

# LM-79-08 Test Report for **OSRAM SYLVANIA INC.**

100 Endicott Street  
Danvers, MA 01923

**Model(s):** Spectrum Lighting SG12SQLED21W35KE1/12SQGW/3.5LA

**8 May 2011**

This test report presents the results of measurements performed on the product, Spectrum Lighting SG12SQLED21W35KE1/12SQGW/3.5LA, in accordance with LM-79-08 Electrical and Photometric Measurements of Solid-State Lighting Products.

**Test Personnel:** M. Sapcoe                      P. Donhauser                      J. Evans

**Test Date:** 26 Apr 2011

**NVLAP Signatory:**  Dr. Ronald O. Daubach

**Laboratory:** Metrology & Analytics Services  
NVLAP Code: 100403-0  
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**Report Number:** LM792011050801



FOR THE SCOPE OF ACCREDITATION UNDER NVLAP LAB CODE 100403-0  
This report does not imply product certification, approval or endorsement by NVLAP, NIST or any agency of the federal government.

## General Information

### Product tested

The product tested is the Spectrum Lighting SG12SQLED21W35KE1/12SQGW/3.5LA containing one (1) OSRAM module ZNN2431853 Ev. 1.3 with twenty-four (24) phosphor converted white LED sources and one (1) OSRAM Optotronic model OT25W/1040C/UNV power supply, input: 100-240VAC, 0.5A, 277VAC, 0.125A; output: 1.04A at 12-24VDC, S/N 1008467346.

### Purpose of test

This test report is prepared on behalf of OSRAM SYLVANIA INC. in accordance with American National Standards Institute standards, Illumination Engineering Society of North America Lighting Methods and International Commission on Illumination (CIE) publications listed below:

- IESNA LM-79-08, Approved Method for the Electrical and Photometric Testing of Solid-State Lighting Products
- IESNA LM-28-1989, Guide for the Selection, Care and Use of Electrical Instruments in the Photometric Laboratory
- CIE Publication No. 13.3-1995, Method of Measuring and Specifying the Color Rendering of Light Sources.

The objective is to demonstrate compliance of the product evaluated to LM-79-08 Electrical and Photometric Measurements of Solid-State Lighting Products.

### Laboratory Accreditation

Metrology & Analytics Services (MAS) is a department of the Central Research and Services Laboratory of OSRAM SYLVANIA INC. MAS is located at 71 Cherry Hill Drive, Beverly, MA 01915.

MAS is accredited under the National Voluntary Laboratory Accreditation Program (NVLAP), Energy Efficient Lighting (EEL) program. NVLAP is a division of the National Institute of Standards and Technology. MAS NVLAP Laboratory Code is 100403-0.

## Test Equipment

### Goniometric

| Description  | Manufacturer            | Model No.  | Serial No.  | Calibration (Cycle in yrs.) |
|--|-------------------------|------------|-------------|-----------------------------|
| High Speed Goniophotometer<br>OL 770 Multi-channel | Lighting Sciences, Inc. | 6240       | 6240TE0168T | 11/4/2010 (1)               |
| Spectroradiometer                                  | Gooch and Housego       | 770VIS/NIR | 10414127    | 11/4/2010 (1)               |
| Digital Power Meter                                | Yokogawa                | WT1600     | 91K110635   | 10/5/2010 (1)               |
| Power Supply                                       | Kikusui                 | PCR4000L   | DJ002858    | Not Required                |
| Digital Thermometer                                | Fluke                   | 52         | 6200078     | 6/30/2010 (1)               |

Calibrated for lumimous intensity and spectral irradiance using NIST intensity standard lamp NBS 10189.  
Assigned candela reading per 844/257263-96 is 1537cd.

### Integrated Sphere

| Description                     | Manufacturer    | Model No.    | S/N        | Cal. Date<br>(cvcle in vears) |
|---------------------------------|-----------------|--------------|------------|-------------------------------|
| 2.4 Meter Integrating Sphere    | -               | -            | -          | Not required                  |
| Monochromator                   | Optronics       | 750-M-D      | 97410056   | Not required                  |
| Silicon Detector Head           | Optronics       | DH-300       | 97101076   | Not required                  |
| Detector Support Module         | Optronics       | DSM-1D       | 97199967   | Not required                  |
| Flux Cal Lamp                   | Hoffman         | 1000W FEL    | 96521      | 9/1/2008(3)                   |
| AC Line Conditioner             | ELGAR           | 5006B-230    | 454        | Not required                  |
| Digital Power Meter             | Yokogawa        | 2531         | 24AW2150   | 07/01/2010 (1)                |
| D.C. Power Supply               | Hewlett Packard | 6030A        | 3332A03465 | Not required                  |
| Shunt (S2)                      | Biddle Co.      | 4222         | 762253     | 7/5/2010(1)                   |
| Multimeter                      | Keithley        | 2000         | 0727509    | 6/30/2010(3)                  |
| Multimeter                      | Keithley        | 2000         | 0727306    | 6/30/2010(3)                  |
| Thermistor Indicator/Controller | Omega           | DP25-TH-A1-R | 3415059    | 7/13/2010(3)                  |

Calibration intervals are based on critical evaluations of equipment and standards behavior as per ANS/ISO/IEC 17025:2005(E)  
5.10.4.4 All calibrations are directly traceable to a NMI (NIST) through an unbroken chain of calibrations or comparisons.

## Procedure

### Goniometry

The luminaire was operated in its intended orientation in application. The luminaire reference plane was located at the center of the luminaire goniometer at a test distance of 45 feet from the detectors. The module was operated at an input voltage of 120VAC supplied by a four contact connection.

The module was stabilized per the criteria of LM-79 prior to the measurement.

Five vertical scans were taken due to symmetry of the source output. Color uniformity was measured at two horizontal angles, 0° and 90°.

Total operating time prior to measurement is approximately 8 hours. Ambient temperature during testing was maintained at 25°C ± 1°C.

### Integrating Sphere Photometry

Relative spectral system response was determined from 380 nm to 800 nm by measurement of the FEL standard lamp. Absolute lumen level for the system is based on the lumen standards. Spectroradiometer bandwidth is approximately 2 nm.

The lamp was operated base up supplied by a four contact socket. Electrical power was applied at 120 VAC 60Hz.

Radiometric and input electrical measurements were performed every 30 seconds until stabilization.

The last reading for the lamp operating within the required stabilization window is corrected for self-absorption determined spectrally and is reported.

Total operating time prior to measurement is approximately 6 hours. Ambient temperature during testing was maintained at 25°C ± 1°C.

## Spectrum Lighting SG12SQLED21W35KE1/12SQGW/3.5LA

### Measured and Derived Performance Parameters

#### Integrating Sphere Values

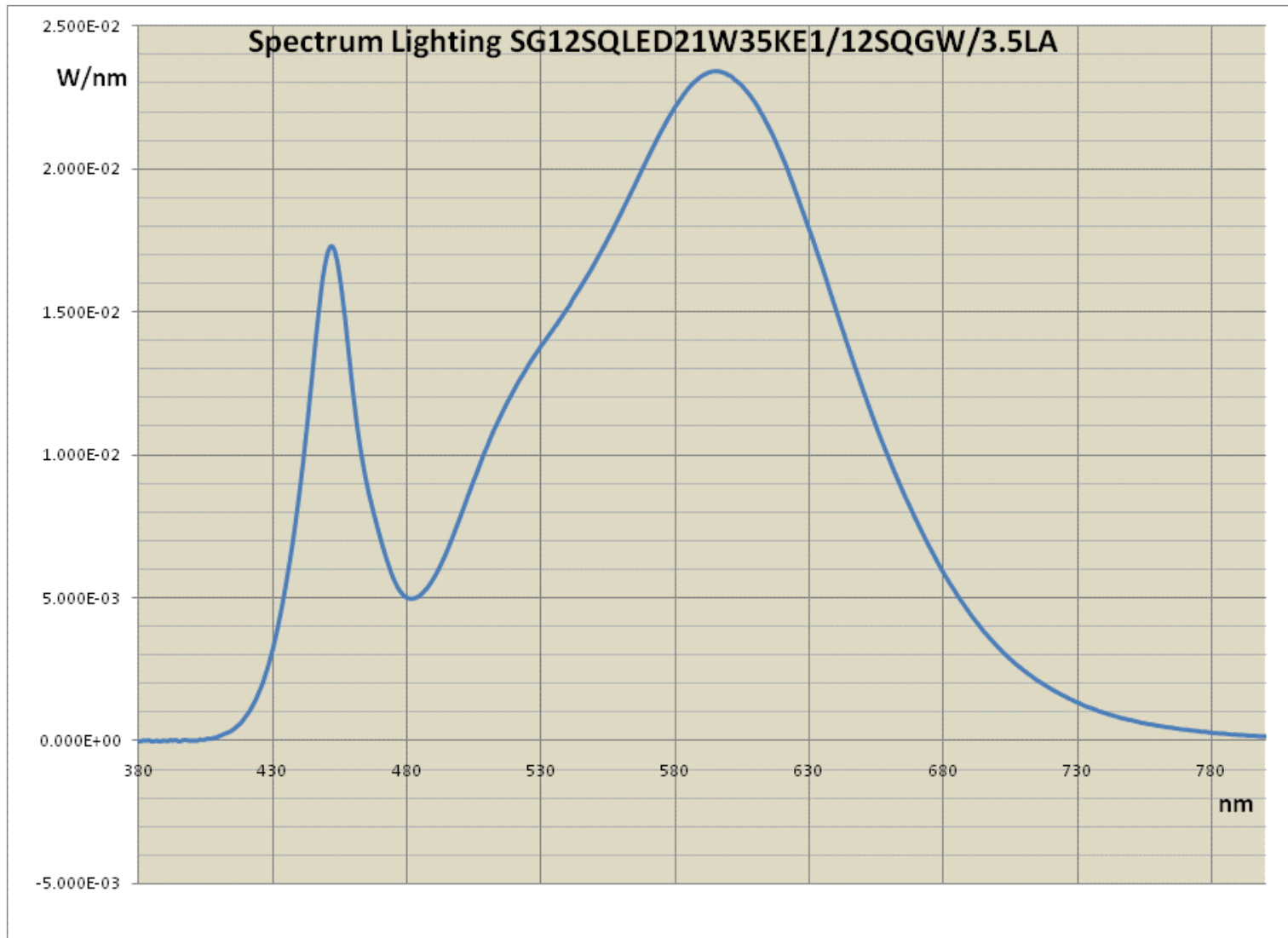
| Integrating Sphere Values |         |
|---------------------------|---------|
| Voltage /V                | 119.99  |
| Current /A                | 0.2082  |
| Wattage /W                | 24.88   |
| Power Factor              | 0.996   |
| Lumens                    | 1241    |
| Efficacy /LPW             | 49.9    |
| x                         | 0.4094  |
| y                         | 0.3915  |
| u'                        | 0.2380  |
| v'                        | 0.5122  |
| Duv                       | -0.0005 |
| CCT /K                    | 3418    |
| CRI                       | 79.8    |
| R9                        | -2.0    |
| T <sub>amb</sub> /°C      | 24.7    |

| Special Color Rendering Indices |    |
|---------------------------------|----|
| R1                              | 77 |
| R2                              | 88 |
| R3                              | 95 |
| R4                              | 77 |
| R5                              | 77 |
| R6                              | 83 |
| R7                              | 83 |
| R8                              | 58 |
| R9                              | -2 |
| R10                             | 71 |
| R11                             | 75 |
| R12                             | 61 |
| R13                             | 80 |
| R14                             | 97 |

#### Goniophotometer Values

| Goniometric Values   |        |
|----------------------|--------|
| Voltage /V           | 120.01 |
| Current /A           | 0.2136 |
| Wattage /W           | 24.93  |
| Power Factor         | 0.9727 |
| Lumens               | 1249   |
| Efficacy /LPW        | 50.1   |
| T <sub>amb</sub> /°C | 24.5   |

Spectrum Lighting SG12SQLED21W35KE1/12SQGW/3.5LA  
Absolute Spectral Radiant Flux



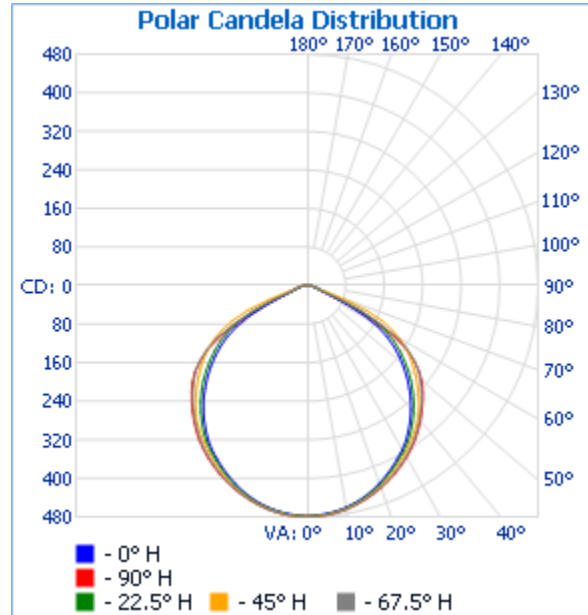
## Spectrum Lighting SG12SQLED21W35KE1/12SQGW/3.5LA

### Absolute Spectral Radiant Flux

| Absolute Spectral Flux |            |     |           |     |           |     |           |     |           |
|------------------------|------------|-----|-----------|-----|-----------|-----|-----------|-----|-----------|
| nm                     | W/nm       | nm  | W/nm      | nm  | W/nm      | nm  | W/nm      | nm  | W/nm      |
| 380                    | -8.221E-06 | 464 | 9.581E-03 | 548 | 1.637E-02 | 632 | 1.737E-02 | 716 | 2.068E-03 |
| 382                    | 2.587E-05  | 466 | 8.648E-03 | 550 | 1.670E-02 | 634 | 1.683E-02 | 718 | 1.947E-03 |
| 384                    | 3.052E-05  | 468 | 7.884E-03 | 552 | 1.704E-02 | 636 | 1.626E-02 | 720 | 1.837E-03 |
| 386                    | -3.661E-06 | 470 | 7.182E-03 | 554 | 1.738E-02 | 638 | 1.567E-02 | 722 | 1.732E-03 |
| 388                    | -1.600E-05 | 472 | 6.531E-03 | 556 | 1.774E-02 | 640 | 1.510E-02 | 724 | 1.624E-03 |
| 390                    | 1.568E-05  | 474 | 5.961E-03 | 558 | 1.811E-02 | 642 | 1.452E-02 | 726 | 1.534E-03 |
| 392                    | 3.914E-05  | 476 | 5.510E-03 | 560 | 1.848E-02 | 644 | 1.395E-02 | 728 | 1.444E-03 |
| 394                    | 4.251E-05  | 478 | 5.194E-03 | 562 | 1.886E-02 | 646 | 1.339E-02 | 730 | 1.350E-03 |
| 396                    | 6.128E-06  | 480 | 5.023E-03 | 564 | 1.925E-02 | 648 | 1.285E-02 | 732 | 1.263E-03 |
| 398                    | 4.108E-05  | 482 | 4.976E-03 | 566 | 1.964E-02 | 650 | 1.231E-02 | 734 | 1.187E-03 |
| 400                    | 1.701E-05  | 484 | 5.034E-03 | 568 | 2.003E-02 | 652 | 1.177E-02 | 736 | 1.121E-03 |
| 402                    | 1.602E-05  | 486 | 5.176E-03 | 570 | 2.042E-02 | 654 | 1.126E-02 | 738 | 1.044E-03 |
| 404                    | 4.465E-05  | 488 | 5.388E-03 | 572 | 2.080E-02 | 656 | 1.076E-02 | 740 | 9.904E-04 |
| 406                    | 9.279E-05  | 490 | 5.681E-03 | 574 | 2.117E-02 | 658 | 1.029E-02 | 742 | 9.279E-04 |
| 408                    | 1.111E-04  | 492 | 6.018E-03 | 576 | 2.152E-02 | 660 | 9.827E-03 | 744 | 8.727E-04 |
| 410                    | 1.680E-04  | 494 | 6.416E-03 | 578 | 2.185E-02 | 662 | 9.374E-03 | 746 | 8.164E-04 |
| 412                    | 2.497E-04  | 496 | 6.859E-03 | 580 | 2.217E-02 | 664 | 8.942E-03 | 748 | 7.714E-04 |
| 414                    | 3.217E-04  | 498 | 7.345E-03 | 582 | 2.244E-02 | 666 | 8.516E-03 | 750 | 7.347E-04 |
| 416                    | 4.485E-04  | 500 | 7.841E-03 | 584 | 2.271E-02 | 668 | 8.113E-03 | 752 | 6.866E-04 |
| 418                    | 6.108E-04  | 502 | 8.343E-03 | 586 | 2.294E-02 | 670 | 7.715E-03 | 754 | 6.365E-04 |
| 420                    | 8.537E-04  | 504 | 8.860E-03 | 588 | 2.311E-02 | 672 | 7.322E-03 | 756 | 6.022E-04 |
| 422                    | 1.138E-03  | 506 | 9.336E-03 | 590 | 2.326E-02 | 674 | 6.949E-03 | 758 | 5.777E-04 |
| 424                    | 1.485E-03  | 508 | 9.847E-03 | 592 | 2.336E-02 | 676 | 6.599E-03 | 760 | 5.425E-04 |
| 426                    | 1.927E-03  | 510 | 1.030E-02 | 594 | 2.342E-02 | 678 | 6.235E-03 | 762 | 5.098E-04 |
| 428                    | 2.496E-03  | 512 | 1.076E-02 | 596 | 2.343E-02 | 680 | 5.901E-03 | 764 | 4.748E-04 |
| 430                    | 3.155E-03  | 514 | 1.117E-02 | 598 | 2.338E-02 | 682 | 5.582E-03 | 766 | 4.510E-04 |
| 432                    | 3.970E-03  | 516 | 1.156E-02 | 600 | 2.328E-02 | 684 | 5.294E-03 | 768 | 4.249E-04 |
| 434                    | 4.920E-03  | 518 | 1.192E-02 | 602 | 2.316E-02 | 686 | 4.997E-03 | 770 | 4.046E-04 |
| 436                    | 6.001E-03  | 520 | 1.227E-02 | 604 | 2.301E-02 | 688 | 4.727E-03 | 772 | 3.720E-04 |
| 438                    | 7.221E-03  | 522 | 1.261E-02 | 606 | 2.281E-02 | 690 | 4.459E-03 | 774 | 3.571E-04 |
| 440                    | 8.609E-03  | 524 | 1.292E-02 | 608 | 2.259E-02 | 692 | 4.207E-03 | 776 | 3.291E-04 |
| 442                    | 1.023E-02  | 526 | 1.324E-02 | 610 | 2.232E-02 | 694 | 3.968E-03 | 778 | 3.203E-04 |
| 444                    | 1.202E-02  | 528 | 1.352E-02 | 612 | 2.199E-02 | 696 | 3.746E-03 | 780 | 2.898E-04 |
| 446                    | 1.390E-02  | 530 | 1.380E-02 | 614 | 2.165E-02 | 698 | 3.530E-03 | 782 | 2.808E-04 |
| 448                    | 1.563E-02  | 532 | 1.406E-02 | 616 | 2.129E-02 | 700 | 3.327E-03 | 784 | 2.626E-04 |
| 450                    | 1.683E-02  | 534 | 1.432E-02 | 618 | 2.087E-02 | 702 | 3.130E-03 | 786 | 2.505E-04 |
| 452                    | 1.731E-02  | 536 | 1.458E-02 | 620 | 2.044E-02 | 704 | 2.951E-03 | 788 | 2.294E-04 |
| 454                    | 1.684E-02  | 538 | 1.486E-02 | 622 | 1.998E-02 | 706 | 2.784E-03 | 790 | 2.159E-04 |
| 456                    | 1.562E-02  | 540 | 1.514E-02 | 624 | 1.948E-02 | 708 | 2.619E-03 | 792 | 2.114E-04 |
| 458                    | 1.398E-02  | 542 | 1.546E-02 | 626 | 1.896E-02 | 710 | 2.474E-03 | 794 | 1.872E-04 |
| 460                    | 1.225E-02  | 544 | 1.576E-02 | 628 | 1.844E-02 | 712 | 2.332E-03 | 796 | 1.863E-04 |
| 462                    | 1.073E-02  | 546 | 1.606E-02 | 630 | 1.790E-02 | 714 | 2.194E-03 | 798 | 1.656E-04 |
|                        |            |     |           |     |           |     |           | 800 | 1.634E-04 |

## Spectrum Lighting SG12SQLED21W35KE1/12SQGW/3.5LA Spatial Distribution Photometry

**Luminaire:** Spectrum Lighting SG12SQLED21W35KE1/12SQGW/3.5LA  
**Lamp Cat:** N/A  
**Lamp Output:** 1 lamp(s), rated Lumens/lamp: 1248.643  
**Max Candela:** 478.9 at Horizontal: 67.5°, Vertical: 2.5°  
**Input Wattage:** 24.9  
**Luminous Opening:** Rectangle (L: 0.95ft, W: 0.95ft)  
**Test Lab:** OSRAM SYLVANIA  
**Photometry :** Type C  
**CIE Class:** Direct



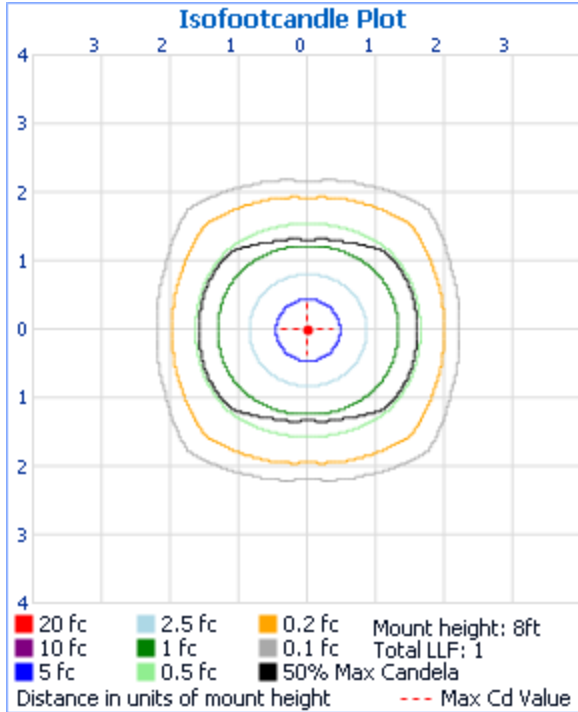
### Zonal Lumen Summary

| Zone   | Lumens  | % Luminaire |
|--------|---------|-------------|
| 0-30   | 370.2   | 29.6%       |
| 0-40   | 608.3   | 48.7%       |
| 0-60   | 1,082.8 | 86.7%       |
| 60-90  | 165.9   | 13.3%       |
| 70-100 | 40.4    | 3.2%        |
| 90-120 | 0       | 0%          |
| 0-90   | 1,248.6 | 100%        |
| 90-180 | 0       | 0%          |
| 0-180  | 1,248.6 | 100%        |

### Lumens Per Zone

| Zone  | Lumens | % Total | Zone    | Lumens | % Total |
|-------|--------|---------|---------|--------|---------|
| 0-10  | 45.2   | 3.6%    | 90-100  | 0      | 0%      |
| 10-20 | 129.2  | 10.3%   | 100-110 | 0      | 0%      |
| 20-30 | 195.7  | 15.7%   | 110-120 | 0      | 0%      |
| 30-40 | 238.1  | 19.1%   | 120-130 | 0      | 0%      |
| 40-50 | 249.6  | 20.0%   | 130-140 | 0      | 0%      |
| 50-60 | 224.9  | 18.0%   | 140-150 | 0      | 0%      |
| 60-70 | 125.5  | 10.1%   | 150-160 | 0      | 0%      |
| 70-80 | 28.8   | 2.3%    | 160-170 | 0      | 0%      |
| 80-90 | 11.6   | 0.9%    | 170-180 | 0      | 0%      |

## Spectrum Lighting SG12SQLED21W35KE1/12SQGW/3.5LA Spatial Distribution Photometry



|       | Center Beam FC | Beam Width |        |
|-------|----------------|------------|--------|
| 1.3ft | 269.10 fc      | 3.5ft      | 4.2ft  |
| 2.7ft | 67.27 fc       | 7.1ft      | 8.5ft  |
| 4.0ft | 29.90 fc       | 10.6ft     | 12.7ft |
| 5.3ft | 16.82 fc       | 14.1ft     | 16.9ft |
| 6.7ft | 10.76 fc       | 17.6ft     | 21.2ft |
| 8.0ft | 7.48 fc        | 21.2ft     | 25.4ft |

■ Vert. Spread: 105.8°    ■ Horiz. Spread: 115.6°

**Flood Summary**

|               | Efficiency  | Lumens         | Horizontal Spread | Vertical Spread |
|---------------|-------------|----------------|-------------------|-----------------|
| Field (10%):  | 96.8%       | 1,208.7        | 136.7             | 136.9           |
| Beam (50%):   | 80.8%       | 1,009.1        | 115.6             | 105.8           |
| <b>Total:</b> | <b>100%</b> | <b>1,248.3</b> |                   |                 |

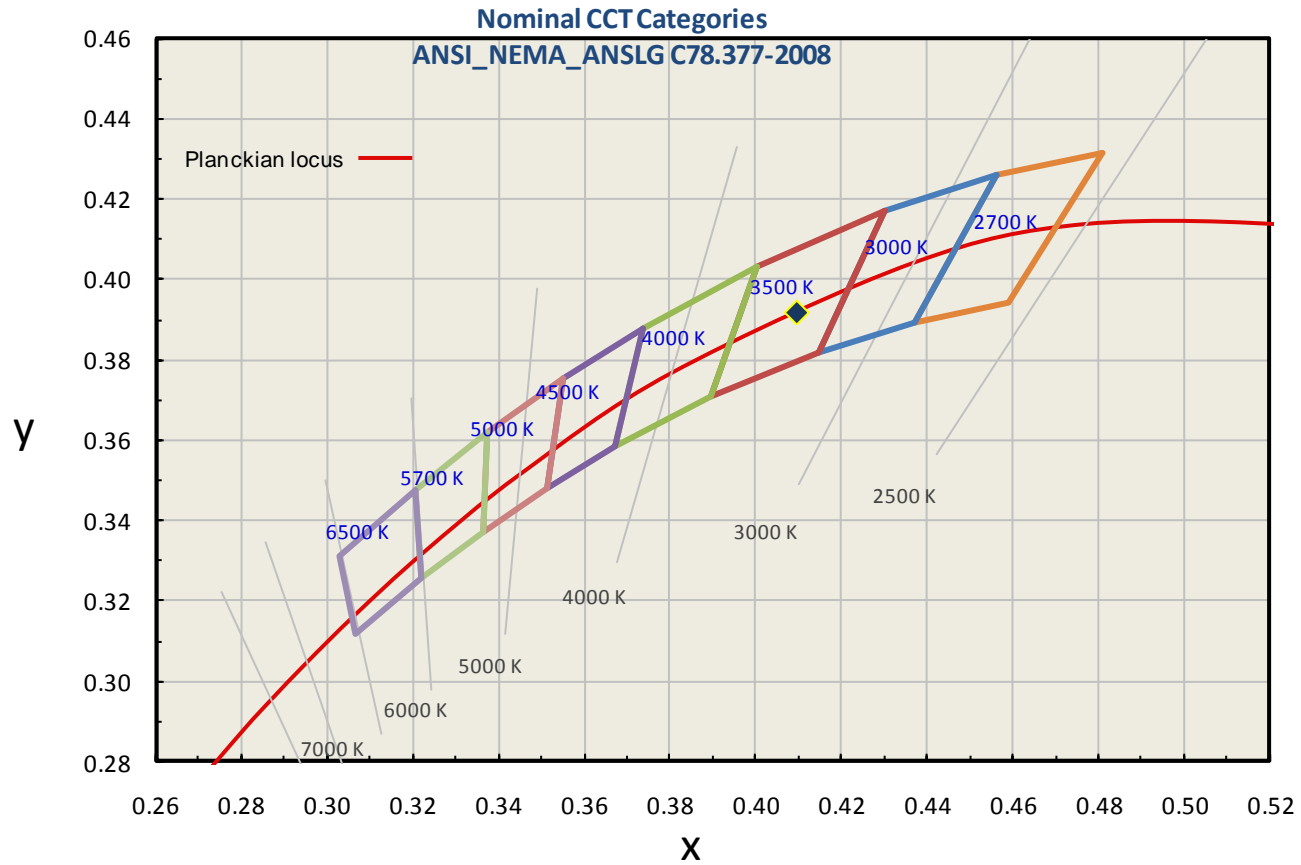
**Spectrum Lighting SG12SQLED21W35KE1/12SQGW/3.5LA  
Spatial Distribution Photometry (continued)**

| Candela Table - Type C |     |      |     |      |     |
|------------------------|-----|------|-----|------|-----|
|                        | 0   | 22.5 | 45  | 67.5 | 90  |
| 0                      | 478 | 478  | 478 | 478  | 478 |
| 2.5                    | 477 | 478  | 478 | 479  | 479 |
| 5                      | 475 | 476  | 477 | 478  | 478 |
| 7.5                    | 471 | 473  | 474 | 474  | 475 |
| 10                     | 467 | 468  | 470 | 471  | 471 |
| 12.5                   | 461 | 463  | 465 | 466  | 466 |
| 15                     | 454 | 456  | 458 | 460  | 460 |
| 17.5                   | 446 | 449  | 452 | 453  | 454 |
| 20                     | 437 | 440  | 444 | 446  | 447 |
| 22.5                   | 427 | 430  | 435 | 438  | 439 |
| 25                     | 416 | 420  | 425 | 429  | 431 |
| 27.5                   | 406 | 410  | 415 | 420  | 422 |
| 30                     | 394 | 398  | 404 | 410  | 412 |
| 32.5                   | 382 | 387  | 393 | 400  | 402 |
| 35                     | 367 | 374  | 382 | 388  | 390 |
| 37.5                   | 352 | 359  | 370 | 376  | 379 |
| 40                     | 336 | 344  | 358 | 364  | 366 |
| 42.5                   | 318 | 328  | 344 | 350  | 353 |
| 45                     | 300 | 310  | 328 | 336  | 339 |
| 47.5                   | 281 | 293  | 311 | 322  | 326 |
| 50                     | 262 | 274  | 295 | 308  | 311 |
| 52.5                   | 241 | 254  | 279 | 293  | 294 |
| 55                     | 220 | 234  | 262 | 272  | 271 |
| 57.5                   | 197 | 213  | 244 | 248  | 244 |
| 60                     | 169 | 190  | 224 | 217  | 205 |
| 62.5                   | 133 | 163  | 200 | 173  | 153 |
| 65                     | 90  | 124  | 172 | 122  | 100 |
| 67.5                   | 53  | 79   | 134 | 72   | 56  |
| 70                     | 33  | 45   | 85  | 38   | 32  |
| 72.5                   | 24  | 29   | 41  | 29   | 29  |
| 75                     | 19  | 22   | 24  | 26   | 26  |
| 77.5                   | 16  | 18   | 21  | 23   | 23  |
| 80                     | 14  | 16   | 18  | 20   | 19  |
| 82.5                   | 12  | 14   | 15  | 16   | 16  |
| 85                     | 10  | 11   | 12  | 12   | 12  |
| 87.5                   | 6   | 7    | 7   | 7    | 8   |
| 90                     | 0   | 0    | 1   | 1    | 0   |

**Spectrum Lighting SG12SQLLED21W35KE1/12SQGW/3.5LA**  
**Spatial Color Deviation**

| Horizontal | Vertical | Average Weighted u', v' |       | $\Delta u'v'$ |
|------------|----------|-------------------------|-------|---------------|
|            |          | 0.238                   | 0.513 |               |
|            |          | Spatial u', v'          |       |               |
| 90         | 60       | 0.238                   | 0.514 | 0.000         |
| 90         | 50       | 0.238                   | 0.514 | 0.000         |
| 90         | 40       | 0.238                   | 0.513 | 0.000         |
| 90         | 30       | 0.238                   | 0.513 | 0.000         |
| 90         | 20       | 0.238                   | 0.513 | 0.000         |
| 90         | 10       | 0.238                   | 0.513 | 0.000         |
| 90         | 0        | 0.238                   | 0.513 | 0.000         |
| 0          | 60       | 0.237                   | 0.514 | 0.000         |
| 0          | 50       | 0.237                   | 0.514 | 0.000         |
| 0          | 40       | 0.237                   | 0.514 | 0.000         |
| 0          | 30       | 0.238                   | 0.513 | 0.000         |
| 0          | 20       | 0.238                   | 0.513 | 0.000         |
| 0          | 10       | 0.238                   | 0.513 | 0.000         |
| 0          | 0        | 0.238                   | 0.513 | 0.001         |

**Spectrum Lighting SG12SLED21W35KE1/12SQGW/3.5LA**  
**Compliance to Specification for Chromaticity of Solid State Lighting Products**



Spectrum Lighting SG12SLED21W35KE1/12SQGW/3.5LA

