|--------|--------|--------|--------|--------|
|                 | 0H     | 1000H  | 2000H  | 3000H  | 4000H  | 5000H  | 6000H  |
| 1               | 0.5271 | 0.5274 | 0.5272 | 0.5275 | 0.5273 | 0.5276 | 0.5275 |
| 2               | 0.5284 | 0.5289 | 0.5288 | 0.5290 | 0.5288 | 0.5297 | 0.5290 |
| 3               | 0.5264 | 0.5268 | 0.5265 | 0.5265 | 0.5265 | 0.5273 | 0.5265 |
| 4               | 0.5285 | 0.5288 | 0.5288 | 0.5289 | 0.5288 | 0.5291 | 0.5288 |
| 5               | 0.5272 | 0.5276 | 0.5274 | 0.5276 | 0.5277 | 0.5282 | 0.5274 |
| 6               | 0.5281 | 0.5287 | 0.5284 | 0.5285 | 0.5286 | 0.5294 | 0.5284 |
| 7               | 0.5263 | 0.5267 | 0.5264 | 0.5267 | 0.5266 | 0.5270 | 0.5265 |
| 8               | 0.5269 | 0.5273 | 0.5272 | 0.5277 | 0.5273 | 0.5279 | 0.5276 |
| 9               | 0.5280 | 0.5285 | 0.5282 | 0.5287 | 0.5285 | 0.5290 | 0.5283 |
| 10              | 0.5277 | 0.5281 | 0.5277 | 0.5283 | 0.5282 | 0.5288 | 0.5282 |
| 11              | 0.5269 | 0.5275 | 0.5272 | 0.5276 | 0.5275 | 0.5280 | 0.5274 |
| 12              | 0.5276 | 0.5278 | 0.5276 | 0.5283 | 0.5281 | 0.5288 | 0.5282 |
| 13              | 0.5287 | 0.5293 | 0.5290 | 0.5294 | 0.5292 | 0.5299 | 0.5294 |
| 14              | 0.5286 | 0.5293 | 0.5288 | 0.5294 | 0.5293 | 0.5298 | 0.5293 |
| 15              | 0.5272 | 0.5276 | 0.5273 | 0.5276 | 0.5275 | 0.5282 | 0.5276 |
| 16              | 0.5284 | 0.5290 | 0.5286 | 0.5292 | 0.5289 | 0.5295 | 0.5290 |
| 17              | 0.5280 | 0.5284 | 0.5281 | 0.5286 | 0.5284 | 0.5291 | 0.5285 |
| 18              | 0.5271 | 0.5277 | 0.5274 | 0.5278 | 0.5277 | 0.5284 | 0.5277 |
| 19              | 0.5281 | 0.5285 | 0.5282 | 0.5286 | 0.5286 | 0.5291 | 0.5285 |
| 20              | 0.5271 | 0.5277 | 0.5273 | 0.5280 | 0.5278 | 0.5284 | 0.5278 |
| Max.            | 0.5287 | 0.5293 | 0.5290 | 0.5294 | 0.5293 | 0.5299 | 0.5294 |
| Ave.            | 0.5276 | 0.5281 | 0.5278 | 0.5282 | 0.5280 | 0.5287 | 0.5281 |
| Min.            | 0.5263 | 0.5267 | 0.5264 | 0.5265 | 0.5265 | 0.5270 | 0.5265 |
| Sigma           | 0.0007 | 0.0008 | 0.0007 | 0.0008 | 0.0008 | 0.0008 | 0.0008 |
| Median          | 0.5277 | 0.5280 | 0.5277 | 0.5283 | 0.5281 | 0.5288 | 0.5282 |

|                 |   |
|-----------------|---|
| Test conditions | Tc=53.8 deg C Ta=53.4 deg C IFDC=3000mA |
|-----------------|---|

|        | $\Delta u'v'$ |        |        |        |        |        |        |
|--------|---------------|--------|--------|--------|--------|--------|--------|
|        | 0H            | 1000H  | 2000H  | 3000H  | 4000H  | 5000H  | 6000H  |
| 1      | -             | 0.0003 | 0.0002 | 0.0005 | 0.0002 | 0.0006 | 0.0005 |
| 2      | -             | 0.0006 | 0.0004 | 0.0007 | 0.0004 | 0.0016 | 0.0006 |
| 3      | -             | 0.0004 | 0.0001 | 0.0001 | 0.0001 | 0.0010 | 0.0001 |
| 4      | -             | 0.0004 | 0.0004 | 0.0005 | 0.0003 | 0.0008 | 0.0004 |
| 5      | -             | 0.0005 | 0.0002 | 0.0005 | 0.0006 | 0.0012 | 0.0003 |
| 6      | -             | 0.0007 | 0.0003 | 0.0005 | 0.0006 | 0.0015 | 0.0005 |
| 7      | -             | 0.0005 | 0.0002 | 0.0004 | 0.0004 | 0.0010 | 0.0004 |
| 8      | -             | 0.0005 | 0.0003 | 0.0011 | 0.0005 | 0.0012 | 0.0007 |
| 9      | -             | 0.0008 | 0.0005 | 0.0008 | 0.0006 | 0.0013 | 0.0007 |
| 10     | -             | 0.0006 | 0.0001 | 0.0007 | 0.0006 | 0.0013 | 0.0006 |
| 11     | -             | 0.0008 | 0.0003 | 0.0007 | 0.0005 | 0.0012 | 0.0006 |
| 12     | -             | 0.0005 | 0.0002 | 0.0008 | 0.0006 | 0.0014 | 0.0008 |
| 13     | -             | 0.0007 | 0.0004 | 0.0009 | 0.0007 | 0.0014 | 0.0009 |
| 14     | -             | 0.0009 | 0.0003 | 0.0009 | 0.0007 | 0.0014 | 0.0008 |
| 15     | -             | 0.0005 | 0.0001 | 0.0005 | 0.0004 | 0.0011 | 0.0005 |
| 16     | -             | 0.0006 | 0.0001 | 0.0008 | 0.0005 | 0.0012 | 0.0007 |
| 17     | -             | 0.0005 | 0.0001 | 0.0007 | 0.0005 | 0.0014 | 0.0007 |
| 18     | -             | 0.0008 | 0.0003 | 0.0008 | 0.0008 | 0.0016 | 0.0009 |
| 19     | -             | 0.0004 | 0.0003 | 0.0006 | 0.0006 | 0.0011 | 0.0004 |
| 20     | -             | 0.0006 | 0.0002 | 0.0009 | 0.0007 | 0.0013 | 0.0007 |
| Max.   | -             | 0.0009 | 0.0005 | 0.0011 | 0.0008 | 0.0016 | 0.0009 |
| Ave.   | -             | 0.0006 | 0.0003 | 0.0007 | 0.0005 | 0.0012 | 0.0006 |
| Min.   | -             | 0.0003 | 0.0001 | 0.0001 | 0.0001 | 0.0006 | 0.0001 |
| Sigma  | -             | 0.0002 | 0.0001 | 0.0002 | 0.0002 | 0.0002 | 0.0002 |
| Median | -             | 0.0005 | 0.0003 | 0.0007 | 0.0006 | 0.0012 | 0.0006 |

|                 |   |
|-----------------|---|
| Test conditions | Tc=84.1 deg C Ta=83.3 deg C IFDC=3000mA |
|-----------------|---|

|        | CCT(K) | V <sub>R</sub> (V) | Luminous Flux(lm) |       |       |       |       |       |       |
|--------|--------|--------------------|-------------------|-------|-------|-------|-------|-------|-------|
|        | 0H     | 0H                 | 0H                | 1000H | 2000H | 3000H | 4000H | 5000H | 6000H |
| 1      | 2613   | 83.0               | 15294             | 15334 | 15262 | 15381 | 15450 | 15174 | 15353 |
| 2      | 2602   | 83.0               | 15532             | 15356 | 15459 | 15506 | 15613 | 15400 | 15502 |
| 3      | 2601   | 84.0               | 15849             | 15884 | 15940 | 15919 | 15972 | 15791 | 15883 |
| 4      | 2625   | 84.0               | 14960             | 14995 | 15034 | 15042 | 15120 | 14961 | 15060 |
| 5      | 2618   | 85.0               | 15830             | 15855 | 15987 | 15971 | 15915 | 15805 | 15971 |
| 6      | 2582   | 85.0               | 15459             | 15549 | 15623 | 15723 | 15735 | 15083 | 15113 |
| 7      | 2598   | 85.0               | 15894             | 15938 | 16060 | 16011 | 16044 | 15817 | 15927 |
| 8      | 2583   | 86.0               | 15415             | 15483 | 15574 | 15544 | 15668 | 15429 | 15503 |
| 9      | 2600   | 85.0               | 15668             | 15730 | 15779 | 15746 | 15841 | 15657 | 15664 |
| 10     | 2616   | 84.0               | 16015             | 16113 | 16148 | 15966 | 16031 | 15964 | 16054 |
| 11     | 2607   | 83.0               | 15737             | 15755 | 15805 | 15798 | 15806 | 15650 | 15767 |
| 12     | 2589   | 85.0               | 15393             | 15449 | 15533 | 15459 | 15551 | 15349 | 15451 |
| 13     | 2586   | 86.0               | 15676             | 15570 | 15776 | 15761 | 15853 | 15743 | 15822 |
| 14     | 2586   | 86.0               | 15716             | 15808 | 15768 | 15812 | 15761 | 15726 | 15821 |
| 15     | 2639   | 86.0               | 16002             | 16012 | 16079 | 16055 | 16093 | 15848 | 15923 |
| 16     | 2613   | 86.0               | 15713             | 15821 | 15904 | 15861 | 15909 | 15761 | 15907 |
| 17     | 2585   | 85.0               | 15706             | 15709 | 15803 | 15738 | 15724 | 15640 | 15738 |
| 18     | 2582   | 85.0               | 15789             | 15803 | 15948 | 15987 | 16037 | 15865 | 15933 |
| 19     | 2587   | 85.0               | 15667             | 15769 | 15884 | 15841 | 15893 | 15724 | 15816 |
| 20     | 2653   | 83.0               | 16066             | 16057 | 16115 | 16073 | 16124 | 15968 | 16096 |
| Max.   | 2653   | 86.0               | 16066             | 16113 | 16148 | 16073 | 16124 | 15968 | 16096 |
| Ave.   | 2603   | 84.7               | 15669             | 15700 | 15774 | 15760 | 15807 | 15618 | 15715 |
| Min.   | 2582   | 83.0               | 14960             | 14995 | 15034 | 15042 | 15120 | 14961 | 15060 |
| Sigma  | 19.5   | 1.1                | 261.6             | 269.7 | 282.4 | 254.5 | 238.5 | 282.2 | 287.0 |
| Median | 2600   | 85.0               | 15710             | 15762 | 15804 | 15805 | 15847 | 15725 | 15819 |

|                 |   |
|-----------------|---|
| Test conditions | Tc=84.1 deg C Ta=83.3 deg C IFDC=3000mA |
|-----------------|---|

| Lumen Maintenance(%) |    |       |       |       |       |       |       |
|----------------------|----|-------|-------|-------|-------|-------|-------|
|                      | 0H | 1000H | 2000H | 3000H | 4000H | 5000H | 6000H |
| 1                    | -  | 100.3 | 99.8  | 100.6 | 101.0 | 99.2  | 100.4 |
| 2                    | -  | 98.9  | 99.5  | 99.8  | 100.5 | 99.2  | 99.8  |
| 3                    | -  | 100.2 | 100.6 | 100.4 | 100.8 | 99.6  | 100.2 |
| 4                    | -  | 100.2 | 100.5 | 100.5 | 101.1 | 100.0 | 100.7 |
| 5                    | -  | 100.2 | 101.0 | 100.9 | 100.5 | 99.8  | 100.9 |
| 6                    | -  | 100.6 | 101.1 | 101.7 | 101.8 | 97.6  | 97.8  |
| 7                    | -  | 100.3 | 101.0 | 100.7 | 100.9 | 99.5  | 100.2 |
| 8                    | -  | 100.4 | 101.0 | 100.8 | 101.6 | 100.1 | 100.6 |
| 9                    | -  | 100.4 | 100.7 | 100.5 | 101.1 | 99.9  | 100.0 |
| 10                   | -  | 100.6 | 100.8 | 99.7  | 100.1 | 99.7  | 100.2 |
| 11                   | -  | 100.1 | 100.4 | 100.4 | 100.4 | 99.4  | 100.2 |
| 12                   | -  | 100.4 | 100.9 | 100.4 | 101.0 | 99.7  | 100.4 |
| 13                   | -  | 99.3  | 100.6 | 100.5 | 101.1 | 100.4 | 100.9 |
| 14                   | -  | 100.6 | 100.3 | 100.6 | 100.3 | 100.1 | 100.7 |
| 15                   | -  | 100.1 | 100.5 | 100.3 | 100.6 | 99.0  | 99.5  |
| 16                   | -  | 100.7 | 101.2 | 100.9 | 101.2 | 100.3 | 101.2 |
| 17                   | -  | 100.0 | 100.6 | 100.2 | 100.1 | 99.6  | 100.2 |
| 18                   | -  | 100.1 | 101.0 | 101.3 | 101.6 | 100.5 | 100.9 |
| 19                   | -  | 100.7 | 101.4 | 101.1 | 101.4 | 100.4 | 101.0 |
| 20                   | -  | 99.9  | 100.3 | 100.0 | 100.4 | 99.4  | 100.2 |
| Max.                 | -  | 100.7 | 101.4 | 101.7 | 101.8 | 100.5 | 101.2 |
| Ave.                 | -  | 100.2 | 100.7 | 100.6 | 100.9 | 99.7  | 100.3 |
| Min.                 | -  | 98.9  | 99.5  | 99.7  | 100.1 | 97.6  | 97.8  |
| Sigma                | -  | 0.4   | 0.4   | 0.5   | 0.5   | 0.6   | 0.7   |
| Median               | -  | 100.2 | 100.7 | 100.5 | 101.0 | 99.7  | 100.3 |

| Chromaticity u' |        |        |        |        |        |        |        |
|-----------------|--------|--------|--------|--------|--------|--------|--------|
|                 | 0H     | 1000H  | 2000H  | 3000H  | 4000H  | 5000H  | 6000H  |
| 1               | 0.2565 | 0.2567 | 0.2568 | 0.2569 | 0.2571 | 0.2576 | 0.2570 |
| 2               | 0.2570 | 0.2577 | 0.2573 | 0.2575 | 0.2574 | 0.2581 | 0.2575 |
| 3               | 0.2572 | 0.2574 | 0.2573 | 0.2576 | 0.2576 | 0.2583 | 0.2577 |
| 4               | 0.2559 | 0.2561 | 0.2560 | 0.2564 | 0.2564 | 0.2572 | 0.2563 |
| 5               | 0.2570 | 0.2574 | 0.2569 | 0.2571 | 0.2573 | 0.2579 | 0.2571 |
| 6               | 0.2582 | 0.2587 | 0.2584 | 0.2586 | 0.2586 | 0.2612 | 0.2603 |
| 7               | 0.2565 | 0.2567 | 0.2564 | 0.2569 | 0.2566 | 0.2575 | 0.2569 |
| 8               | 0.2582 | 0.2583 | 0.2581 | 0.2585 | 0.2581 | 0.2590 | 0.2584 |
| 9               | 0.2577 | 0.2580 | 0.2576 | 0.2579 | 0.2579 | 0.2586 | 0.2579 |
| 10              | 0.2569 | 0.2571 | 0.2570 | 0.2572 | 0.2573 | 0.2579 | 0.2571 |
| 11              | 0.2572 | 0.2576 | 0.2572 | 0.2576 | 0.2576 | 0.2585 | 0.2573 |
| 12              | 0.2578 | 0.2579 | 0.2577 | 0.2580 | 0.2581 | 0.2589 | 0.2579 |
| 13              | 0.2584 | 0.2588 | 0.2584 | 0.2587 | 0.2585 | 0.2592 | 0.2584 |
| 14              | 0.2583 | 0.2584 | 0.2583 | 0.2584 | 0.2584 | 0.2589 | 0.2583 |
| 15              | 0.2557 | 0.2561 | 0.2559 | 0.2562 | 0.2561 | 0.2569 | 0.2560 |
| 16              | 0.2571 | 0.2574 | 0.2570 | 0.2575 | 0.2573 | 0.2581 | 0.2572 |
| 17              | 0.2583 | 0.2588 | 0.2584 | 0.2587 | 0.2586 | 0.2591 | 0.2584 |
| 18              | 0.2581 | 0.2587 | 0.2582 | 0.2586 | 0.2584 | 0.2592 | 0.2583 |
| 19              | 0.2583 | 0.2585 | 0.2582 | 0.2585 | 0.2585 | 0.2591 | 0.2582 |
| 20              | 0.2555 | 0.2559 | 0.2556 | 0.2559 | 0.2559 | 0.2567 | 0.2559 |
| Max.            | 0.2584 | 0.2588 | 0.2584 | 0.2587 | 0.2586 | 0.2612 | 0.2603 |
| Ave.            | 0.2573 | 0.2576 | 0.2573 | 0.2576 | 0.2576 | 0.2584 | 0.2576 |
| Min.            | 0.2555 | 0.2559 | 0.2556 | 0.2559 | 0.2559 | 0.2567 | 0.2559 |
| Sigma           | 0.0009 | 0.0009 | 0.0009 | 0.0008 | 0.0008 | 0.0010 | 0.0010 |
| Median          | 0.2572 | 0.2577 | 0.2573 | 0.2576 | 0.2576 | 0.2584 | 0.2576 |

|                 |   |
|-----------------|---|
| Test conditions | Tc=84.1 deg C Ta=83.3 deg C IFDC=3000mA |
|-----------------|---|

| Chromaticity v' |        |        |        |        |        |        |        |
|-----------------|--------|--------|--------|--------|--------|--------|--------|
|                 | 0H     | 1000H  | 2000H  | 3000H  | 4000H  | 5000H  | 6000H  |
| 1               | 0.5272 | 0.5277 | 0.5273 | 0.5277 | 0.5275 | 0.5291 | 0.5274 |
| 2               | 0.5278 | 0.5281 | 0.5280 | 0.5286 | 0.5284 | 0.5297 | 0.5282 |
| 3               | 0.5279 | 0.5282 | 0.5281 | 0.5286 | 0.5283 | 0.5297 | 0.5282 |
| 4               | 0.5258 | 0.5261 | 0.5262 | 0.5265 | 0.5262 | 0.5276 | 0.5260 |
| 5               | 0.5265 | 0.5272 | 0.5268 | 0.5273 | 0.5272 | 0.5285 | 0.5263 |
| 6               | 0.5275 | 0.5280 | 0.5277 | 0.5280 | 0.5281 | 0.5306 | 0.5294 |
| 7               | 0.5276 | 0.5279 | 0.5280 | 0.5283 | 0.5280 | 0.5292 | 0.5279 |
| 8               | 0.5278 | 0.5282 | 0.5280 | 0.5284 | 0.5280 | 0.5294 | 0.5274 |
| 9               | 0.5275 | 0.5280 | 0.5277 | 0.5282 | 0.5280 | 0.5292 | 0.5273 |
| 10              | 0.5272 | 0.5276 | 0.5274 | 0.5281 | 0.5278 | 0.5294 | 0.5271 |
| 11              | 0.5280 | 0.5283 | 0.5281 | 0.5287 | 0.5284 | 0.5298 | 0.5277 |
| 12              | 0.5268 | 0.5271 | 0.5268 | 0.5275 | 0.5271 | 0.5287 | 0.5266 |
| 13              | 0.5277 | 0.5282 | 0.5279 | 0.5285 | 0.5281 | 0.5295 | 0.5275 |
| 14              | 0.5283 | 0.5286 | 0.5284 | 0.5288 | 0.5287 | 0.5300 | 0.5279 |
| 15              | 0.5268 | 0.5273 | 0.5269 | 0.5277 | 0.5271 | 0.5287 | 0.5266 |
| 16              | 0.5271 | 0.5274 | 0.5270 | 0.5277 | 0.5274 | 0.5287 | 0.5266 |
| 17              | 0.5285 | 0.5292 | 0.5286 | 0.5291 | 0.5291 | 0.5300 | 0.5283 |
| 18              | 0.5294 | 0.5300 | 0.5294 | 0.5298 | 0.5298 | 0.5309 | 0.5289 |
| 19              | 0.5285 | 0.5291 | 0.5285 | 0.5291 | 0.5291 | 0.5302 | 0.5283 |
| 20              | 0.5252 | 0.5259 | 0.5254 | 0.5261 | 0.5256 | 0.5270 | 0.5249 |
| Max.            | 0.5294 | 0.5300 | 0.5294 | 0.5298 | 0.5298 | 0.5309 | 0.5294 |
| Ave.            | 0.5274 | 0.5279 | 0.5276 | 0.5281 | 0.5279 | 0.5293 | 0.5274 |
| Min.            | 0.5252 | 0.5259 | 0.5254 | 0.5261 | 0.5256 | 0.5270 | 0.5249 |
| Sigma           | 0.0009 | 0.0009 | 0.0009 | 0.0009 | 0.0010 | 0.0009 | 0.0010 |
| Median          | 0.5276 | 0.5280 | 0.5278 | 0.5283 | 0.5280 | 0.5294 | 0.5274 |

| $\Delta u'v'$ |    |        |        |        |        |        |        |
|---------------|----|--------|--------|--------|--------|--------|--------|
|               | 0H | 1000H  | 2000H  | 3000H  | 4000H  | 5000H  | 6000H  |
| 1             | -  | 0.0006 | 0.0003 | 0.0007 | 0.0007 | 0.0022 | 0.0006 |
| 2             | -  | 0.0008 | 0.0004 | 0.0010 | 0.0008 | 0.0023 | 0.0007 |
| 3             | -  | 0.0003 | 0.0002 | 0.0007 | 0.0006 | 0.0021 | 0.0005 |
| 4             | -  | 0.0003 | 0.0004 | 0.0009 | 0.0006 | 0.0022 | 0.0004 |
| 5             | -  | 0.0008 | 0.0003 | 0.0008 | 0.0007 | 0.0022 | 0.0003 |
| 6             | -  | 0.0006 | 0.0002 | 0.0006 | 0.0007 | 0.0043 | 0.0028 |
| 7             | -  | 0.0004 | 0.0004 | 0.0008 | 0.0004 | 0.0018 | 0.0004 |
| 8             | -  | 0.0004 | 0.0001 | 0.0007 | 0.0001 | 0.0017 | 0.0005 |
| 9             | -  | 0.0007 | 0.0003 | 0.0008 | 0.0006 | 0.0020 | 0.0003 |
| 10            | -  | 0.0005 | 0.0003 | 0.0009 | 0.0007 | 0.0024 | 0.0003 |
| 11            | -  | 0.0005 | 0.0001 | 0.0008 | 0.0005 | 0.0021 | 0.0003 |
| 12            | -  | 0.0003 | 0.0001 | 0.0007 | 0.0005 | 0.0022 | 0.0003 |
| 13            | -  | 0.0006 | 0.0002 | 0.0008 | 0.0005 | 0.0020 | 0.0002 |
| 14            | -  | 0.0003 | 0.0001 | 0.0005 | 0.0004 | 0.0018 | 0.0004 |
| 15            | -  | 0.0007 | 0.0002 | 0.0010 | 0.0005 | 0.0023 | 0.0004 |
| 16            | -  | 0.0004 | 0.0001 | 0.0007 | 0.0004 | 0.0019 | 0.0004 |
| 17            | -  | 0.0009 | 0.0002 | 0.0007 | 0.0007 | 0.0017 | 0.0002 |
| 18            | -  | 0.0009 | 0.0001 | 0.0007 | 0.0005 | 0.0019 | 0.0005 |
| 19            | -  | 0.0007 | 0.0001 | 0.0007 | 0.0006 | 0.0019 | 0.0002 |
| 20            | -  | 0.0008 | 0.0002 | 0.0011 | 0.0006 | 0.0022 | 0.0005 |
| Max.          | -  | 0.0009 | 0.0004 | 0.0011 | 0.0008 | 0.0043 | 0.0028 |
| Ave.          | -  | 0.0006 | 0.0002 | 0.0008 | 0.0006 | 0.0022 | 0.0005 |
| Min.          | -  | 0.0003 | 0.0001 | 0.0005 | 0.0001 | 0.0017 | 0.0002 |
| Sigma         | -  | 0.0002 | 0.0001 | 0.0001 | 0.0001 | 0.0005 | 0.0005 |
| Median        | -  | 0.0006 | 0.0002 | 0.0008 | 0.0006 | 0.0021 | 0.0004 |

| Test conditions |        | Tc=103.8 deg C Ta=103.5 deg C IFDC=3000mA |                   |       |       |       |       |       |       |  |
|-----------------|--------|---|-------------------|-------|-------|-------|-------|-------|-------|--|
|                 | CCT(K) | Vr(V)                                     | Luminous Flux(lm) |       |       |       |       |       |       |  |
|                 | 0H     | 0H  | 0H                | 1000H | 2000H | 3000H | 4000H | 5000H | 6000H |  |
| 1               | 2590   | 85.0                                      | 15591             | 15562 | 15394 | 15475 | 15530 | 15308 | 15547 |  |
| 2               | 2599   | 85.0                                      | 15718             | 15666 | 15769 | 15821 | 15801 | 15586 | 15633 |  |
| 3               | 2598   | 84.0                                      | 15569             | 15554 | 15744 | 15725 | 15782 | 15582 | 15724 |  |
| 4               | 2604   | 85.0                                      | 16061             | 16094 | 16100 | 16094 | 15383 | 15522 | 15699 |  |
| 5               | 2600   | 86.0                                      | 16200             | 16210 | 16214 | 16225 | 15701 | 15696 | 15687 |  |
| 6               | 2581   | 85.0                                      | 15682             | 15737 | 15805 | 15789 | 15802 | 15677 | 15813 |  |
| 7               | 2615   | 85.0                                      | 15894             | 15802 | 16029 | 16019 | 16016 | 15890 | 16026 |  |
| 8               | 2625   | 85.0                                      | 15762             | 15721 | 15923 | 15812 | 15934 | 15781 | 15913 |  |
| 9               | 2619   | 85.0                                      | 15461             | 15584 | 15624 | 15690 | 15679 | 15558 | 15729 |  |
| 10              | 2608   | 84.0                                      | 15465             | 15405 | 15602 | 15621 | 15599 | 15515 | 15612 |  |
| 11              | 2600   | 85.0                                      | 15378             | 15436 | 15546 | 15526 | 15407 | 15351 | 15474 |  |
| 12              | 2592   | 85.0                                      | 15444             | 15449 | 15560 | 15496 | 15491 | 15387 | 15507 |  |
| 13              | 2620   | 85.0                                      | 15537             | 15485 | 15656 | 15620 | 15689 | 15473 | 15638 |  |
| 14              | 2627   | 85.0                                      | 16065             | 16057 | 16089 | 16088 | 15728 | 15577 | 15650 |  |
| 15              | 2581   | 84.0                                      | 16471             | 16490 | 16498 | 16494 | 16021 | 15975 | 16031 |  |
| 16              | 2605   | 84.0                                      | 15442             | 15398 | 15577 | 15572 | 15602 | 15543 | 15604 |  |
| 17              | 2603   | 85.0                                      | 15780             | 15755 | 15894 | 15884 | 15846 | 15737 | 15894 |  |
| 18              | 2627   | 85.0                                      | 15892             | 15915 | 16105 | 16101 | 16144 | 15970 | 16097 |  |
| 19              | 2626   | 83.0                                      | 15903             | 15890 | 16039 | 16099 | 15980 | 15881 | 16017 |  |
| 20              | 2599   | 84.0                                      | 15524             | 15522 | 15643 | 15742 | 15770 | 15544 | 15663 |  |
| Max.            | 2627   | 86.0                                      | 16471             | 16490 | 16498 | 16494 | 16144 | 15975 | 16097 |  |
| Ave.            | 2606   | 84.7                                      | 15742             | 15737 | 15841 | 15845 | 15745 | 15628 | 15748 |  |
| Min.            | 2581   | 83.0                                      | 15378             | 15398 | 15394 | 15475 | 15383 | 15308 | 15474 |  |
| Sigma           | 14.2   | 0.6                                       | 285.8             | 290.0 | 272.2 | 268.2 | 203.2 | 190.2 | 182.5 |  |
| Median          | 2603   | 85.0                                      | 15700             | 15694 | 15787 | 15801 | 15749 | 15580 | 15693 |  |

| Lumen Maintenance(%) |    |       |       |       |       |       |       |
|----------------------|----|-------|-------|-------|-------|-------|-------|
|                      | 0H | 1000H | 2000H | 3000H | 4000H | 5000H | 6000H |
| 1                    | -  | 99.8  | 98.7  | 99.3  | 99.6  | 98.2  | 99.7  |
| 2                    | -  | 99.7  | 100.3 | 100.7 | 100.5 | 99.2  | 99.5  |
| 3                    | -  | 99.9  | 101.1 | 101.0 | 101.4 | 100.1 | 101.0 |
| 4                    | -  | 100.2 | 100.2 | 100.2 | 95.8  | 96.6  | 97.7  |
| 5                    | -  | 100.1 | 100.1 | 100.2 | 96.9  | 96.9  | 96.8  |
| 6                    | -  | 100.4 | 100.8 | 100.7 | 100.8 | 100.0 | 100.8 |
| 7                    | -  | 99.4  | 100.8 | 100.8 | 100.8 | 100.0 | 100.8 |
| 8                    | -  | 99.7  | 101.0 | 100.3 | 101.1 | 100.1 | 101.0 |
| 9                    | -  | 100.8 | 101.1 | 101.5 | 101.4 | 100.6 | 101.7 |
| 10                   | -  | 99.6  | 100.9 | 101.0 | 100.9 | 100.3 | 101.0 |
| 11                   | -  | 100.4 | 101.1 | 101.0 | 100.2 | 99.8  | 100.6 |
| 12                   | -  | 100.0 | 100.8 | 100.3 | 100.3 | 99.6  | 100.4 |
| 13                   | -  | 99.7  | 100.8 | 100.5 | 101.0 | 99.6  | 100.7 |
| 14                   | -  | 100.0 | 100.1 | 100.1 | 97.9  | 97.0  | 97.4  |
| 15                   | -  | 100.1 | 100.2 | 100.1 | 97.3  | 97.0  | 97.3  |
| 16                   | -  | 99.7  | 100.9 | 100.8 | 101.0 | 100.7 | 101.0 |
| 17                   | -  | 99.8  | 100.7 | 100.7 | 100.4 | 99.7  | 100.7 |
| 18                   | -  | 100.1 | 101.3 | 101.3 | 101.6 | 100.5 | 101.3 |
| 19                   | -  | 99.9  | 100.9 | 101.2 | 100.5 | 99.9  | 100.7 |
| 20                   | -  | 100.0 | 100.8 | 101.4 | 101.6 | 100.1 | 100.9 |
| Max.                 | -  | 100.8 | 101.3 | 101.5 | 101.6 | 100.7 | 101.7 |
| Ave.                 | -  | 100.0 | 100.6 | 100.7 | 100.0 | 99.3  | 100.1 |
| Min.                 | -  | 99.4  | 98.7  | 99.3  | 95.8  | 96.6  | 96.8  |
| Sigma                | -  | 0.3   | 0.6   | 0.5   | 1.6   | 1.3   | 1.4   |
| Median               | -  | 99.9  | 100.8 | 100.7 | 100.6 | 99.8  | 100.7 |

|                 |   |
|-----------------|---|
| Test conditions | Tc=103.8 deg C Ta=103.5 deg C IFDC=3000mA |
|-----------------|---|

| Chromaticity u' |        |        |        |        |        |        |        |
|-----------------|--------|--------|--------|--------|--------|--------|--------|
|                 | 0H     | 1000H  | 2000H  | 3000H  | 4000H  | 5000H  | 6000H  |
| 1               | 0.2580 | 0.2585 | 0.2581 | 0.2583 | 0.2583 | 0.2593 | 0.2582 |
| 2               | 0.2578 | 0.2583 | 0.2580 | 0.2581 | 0.2581 | 0.2589 | 0.2582 |
| 3               | 0.2575 | 0.2579 | 0.2576 | 0.2579 | 0.2577 | 0.2586 | 0.2580 |
| 4               | 0.2608 | 0.2614 | 0.2609 | 0.2612 | 0.2592 | 0.2597 | 0.2589 |
| 5               | 0.2592 | 0.2597 | 0.2594 | 0.2597 | 0.2574 | 0.2580 | 0.2573 |
| 6               | 0.2581 | 0.2585 | 0.2583 | 0.2587 | 0.2588 | 0.2596 | 0.2586 |
| 7               | 0.2568 | 0.2573 | 0.2569 | 0.2572 | 0.2573 | 0.2579 | 0.2572 |
| 8               | 0.2561 | 0.2567 | 0.2564 | 0.2568 | 0.2566 | 0.2573 | 0.2567 |
| 9               | 0.2567 | 0.2568 | 0.2568 | 0.2569 | 0.2571 | 0.2577 | 0.2569 |
| 10              | 0.2567 | 0.2573 | 0.2569 | 0.2573 | 0.2572 | 0.2580 | 0.2573 |
| 11              | 0.2569 | 0.2574 | 0.2571 | 0.2573 | 0.2576 | 0.2581 | 0.2574 |
| 12              | 0.2578 | 0.2583 | 0.2578 | 0.2583 | 0.2583 | 0.2589 | 0.2584 |
| 13              | 0.2564 | 0.2569 | 0.2566 | 0.2568 | 0.2568 | 0.2574 | 0.2568 |
| 14              | 0.2609 | 0.2614 | 0.2611 | 0.2612 | 0.2589 | 0.2596 | 0.2588 |
| 15              | 0.2587 | 0.2590 | 0.2589 | 0.2591 | 0.2571 | 0.2574 | 0.2567 |
| 16              | 0.2571 | 0.2577 | 0.2574 | 0.2576 | 0.2575 | 0.2588 | 0.2577 |
| 17              | 0.2573 | 0.2579 | 0.2576 | 0.2578 | 0.2578 | 0.2587 | 0.2578 |
| 18              | 0.2565 | 0.2568 | 0.2565 | 0.2567 | 0.2567 | 0.2575 | 0.2569 |
| 19              | 0.2564 | 0.2570 | 0.2565 | 0.2570 | 0.2571 | 0.2578 | 0.2569 |
| 20              | 0.2576 | 0.2580 | 0.2575 | 0.2580 | 0.2579 | 0.2589 | 0.2580 |
| Max.            | 0.2609 | 0.2614 | 0.2611 | 0.2612 | 0.2592 | 0.2597 | 0.2589 |
| Ave.            | 0.2577 | 0.2581 | 0.2578 | 0.2581 | 0.2577 | 0.2584 | 0.2576 |
| Min.            | 0.2561 | 0.2567 | 0.2564 | 0.2567 | 0.2566 | 0.2573 | 0.2567 |
| Sigma           | 0.0013 | 0.0013 | 0.0013 | 0.0013 | 0.0007 | 0.0008 | 0.0007 |
| Median          | 0.2574 | 0.2579 | 0.2575 | 0.2578 | 0.2576 | 0.2584 | 0.2575 |

| Chromaticity v' |        |        |        |        |        |        |        |
|-----------------|--------|--------|--------|--------|--------|--------|--------|
|                 | 0H     | 1000H  | 2000H  | 3000H  | 4000H  | 5000H  | 6000H  |
| 1               | 0.5274 | 0.5280 | 0.5273 | 0.5278 | 0.5274 | 0.5289 | 0.5269 |
| 2               | 0.5263 | 0.5270 | 0.5265 | 0.5271 | 0.5267 | 0.5281 | 0.5260 |
| 3               | 0.5277 | 0.5286 | 0.5280 | 0.5285 | 0.5280 | 0.5299 | 0.5276 |
| 4               | 0.5288 | 0.5295 | 0.5291 | 0.5295 | 0.5281 | 0.5294 | 0.5277 |
| 5               | 0.5278 | 0.5285 | 0.5281 | 0.5285 | 0.5269 | 0.5285 | 0.5270 |
| 6               | 0.5277 | 0.5285 | 0.5281 | 0.5285 | 0.5280 | 0.5294 | 0.5278 |
| 7               | 0.5265 | 0.5271 | 0.5267 | 0.5273 | 0.5268 | 0.5282 | 0.5263 |
| 8               | 0.5272 | 0.5279 | 0.5275 | 0.5279 | 0.5277 | 0.5289 | 0.5271 |
| 9               | 0.5266 | 0.5275 | 0.5269 | 0.5275 | 0.5272 | 0.5287 | 0.5268 |
| 10              | 0.5278 | 0.5285 | 0.5282 | 0.5288 | 0.5284 | 0.5297 | 0.5278 |
| 11              | 0.5279 | 0.5286 | 0.5282 | 0.5286 | 0.5283 | 0.5299 | 0.5277 |
| 12              | 0.5267 | 0.5276 | 0.5271 | 0.5275 | 0.5273 | 0.5285 | 0.5268 |
| 13              | 0.5268 | 0.5275 | 0.5272 | 0.5275 | 0.5272 | 0.5287 | 0.5268 |
| 14              | 0.5286 | 0.5293 | 0.5288 | 0.5292 | 0.5282 | 0.5297 | 0.5279 |
| 15              | 0.5293 | 0.5301 | 0.5297 | 0.5301 | 0.5290 | 0.5304 | 0.5287 |
| 16              | 0.5270 | 0.5279 | 0.5274 | 0.5279 | 0.5271 | 0.5286 | 0.5265 |
| 17              | 0.5280 | 0.5288 | 0.5282 | 0.5288 | 0.5283 | 0.5299 | 0.5278 |
| 18              | 0.5254 | 0.5261 | 0.5256 | 0.5262 | 0.5259 | 0.5272 | 0.5254 |
| 19              | 0.5261 | 0.5266 | 0.5263 | 0.5268 | 0.5265 | 0.5279 | 0.5261 |
| 20              | 0.5280 | 0.5284 | 0.5282 | 0.5286 | 0.5282 | 0.5298 | 0.5278 |
| Max.            | 0.5293 | 0.5301 | 0.5297 | 0.5301 | 0.5290 | 0.5304 | 0.5287 |
| Ave.            | 0.5274 | 0.5281 | 0.5277 | 0.5281 | 0.5276 | 0.5290 | 0.5271 |
| Min.            | 0.5254 | 0.5261 | 0.5256 | 0.5262 | 0.5259 | 0.5272 | 0.5254 |
| Sigma           | 0.0009 | 0.0010 | 0.0010 | 0.0009 | 0.0008 | 0.0008 | 0.0008 |
| Median          | 0.5275 | 0.5282 | 0.5277 | 0.5282 | 0.5275 | 0.5289 | 0.5271 |



|                 |   |
|-----------------|---|
| Test conditions | Tc=103.8 deg C Ta=103.5 deg C IFDC=3000 |
|-----------------|---|

|        | $\Delta u'v'$ |        |        |        |        |        |        |
|--------|---------------|--------|--------|--------|--------|--------|--------|
|        | 0H            | 1000H  | 2000H  | 3000H  | 4000H  | 5000H  | 6000H  |
| 1      | -             | 0.0008 | 0.0001 | 0.0006 | 0.0003 | 0.0020 | 0.0005 |
| 2      | -             | 0.0009 | 0.0003 | 0.0008 | 0.0005 | 0.0021 | 0.0005 |
| 3      | -             | 0.0010 | 0.0002 | 0.0009 | 0.0003 | 0.0025 | 0.0005 |
| 4      | -             | 0.0009 | 0.0003 | 0.0008 | 0.0018 | 0.0013 | 0.0023 |
| 5      | -             | 0.0009 | 0.0004 | 0.0009 | 0.0020 | 0.0014 | 0.0020 |
| 6      | -             | 0.0008 | 0.0004 | 0.0010 | 0.0008 | 0.0022 | 0.0005 |
| 7      | -             | 0.0008 | 0.0002 | 0.0009 | 0.0006 | 0.0020 | 0.0005 |
| 8      | -             | 0.0009 | 0.0004 | 0.0010 | 0.0007 | 0.0021 | 0.0006 |
| 9      | -             | 0.0009 | 0.0003 | 0.0009 | 0.0007 | 0.0023 | 0.0003 |
| 10     | -             | 0.0010 | 0.0004 | 0.0012 | 0.0008 | 0.0023 | 0.0006 |
| 11     | -             | 0.0009 | 0.0004 | 0.0008 | 0.0008 | 0.0023 | 0.0005 |
| 12     | -             | 0.0010 | 0.0004 | 0.0010 | 0.0008 | 0.0021 | 0.0006 |
| 13     | -             | 0.0008 | 0.0005 | 0.0008 | 0.0006 | 0.0021 | 0.0004 |
| 14     | -             | 0.0009 | 0.0003 | 0.0007 | 0.0020 | 0.0017 | 0.0022 |
| 15     | -             | 0.0009 | 0.0004 | 0.0009 | 0.0016 | 0.0016 | 0.0020 |
| 16     | -             | 0.0010 | 0.0005 | 0.0010 | 0.0004 | 0.0023 | 0.0008 |
| 17     | -             | 0.0010 | 0.0003 | 0.0009 | 0.0006 | 0.0024 | 0.0006 |
| 18     | -             | 0.0007 | 0.0002 | 0.0008 | 0.0005 | 0.0021 | 0.0004 |
| 19     | -             | 0.0008 | 0.0003 | 0.0009 | 0.0008 | 0.0023 | 0.0004 |
| 20     | -             | 0.0006 | 0.0002 | 0.0008 | 0.0004 | 0.0023 | 0.0005 |
| Max.   | -             | 0.0010 | 0.0005 | 0.0012 | 0.0020 | 0.0025 | 0.0023 |
| Ave.   | -             | 0.0009 | 0.0003 | 0.0009 | 0.0009 | 0.0021 | 0.0008 |
| Min.   | -             | 0.0006 | 0.0001 | 0.0006 | 0.0003 | 0.0013 | 0.0003 |
| Sigma  | -             | 0.0001 | 0.0001 | 0.0001 | 0.0005 | 0.0003 | 0.0007 |
| Median | -             | 0.0009 | 0.0003 | 0.0009 | 0.0007 | 0.0021 | 0.0005 |

15. Remarks 1

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 Test engineers : Masayuki Hada

*M. Hada*

Test report reviewer(Technical manager): Mitsunori Ishizaka

*M. Ishizaka*

Quality manager : Kazuhiro Arai

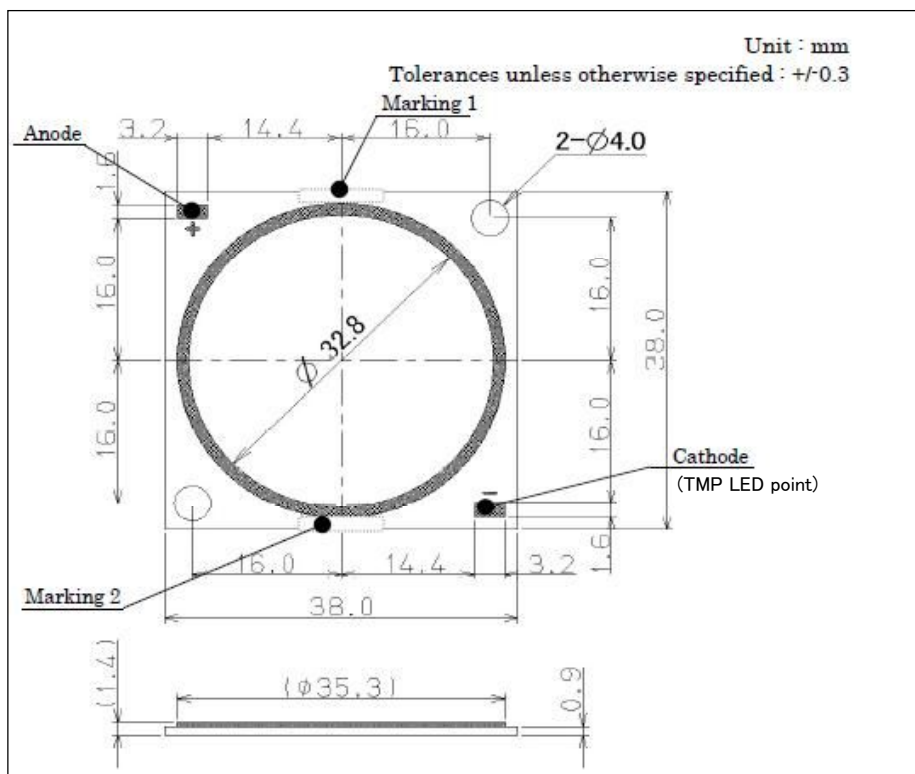
*K. Arai*

Approved by:Kazuhiro Okada (Laboratory Director )

*K. Okada*

16. Remarks 2

| Measurement item         | Instrument name    | Part Number | Manufacturer         | Measurement range | Calibration date | Next calibration date |
|--------------------------|--------------------|-------------|----------------------|-------------------|------------------|-----------------------|
| Temperature              | Thermo regulator   | LSCC-20A    | KYUSHU NISSHO        | 0C°~120C°         | 28-Jun-12        | 30-Jun-13             |
|                          | Date logger        | LR8400      | HIOKI                | 0C°~120C°         | 28-Jun-12        | 30-Jun-13             |
| Temperature and humidity | Date logger        | TR-72S      | T&D Corporation      | 0C°~50C°, 10~95%  | 7-Sep-12         | 30-Sep-13             |
| Current                  | Digital multimeter | 34401A      | Agilent Technologies | 10mA~3A           | 3-Dec-12         | 31-Dec-13             |
| Power                    | DC Power           | PAS320-3    | Kikusui Electronics  | 10mA~2A           | —                | —                     |
| Voltage                  | Oscilloscope       | DPO2012-D1  | Tektronix            | 10mV~100V         | 6-Dec-12         | 31-Dec-13             |
| Luminous flux            | Integrating sphere | MCPD7000    | Otsuka Electronics   | 3lm~5000lm        | 1-Nov-12         | 30-Nov-13             |



Outline drawing