



Report No.: GZE161121-T

## LM-79-08 Test Report

For

# IKIO LED LIGHTING (Brand Name: IKIO)

8470 Allison Pointe Blvd, Suite 128  
Indianapolis, IN 46250

## Dual Mode Internal Driver (UL Type A and Type B)

Model name(s): IK-T804-0020-XXA&B-J ((Frosted)

Representative (Tested) Model: IK-T804-0020-30A&B-J ((Frosted)

IK-T804-0020-35A&B-J ((Frosted)

IK-T804-0020-40A&B-J ((Frosted)

IK-T804-0020-50A&B-J ((Frosted)

Model Difference: All construction and rating are the same, except CCT

Test & Report By:

*Jack Luo*

Engineer: Jack Luo

Date: Nov.14,2016

Review By:

*Tommy Liang*

Manager: Tommy Liang

Note: This report does not imply product certification, approval, or endorsement by NVLAP, NIST, or any agency of the Federal Government.

Laboratory: Standard-Tech Co. Ltd Testing Center  
NVLAP CODE: 201011-0

Report Format Number STD/QR4909-A/2

Address: Standard-Tech Building, No.6 Guanhong Road, Guangzhou Science City, Guangzhou 510663, China

Tel: 8620-3229 0320 Fax: 8620-32290422 <http://www.standard-tech.com>

### 1.1 Product Information:

|   |  |    |
|---|--|----|
| Organization Name   | IKIO LED LIGHTING  |    |
| Brand Name  | IKIO   |    |
| Model Number  | IK-T804-0020-XXA&B-J ((Frosted)                          |    |
| SKU (if available)  | N/A  |    |
| Type of Luminaire<br>(for integral lamps, list base type and lamp type) | Dual Mode Internal Driver (UL Type A and Type B)         |    |
| Rated Voltage / Frequency   | 100 ~ 277 Vac, 50/60 Hz                                  |    |
| Nominal Power   | 20W  |    |
| Rated Initial Lamp Lumen  | --   |    |
| Declared CCT  | 3000K,3500K,4000K,5000K                                  |    |
| LED Manufacturer  | EVERLIGHT ELECTRONICS CO.,LTD                            |    |
| LED Model   | 67-21S Series  |    |
| Test Ballast  | OSRAM SYLVANIA QTP 2x32T8/UNV ISN-SC                     |    |
| Sample Number   | GZE161121-T1,T2(3000K),T3(3500K),<br>T4(4000K),T5(5000K) |    |
| Lamp Length   | 1200   | mm |
| Lamp Width  | --   | mm |
| Number of Units (modular products)                                      | N/A  | s  |

#### Photo



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## 1.2 Test Specifications:

|                            |  |
|----------------------------|--|
| Date of Receipt            | Nov.12, 2016   |
| Date of Test               | Nov.12, 2016   |
| Test item                  | <ol style="list-style-type: none"> <li>1. Total Luminous Flux</li> <li>2. Luminous Distribution Intensity</li> <li>3. Luminous Efficacy</li> <li>4. Correlated Color Temperature</li> <li>5. Color Rendering Index</li> <li>6. Chromaticity Coordinate</li> <li>7. Electrical Parameters</li> </ol>  |
| Reference Standard         | <ol style="list-style-type: none"> <li>1. IES LM-79-2008 Electrical and Photometric Measurements of Solid-State Lighting Products</li> <li>2. ANSI C78.377-2008 Specifications for the Chromaticity of Solid State Lighting Products</li> <li>3. CIE 13.3-1995 Method of Measuring and Specifying Colour Rendering Properties of Light Sources</li> <li>4. CIE 15-2004 Technical Report Colorimetry</li> <li>5. IESNA LM-16-93 Practical Guide to Colorimetry of Light Source</li> <li>6. IESNA TM-16-05 Technical Memorandum on Light Emitting Diode (LED) Sources and Systems</li> </ol> |
| Reference Work Instruction | QD25   |

## 1.3 Test Methods

### 1) Photometric and Light Distribution Measurement – Goniophotometer Method:

Photometric parameters were measured using the goniophotometer and software. The ambient temperature shall be maintained at  $25^{\circ}\text{C} \pm 1^{\circ}\text{C}$ , measured at a point not more than 1 m from the sample and at the same height as the sample. The sample was operated at 120 or rated Volts AC, 60Hz. It was stabilized before measurement was made. Luminous flux, luminaire efficacy, zonal lumen were calculated from the software taken at  $1^{\circ}$  vertical intervals and  $22.5^{\circ}$  horizontal intervals.

### 2) Chromaticity Measurement – Sphere-Spectroradiometer Method:

Chromaticity parameters were measured using an integrating sphere, a spectroradiometer and software. The ambient temperature condition inside the sphere was maintained at  $25^{\circ}\text{C} \pm 1^{\circ}\text{C}$ . The sample measurements were made using a spectroradiometer connected by a fiber optic cable and detector through the detector port of the integrating sphere. The sample was operated at 120 or rated Volts AC, 60Hz. It was stabilized before measurement was made. Chromaticity coordinates, correlated color temperature and color rendering index were calculated from the spectral power distribution taken at 5 nm intervals over the range of 380 to 780 nm.

### 3) Electrical Measurements:

Electrical parameters were measured using power meters incorporated in goniophotometer or sphere-spectroradiometer system. The ambient temperature surrounding the sample was maintained at  $25^{\circ}\text{C} \pm 1^{\circ}\text{C}$ . The sample was operated at 120 or rated Volts AC, 60Hz. It was stabilized before measurement was made. Voltage, frequency, current, power, power factor and total harmonic distortion were measured by and read from the power meter.

### 2.1.1 Electrical, Photometric and Chromaticity Measurements

(Refer to Work Instruction QD25)

|                  |   |                          |         |
|------------------|---|--------------------------|---------|
| Test date        | 2016-11-12  | Test Ambient:            | 25.2 °C |
| Test Orientation | Horizontal  | Stabilization Time (min) | 90      |
| Model Number     | IK-T804-0020-30A&B-J<br>(Frosted) , with ballast OSRAM<br>SYLVANIA QTP 2x32T8/UNV<br>ISN-SC |                          |         |

#### Electrical Measurement for Bare-lamp:

| Sample No.        | Voltage (Vac) | Frequency (Hz) | Current (A) | Power (W) | Power Factor | THD %     |
|-------------------|---------------|----------------|-------------|-----------|--------------|-----------|
| GZE161121         | 120.0         | 60             | 0.1679      | 20.08     | 0.9965       | 4.88      |
| -T1               | 277.0         | 60             | 0.0734      | 19.70     | 0.9693       | 6.38      |
| DLC Pass Criteria |               |                |             |           | >= 0.9(-3%)  | <= 20(+5) |

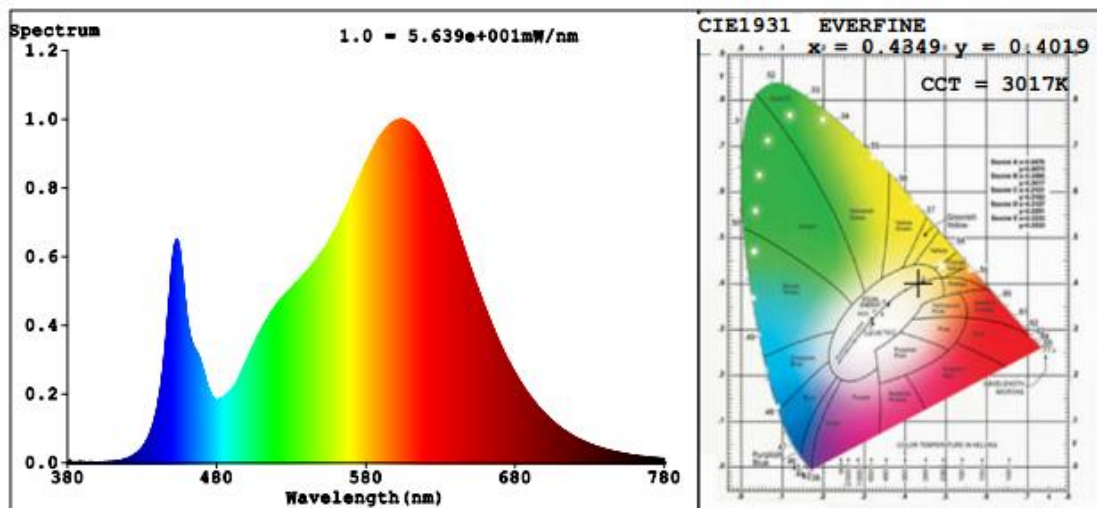
#### Chromaticity Measurement for Bare-lamp - Sphere-Spectroradiometer Method:

| Parameter                   | Result              | Special Color Rendering Indices |    |     |    |
|-----------------------------|---------------------|---------------------------------|----|-----|----|
| Test Voltage (V)            | 120.0               | R1                              | 81 | R9  | 6  |
| Frequency (Hz)              | 60                  | R2                              | 91 | R10 | 79 |
| CCT (K)                     | 3017                | R3                              | 96 | R11 | 78 |
| Duv                         | -0.0006             | R4                              | 79 | R12 | 67 |
| Chromaticity (x, y)         | x=0.4349 y=0.4019   | R5                              | 81 | R13 | 83 |
| Chromaticity (u', v')       | u'=0.2502 v'=0.5202 | R6                              | 89 | R14 | 99 |
| Color Rendering Index (CRI) | 82.2                | R7                              | 82 | R15 | 73 |
| R9                          | 6                   | R8                              | 58 | --  | -- |

#### Photometric Measurement for Bare-lamp –Sphere-Spectroradiometer Method:

| Parameter                | Result |        | DLC V4.0 Pass Criteria   |
|--------------------------|--------|--------|--------------------------|
| Test Voltage (V)         | 120.0  | 277.0  | --                       |
| Frequency (Hz)           | 60     | 60     |                          |
| Total Luminous (lm)      | 2697   | 2692   | Bare Lamp: >= 1600(-10%) |
| Luminous Efficacy (lm/W) | 134.35 | 136.65 | Bare lamp: >= 110(-3%)   |

**Spectral Power Distribution & Chromaticity Diagram**



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## 2.1.2 Electrical, Photometric and Chromaticity Measurements

(Refer to Work Instruction QD25)

|                  |   |                          |         |
|------------------|---|--------------------------|---------|
| Test date        | 2016-11-12  | Test Ambient:            | 25.2 °C |
| Test Orientation | Horizontal  | Stabilization Time (min) | 90      |
| Model Number     | IK-T804-0020-30A&B-J<br>(Frosted) , Connected to line voltage |                          |         |

### Electrical Measurement for Bare-lamp:

| Sample No.        | Voltage (Vac) | Frequency (Hz) | Current (A) | Power (W) | Power Factor | THD %     |
|-------------------|---------------|----------------|-------------|-----------|--------------|-----------|
| GZE161121         | 120.0         | 60             | 0.1631      | 19.18     | 0.9801       | 8.79      |
| -T1               | 277.0         | 60             | 0.0731      | 18.93     | 0.9346       | 14.65     |
| DLC Pass Criteria |               |                |             |           | >= 0.9(-3%)  | <= 20(+5) |

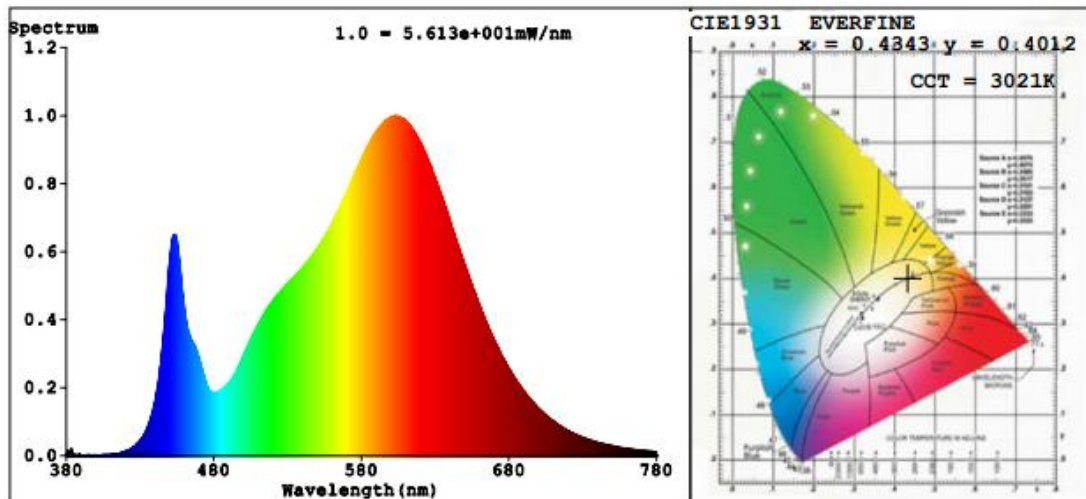
### Chromaticity Measurement for Bare-lamp - Sphere-Spectroradiometer Method:

| Parameter                   | Result              | Special Color Rendering Indices |    |     |    |
|-----------------------------|---------------------|---------------------------------|----|-----|----|
| Test Voltage (V)            | 120.0               | R1                              | 81 | R9  | 5  |
| Frequency (Hz)              | 60                  | R2                              | 91 | R10 | 79 |
| CCT (K)                     | 3021                | R3                              | 96 | R11 | 78 |
| Duv                         | -0.0008             | R4                              | 79 | R12 | 67 |
| Chromaticity (x, y)         | x=0.4343 y=0.4012   | R5                              | 80 | R13 | 83 |
| Chromaticity (u', v')       | u'=0.2501 v'=0.5199 | R6                              | 89 | R14 | 99 |
| Color Rendering Index (CRI) | 81.9                | R7                              | 82 | R15 | 73 |
| R9                          | 5                   | R8                              | 58 | --  | -- |

### Photometric Measurement for Bare-lamp –Sphere-Spectroradiometer Method:

| Parameter                | Result |        | DLC V4.0 Pass Criteria   |
|--------------------------|--------|--------|--------------------------|
| Test Voltage (V)         | 120.0  | 277.0  | --                       |
| Frequency (Hz)           | 60     | 60     |                          |
| Total Luminous (lm)      | 2612   | 2607   | Bare Lamp: >= 1600(-10%) |
| Luminous Efficacy (lm/W) | 136.18 | 137.72 | Bare lamp: >= 110(-3%)   |

**Spectral Power Distribution & Chromaticity Diagram**



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|         |
|---------|
| Summary |
|---------|

| Sample No.   | Test Method               | Voltage (Vac) | Frequency (Hz ) | Lumen Output(lm) | Lumen Efficacy(lm/w) | Power (W) |
|--------------|---------------------------|---------------|-----------------|------------------|----------------------|-----------|
| GZE161121-T1 | With Ballast              | 120.0         | 60              | 2697             | 134.35               | 20.08     |
| GZE161121-T1 | Connected to line voltage | 120.0         | 60              | 2612             | 136.18               | 19.18     |

The measured lumen efficacy of test condition “with ballast” was more than test condition “Connect to line voltage”, but had more power consumption. So the following test will be conducted as test condition “with ballast”.

## 2.2 Electrical, Photometric and Chromaticity Measurements

(Refer to Work Instruction QD25)

|                  |  |                          |         |
|------------------|--|--------------------------|---------|
| Test date        | 2016-11-12   | Test Ambient:            | 25.2 °C |
| Test Orientation | Horizontal   | Stabilization Time (min) | 90      |
| Model Number     | IK-T804-0020-30A&B-J<br>(Frosted), with ballast OSRAM<br>SYLVANIA QTP 2x32T8/UNV<br>ISN-SC |                          |         |

### Electrical Measurement for 2-lamp in Lithonia 2PM3N 12 cell 2x4 parabolic:

| Sample No.        | Voltage (Vac) | Frequency (Hz) | Current (A) | Power (W) | Power Factor | THD %     |
|-------------------|---------------|----------------|-------------|-----------|--------------|-----------|
| GZE161121         | 120.0         | 60             | 0.3355      | 40.15     | 0.9973       | 4.73      |
| -T1,T2            | 277.0         | 60             | 0.1464      | 39.40     | 0.9715       | 6.50      |
| DLC Pass Criteria |               |                |             |           | >= 0.9(-3%)  | <= 20(+5) |

### Chromaticity Measurement for 2-lamp in Lithonia 2PM3N 12 cell 2x4 parabolic - Sphere-Spectroradiometer Method:

| Parameter                   | Result              | Special Color Rendering Indices |    |     |    |
|-----------------------------|---------------------|---------------------------------|----|-----|----|
| Test Voltage (V)            | 120.0               | R1                              | 80 | R9  | 4  |
| Frequency (Hz)              | 60                  | R2                              | 91 | R10 | 79 |
| CCT (K)                     | 3015                | R3                              | 96 | R11 | 78 |
| Duv                         | -0.009              | R4                              | 79 | R12 | 67 |
| Chromaticity (x, y)         | x=0.4347 y=0.4011   | R5                              | 80 | R13 | 83 |
| Chromaticity (u', v')       | u'=0.2504 v'=0.5199 | R6                              | 89 | R14 | 99 |
| Color Rendering Index (CRI) | 81.8                | R7                              | 82 | R15 | 73 |
| R9                          | 4                   | R8                              | 57 | --  | -- |

### Photometric Measurement 2-lamp in Lithonia 2PM3N 12 cell 2x4 parabolic – Goniophotometer Method:

| Parameter                          | Result |        | DLC V4.0 Pass Criteria                   |
|------------------------------------|--------|--------|--|
| Test Voltage (V)                   | 120.0  | 277.0  | --                                       |
| Frequency (Hz)                     | 60     | 60     |  |
| Total Luminous (lm)                | 4476.5 | 4466.6 | In luminaire (2 lamps):<br>>= 3000(-10%) |
| Luminous Efficacy (lm/W)           | 111.49 | 113.37 | In luminaire: >= 100(-3%)                |
| Zonal lumens in the 0-60° zone (%) | 90.3   | --     | >= 75(-3)                                |
| SC: 0-180° (if applicable)         | 1.36   | --     | 1.0-2.0(±0.1)                            |
| SC: 90-270° (if applicable)        | 1.14   | --     | 1.0-2.0(±0.1)                            |
| Beam Angle (°)                     | 101.4  | --     | --                                       |
| Center Beam Candle Power (cd)      | 1870   | --     | --                                       |

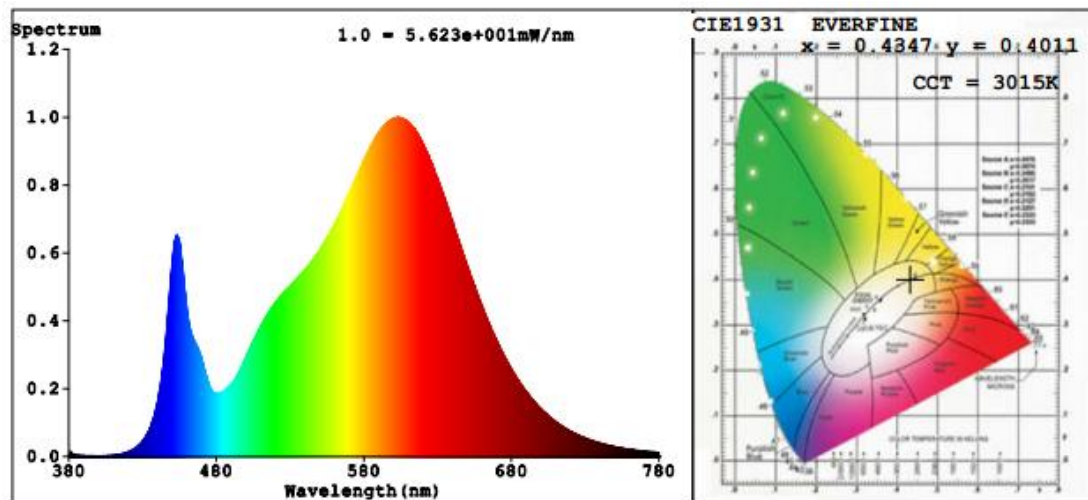
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## Spectral Power Distribution & Chromaticity Diagram



## Zonal Lumen Tabulation

| Zonal Lumen Summary |         |             |
|---------------------|---------|-------------|
| Zone                | Lumens  | % Luminaire |
| 0-30                | 1,431.1 | 32%         |
| 0-40                | 2,347.6 | 52.5%       |
| 0-60                | 4,043.2 | 90.3%       |
| 60-90               | 431.6   | 9.6%        |
| 70-100              | 117.2   | 2.6%        |
| 90-120              | 0.3     | 0%          |
| 0-90                | 4,474.8 | 100%        |
| 90-180              | 0.9     | 0%          |
| 0-180               | 4,475.7 | 100%        |

| Lumens Per Zone |        |         |         |        |         |
|-----------------|--------|---------|---------|--------|---------|
| Zone            | Lumens | % Total | Zone    | Lumens | % Total |
| 0-10            | 176.4  | 3.9%    | 90-100  | 0.0    | 0%      |
| 10-20           | 500.2  | 11.2%   | 100-110 | 0.1    | 0%      |
| 20-30           | 754.5  | 16.9%   | 110-120 | 0.2    | 0%      |
| 30-40           | 916.5  | 20.5%   | 120-130 | 0.2    | 0%      |
| 40-50           | 965.3  | 21.6%   | 130-140 | 0.1    | 0%      |
| 50-60           | 730.3  | 16.3%   | 140-150 | 0.1    | 0%      |
| 60-70           | 314.3  | 7.0%    | 150-160 | 0.1    | 0%      |
| 70-80           | 101.0  | 2.3%    | 160-170 | 0.1    | 0%      |
| 80-90           | 16.2   | 0.4%    | 170-180 | 0.0    | 0%      |

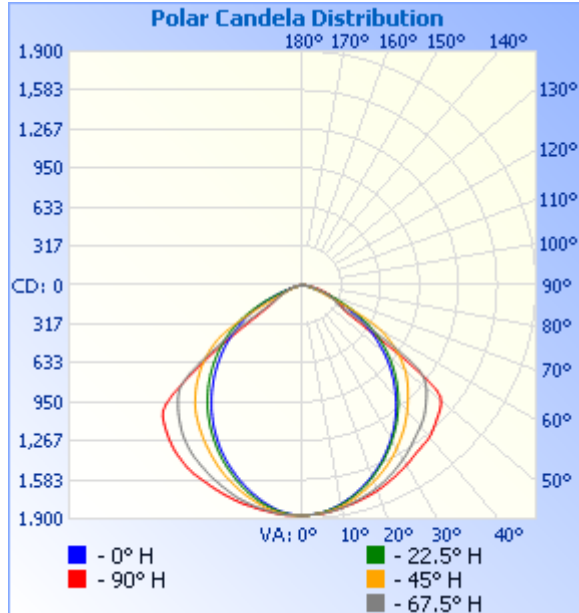
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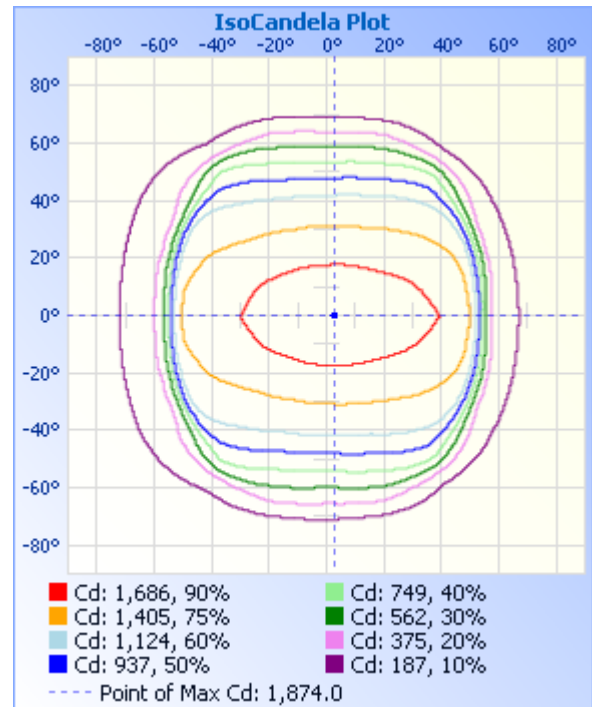
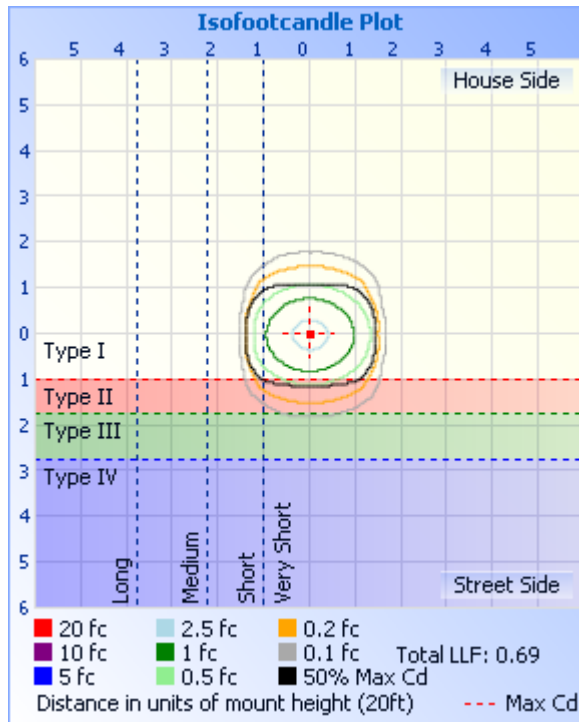
**Photometric Data**



**Illuminance at a Distance**

|         | Center Beam fc | Beam Width        |
|---------|----------------|-------------------|
| 17.0ft  | 6.47 fc        | 37.7 ft 46.1 ft   |
| 34.0ft  | 1.62 fc        | 75.4 ft 92.1 ft   |
| 51.0ft  | 0.72 fc        | 113.2 ft 138.2 ft |
| 68.0ft  | 0.40 fc        | 150.9 ft 184.3 ft |
| 85.0ft  | 0.26 fc        | 188.6 ft 230.4 ft |
| 102.0ft | 0.18 fc        | 226.3 ft 276.4 ft |

■ Vert. Spread: 95.9°  
■ Horiz. Spread: 107.1°



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Table--1

UNIT: cd

| C (DEG)<br>γ (DEG) | 0    | 23   | 45   | 68   | 90   | 113  | 135  | 158  | 180  | 203  | 225  | 248  | 270  | 293  | 315  | 338  |  |
|--------------------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|--|
| 0                  | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 |  |
| 5                  | 1873 | 1872 | 1865 | 1859 | 1855 | 1854 | 1859 | 1861 | 1864 | 1862 | 1854 | 1851 | 1851 | 1856 | 1864 | 1870 |  |
| 10                 | 1857 | 1852 | 1833 | 1817 | 1804 | 1810 | 1825 | 1839 | 1838 | 1836 | 1814 | 1799 | 1793 | 1808 | 1828 | 1849 |  |
| 15                 | 1842 | 1825 | 1780 | 1752 | 1735 | 1744 | 1766 | 1799 | 1810 | 1793 | 1749 | 1725 | 1716 | 1738 | 1771 | 1821 |  |
| 20                 | 1820 | 1787 | 1717 | 1670 | 1649 | 1660 | 1697 | 1755 | 1778 | 1745 | 1676 | 1639 | 1625 | 1650 | 1702 | 1779 |  |
| 25                 | 1794 | 1740 | 1647 | 1578 | 1552 | 1564 | 1620 | 1699 | 1734 | 1685 | 1595 | 1539 | 1524 | 1554 | 1626 | 1730 |  |
| 30                 | 1771 | 1690 | 1565 | 1474 | 1440 | 1454 | 1531 | 1635 | 1689 | 1621 | 1503 | 1427 | 1411 | 1447 | 1538 | 1676 |  |
| 35                 | 1729 | 1633 | 1475 | 1359 | 1317 | 1338 | 1434 | 1561 | 1642 | 1546 | 1404 | 1309 | 1286 | 1331 | 1448 | 1616 |  |
| 40                 | 1671 | 1554 | 1378 | 1234 | 1179 | 1211 | 1326 | 1495 | 1609 | 1479 | 1298 | 1185 | 1151 | 1205 | 1351 | 1535 |  |
| 45                 | 1594 | 1451 | 1258 | 1096 | 1032 | 1074 | 1213 | 1413 | 1543 | 1395 | 1187 | 1051 | 1007 | 1071 | 1233 | 1434 |  |
| 50                 | 1376 | 1319 | 1108 | 940  | 872  | 926  | 1093 | 1317 | 1470 | 1298 | 1069 | 909  | 856  | 925  | 1092 | 1304 |  |
| 55                 | 576  | 800  | 925  | 766  | 700  | 765  | 934  | 1065 | 806  | 1039 | 920  | 758  | 700  | 774  | 922  | 774  |  |
| 60                 | 277  | 291  | 652  | 581  | 522  | 586  | 737  | 388  | 381  | 377  | 726  | 594  | 537  | 601  | 629  | 285  |  |
| 65                 | 209  | 197  | 235  | 376  | 345  | 393  | 312  | 283  | 311  | 279  | 296  | 412  | 375  | 401  | 232  | 196  |  |
| 70                 | 143  | 130  | 118  | 178  | 176  | 204  | 159  | 203  | 229  | 199  | 163  | 215  | 206  | 199  | 123  | 131  |  |
| 75                 | 86.9 | 74.7 | 60.8 | 72.5 | 83.7 | 84.9 | 88.5 | 127  | 152  | 125  | 89.7 | 94.3 | 93.2 | 81.7 | 63.7 | 76.2 |  |
| 80                 | 40.6 | 34.6 | 28.4 | 31.9 | 37.2 | 38.6 | 42.1 | 60.2 | 72.7 | 58.2 | 42.2 | 39.2 | 36.3 | 32.3 | 29.3 | 34.4 |  |
| 85                 | 12.8 | 10.7 | 9.21 | 9.74 | 11.0 | 11.9 | 13.5 | 18.9 | 22.7 | 17.2 | 12.5 | 10.5 | 9.72 | 8.65 | 8.69 | 10.4 |  |
| 90                 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.01 | 0.02 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |  |
| 95                 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |  |
| 100                | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.10 | 0.00 | 0.00 | 0.00 | 0.00 |  |
| 105                | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.32 | 0.00 | 0.00 | 0.00 | 0.48 | 0.16 |  |
| 110                | 0.42 | 0.37 | 0.00 | 0.00 | 0.11 | 0.00 | 0.21 | 0.00 | 0.32 | 0.37 | 0.37 | 0.00 | 0.00 | 0.00 | 0.05 | 0.42 |  |
| 115                | 0.32 | 0.37 | 0.11 | 0.00 | 0.11 | 0.00 | 0.26 | 0.53 | 1.01 | 0.32 | 0.53 | 0.00 | 0.00 | 0.00 | 0.05 | 0.21 |  |
| 120                | 0.42 | 0.43 | 0.16 | 0.00 | 0.05 | 0.00 | 0.32 | 0.32 | 0.48 | 0.16 | 0.53 | 0.00 | 0.00 | 0.00 | 0.05 | 0.21 |  |
| 125                | 0.48 | 0.48 | 0.16 | 0.00 | 0.00 | 0.00 | 0.37 | 0.43 | 0.48 | 0.21 | 0.53 | 0.00 | 0.00 | 0.00 | 0.00 | 0.21 |  |
| 130                | 0.53 | 0.48 | 0.16 | 0.00 | 0.00 | 0.00 | 0.21 | 0.43 | 0.53 | 0.21 | 0.47 | 0.00 | 0.00 | 0.00 | 0.00 | 0.27 |  |
| 135                | 0.42 | 0.48 | 0.00 | 0.00 | 0.00 | 0.00 | 0.11 | 0.43 | 0.58 | 0.26 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.27 |  |
| 140                | 0.48 | 0.48 | 0.05 | 0.00 | 0.00 | 0.00 | 0.00 | 0.43 | 0.53 | 0.11 | 0.00 | 0.11 | 0.21 | 0.00 | 0.00 | 0.27 |  |
| 145                | 0.43 | 0.37 | 0.00 | 0.00 | 0.43 | 0.00 | 0.00 | 0.32 | 0.53 | 0.11 | 0.00 | 0.21 | 0.16 | 0.21 | 0.00 | 0.21 |  |
| 150                | 0.37 | 0.21 | 0.00 | 0.00 | 0.21 | 0.00 | 0.00 | 0.16 | 0.53 | 0.11 | 0.00 | 0.32 | 0.37 | 0.37 | 0.11 | 0.21 |  |
| 155                | 0.27 | 0.05 | 0.00 | 0.00 | 0.27 | 0.05 | 0.00 | 0.16 | 0.42 | 0.11 | 0.05 | 0.37 | 0.58 | 0.53 | 0.37 | 0.00 |  |
| 160                | 0.11 | 0.16 | 0.00 | 0.27 | 0.26 | 0.11 | 0.00 | 0.11 | 0.48 | 0.21 | 0.05 | 0.37 | 0.48 | 0.53 | 0.53 | 0.00 |  |
| 165                | 0.27 | 0.16 | 0.05 | 0.32 | 0.42 | 0.26 | 0.37 | 0.11 | 0.48 | 0.37 | 0.05 | 0.37 | 0.48 | 0.53 | 0.53 | 0.16 |  |
| 170                | 0.27 | 0.16 | 0.26 | 0.42 | 0.48 | 0.42 | 0.32 | 0.05 | 0.48 | 0.32 | 0.05 | 0.37 | 0.48 | 0.53 | 0.53 | 0.16 |  |
| 175                | 0.27 | 0.05 | 0.32 | 0.42 | 0.58 | 0.53 | 0.32 | 0.05 | 0.37 | 0.21 | 0.05 | 0.32 | 0.48 | 0.53 | 0.53 | 0.16 |  |
| 180                | 0.27 | 0.05 | 0.32 | 0.42 | 0.53 | 0.43 | 0.16 | 0.05 | 0.32 | 0.32 | 0.05 | 0.32 | 0.42 | 0.53 | 0.48 | 0.16 |  |

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## 2.3 Electrical, Photometric and Chromaticity Measurements

(Refer to Work Instruction QD25)

|                  |  |                          |         |
|------------------|--|--------------------------|---------|
| Test date        | 2016-11-12   | Test Ambient:            | 25.2 °C |
| Test Orientation | Horizontal   | Stabilization Time (min) | 90      |
| Model Number     | IK-T804-0020-35A&B-J<br>(Frosted), with ballast OSRAM<br>SYLVANIA QTP 2x32T8/UNV<br>ISN-SC |                          |         |

### Electrical Measurement for Bare-lamp:

| Sample No.        | Voltage (Vac) | Frequency (Hz) | Current (A) | Power (W) | Power Factor | THD %     |
|-------------------|---------------|----------------|-------------|-----------|--------------|-----------|
| GZE161121         | 120.0         | 60             | 0.1656      | 19.84     | 0.9985       | 5.36      |
| -T3               | 277.0         | 60             | 0.0725      | 19.47     | 0.9701       | 6.40      |
| DLC Pass Criteria |               |                |             |           | >= 0.9(-3%)  | <= 20(+5) |

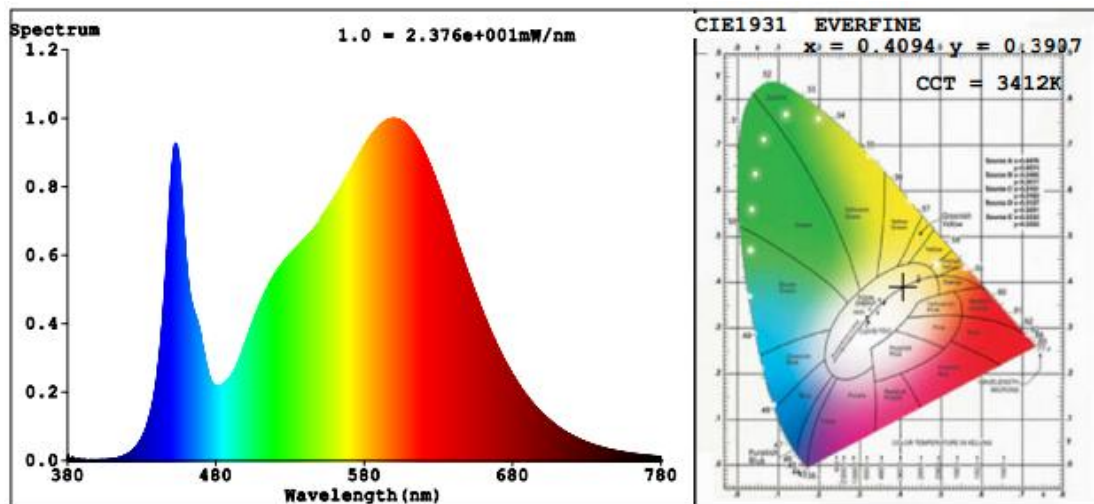
### Chromaticity Measurement for Bare-lamp - Sphere-Spectroradiometer Method:

| Parameter                   | Result              | Special Color Rendering Indices |    |     |    |
|-----------------------------|---------------------|---------------------------------|----|-----|----|
| Test Voltage (V)            | 120.0               | R1                              | 81 | R9  | 8  |
| Frequency (Hz)              | 60                  | R2                              | 90 | R10 | 76 |
| CCT (K)                     | 3412                | R3                              | 96 | R11 | 79 |
| Duv                         | -0.0009             | R4                              | 80 | R12 | 62 |
| Chromaticity (x, y)         | x=0.4094 y=0.3907   | R5                              | 81 | R13 | 83 |
| Chromaticity (u', v')       | u'=0.2384 v'=0.5118 | R6                              | 86 | R14 | 98 |
| Color Rendering Index (CRI) | 82.6                | R7                              | 84 | R15 | 75 |
| R9                          | 8                   | R8                              | 62 | --  | -- |

### Photometric Measurement for Bare-lamp –Sphere-Spectroradiometer Method:

| Parameter                | Result |        | DLC V4.0 Pass Criteria   |
|--------------------------|--------|--------|--------------------------|
| Test Voltage (V)         | 120.0  | 277.0  | --                       |
| Frequency (Hz)           | 60     | 60     |                          |
| Total Luminous (lm)      | 2724   | 2704   | Bare Lamp: >= 1600(-10%) |
| Luminous Efficacy (lm/W) | 137.30 | 138.88 | Bare lamp: >= 110(-3%)   |

**Spectral Power Distribution & Chromaticity Diagram**



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## 2.4 Electrical, Photometric and Chromaticity Measurements

(Refer to Work Instruction QD25)

|                  |  |                          |         |
|------------------|--|--------------------------|---------|
| Test date        | 2016-11-12   | Test Ambient:            | 25.2 °C |
| Test Orientation | Horizontal   | Stabilization Time (min) | 90      |
| Model Number     | IK-T804-0020-40A&B-J<br>(Frosted), with ballast OSRAM<br>SYLVANIA QTP 2x32T8/UNV<br>ISN-SC |                          |         |

### Electrical Measurement for Bare-lamp:

| Sample No.        | Voltage (Vac) | Frequency (Hz) | Current (A) | Power (W) | Power Factor | THD %     |
|-------------------|---------------|----------------|-------------|-----------|--------------|-----------|
| GZE161121         | 120.0         | 60             | 0.1700      | 20.31     | 0.9955       | 4.68      |
| -T4               | 277.0         | 60             | 0.0739      | 19.88     | 0.9714       | 6.14      |
| DLC Pass Criteria |               |                |             |           | >= 0.9(-3%)  | <= 20(+5) |

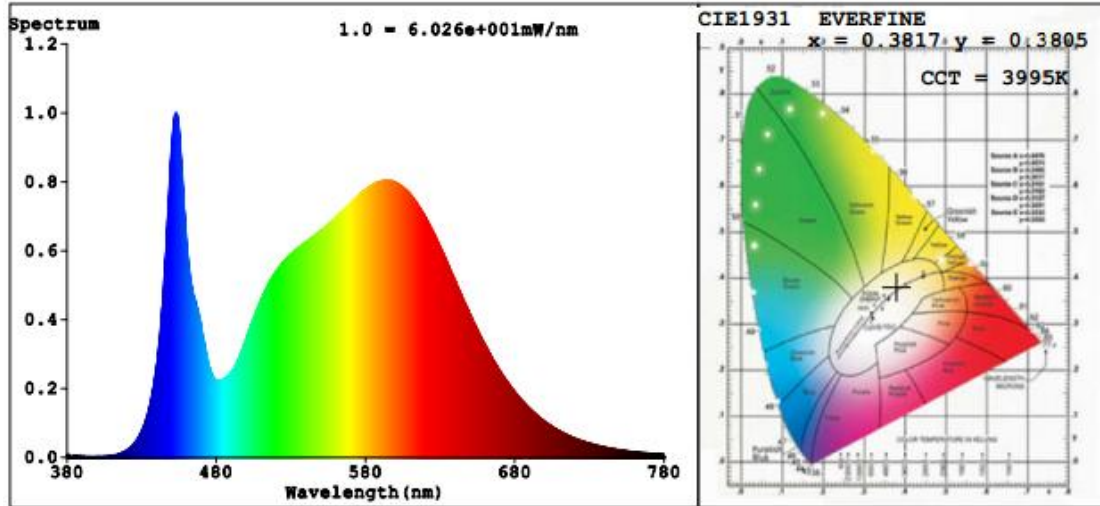
### Chromaticity Measurement for Bare-lamp - Sphere-Spectroradiometer Method:

| Parameter                   | Result              | Special Color Rendering Indices |    |     |    |
|-----------------------------|---------------------|---------------------------------|----|-----|----|
| Test Voltage (V)            | 120.0               | R1                              | 81 | R9  | 9  |
| Frequency (Hz)              | 60                  | R2                              | 89 | R10 | 73 |
| CCT (K)                     | 3995                | R3                              | 94 | R11 | 79 |
| Duv                         | 0.0014              | R4                              | 81 | R12 | 56 |
| Chromaticity (x, y)         | x=0.3817 y=0.3805   | R5                              | 80 | R13 | 83 |
| Chromaticity (u', v')       | u'=0.2244 v'=0.5034 | R6                              | 84 | R14 | 97 |
| Color Rendering Index (CRI) | 82.5                | R7                              | 86 | R15 | 75 |
| R9                          | 9                   | R8                              | 65 | --  | -- |

### Photometric Measurement for Bare-lamp –Sphere-Spectroradiometer Method:

| Parameter                | Result |        | DLC V4.0 Pass Criteria   |
|--------------------------|--------|--------|--------------------------|
| Test Voltage (V)         | 120.0  | 277.0  | --                       |
| Frequency (Hz)           | 60     | 60     |                          |
| Total Luminous (lm)      | 2852   | 2830   | Bare Lamp: >= 1600(-10%) |
| Luminous Efficacy (lm/W) | 140.42 | 142.35 | Bare lamp: >= 110(-3%)   |

**Spectral Power Distribution & Chromaticity Diagram**



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## 2.5 Electrical, Photometric and Chromaticity Measurements

(Refer to Work Instruction QD25)

|                  |  |                          |         |
|------------------|--|--------------------------|---------|
| Test date        | 2016-11-12   | Test Ambient:            | 25.2 °C |
| Test Orientation | Horizontal   | Stabilization Time (min) | 90      |
| Model Number     | IK-T804-0020-50A&B-J<br>(Frosted), with ballast OSRAM<br>SYLVANIA QTP 2x32T8/UNV<br>ISN-SC |                          |         |

### Electrical Measurement for Bare-lamp:

| Sample No.        | Voltage (Vac) | Frequency (Hz) | Current (A) | Power (W) | Power Factor | THD %     |
|-------------------|---------------|----------------|-------------|-----------|--------------|-----------|
| GZE161121         | 120.0         | 60             | 0.1669      | 19.97     | 0.9970       | 4.18      |
| -T5               | 277.0         | 60             | 0.0725      | 19.52     | 0.9722       | 6.36      |
| DLC Pass Criteria |               |                |             |           | >= 0.9(-3%)  | <= 20(+5) |

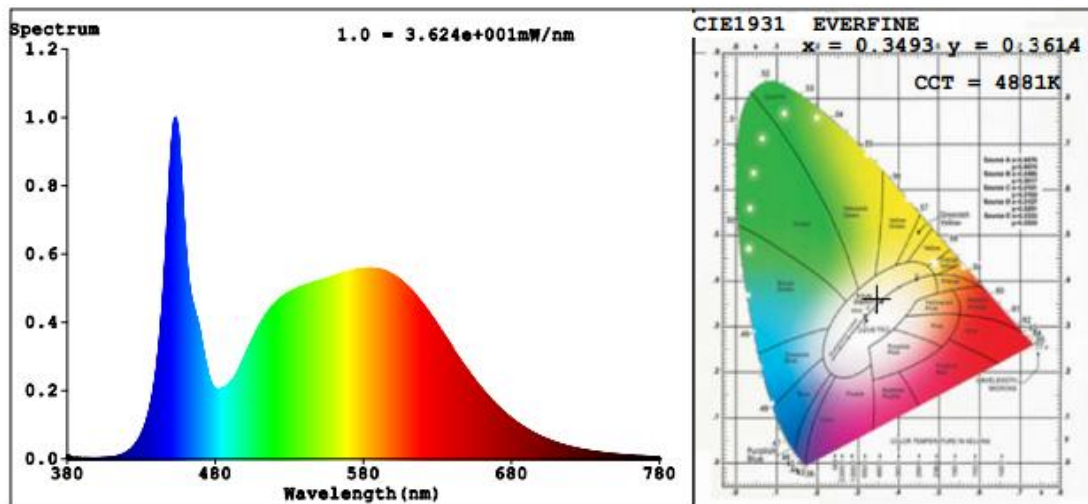
### Chromaticity Measurement for Bare-lamp - Sphere-Spectroradiometer Method:

| Parameter                   | Result              | Special Color Rendering Indices |    |     |    |
|-----------------------------|---------------------|---------------------------------|----|-----|----|
| Test Voltage (V)            | 120.0               | R1                              | 80 | R9  | 7  |
| Frequency (Hz)              | 60                  | R2                              | 88 | R10 | 71 |
| CCT (K)                     | 4881                | R3                              | 93 | R11 | 78 |
| Duv                         | 0.0032              | R4                              | 80 | R12 | 51 |
| Chromaticity (x, y)         | x=0.3493 y=0.3614   | R5                              | 80 | R13 | 83 |
| Chromaticity (u', v')       | u'=0.2105 v'=0.4900 | R6                              | 82 | R14 | 96 |
| Color Rendering Index (CRI) | 82.3                | R7                              | 88 | R15 | 75 |
| R9                          | 7                   | R8                              | 67 | --  | -- |

### Photometric Measurement for Bare-lamp –Sphere-Spectroradiometer Method:

| Parameter                | Result |        | DLC V4.0 Pass Criteria   |
|--------------------------|--------|--------|--------------------------|
| Test Voltage (V)         | 120.0  | 277.0  | --                       |
| Frequency (Hz)           | 60     | 60     |                          |
| Total Luminous (lm)      | 2827   | 2792   | Bare Lamp: >= 1600(-10%) |
| Luminous Efficacy (lm/W) | 141.56 | 143.03 | Bare lamp: >= 110(-3%)   |

**Spectral Power Distribution & Chromaticity Diagram**



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### 3. Test Equipment

| Equipment ID   | Equipment Name                     | Last Calibration Date | Next Calibration Date |
|--|------------------------------------|-----------------------|-----------------------|
| ST-R-336   | 2 meter Integrating Sphere         | 2016-07-01            | 2017-06-30            |
| ST-R-331   | Spectral analysis system HAAS-2000 | 2016-07-01            | 2017-06-30            |
| D204   | Standard Lamp                      | 2016-07-01            | 2017-06-30            |
| PF2010   | Power Meter for Integrating Sphere | 2016-07-01            | 2017-06-30            |
| EE-09  | Goniophotometer system             | 2016-07-01            | 2017-06-30            |
| D908S  | Standard Lamp                      | 2016-07-01            | 2017-06-30            |
| PF210  | Power Meter for Goniophotometer    | 2016-07-01            | 2017-06-30            |
| ST-R-181A  | Temperature Tester                 | 2016-07-01            | 2017-06-30            |
| Uncertainty:<br>Photometric Measurement (Sphere):1.74%<br>Chromaticity Measurement(Sphere):14.3K<br>Photometric Measurement(Goniophotometer):1.62% |                                    |                       |                       |

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