

## LM-79-08 TEST REPORT

for

### GREEN CREATIVE LTD

756 North Zhongshan Rd., Unit B301 Zhabei District, Shanghai

### LED Lamp

**Model: 6MR16DIM/827FL35/R**

### Laboratory: Leading Testing Laboratories

**NVLAP CODE: 200960-0**

3rd Floor, Bld. 2, NO. 96 Longchuanwu Rd Qianjiang Economy Dev. Zone, YuhangDist,  
Hangzhou, Zhejiang Province, China 311100

Tel: +86571 86376106

[www.ledtestlab.com](http://www.ledtestlab.com)

Report No.: HZ19040047k

The laboratory that conducted the testing detailed in this report has been accredited for SSL by NVLAP.

Review by:



Engineer: April Zou  
May 10, 2019

Approved by:



Manager: Jim Zhang  
May 10, 2019

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

## TEST SUMMARY

Sample Tested: 6MR16DIM/827FL35/R

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)	Power Factor
106.8	619.5	5.80	0.9200
CCT (K)	CRI	Stabilization Time (Light & Power)	
2753	82.2	60	

Table 1: Executive Data Summary

Note: The above results are recorded/ derived from measurements made using an Integrating Sphere.

### Test specifications:

<b>Date of Receipt</b>	: Apr. 26, 2019
<b>Date of Test</b>	: Apr. 29, 2019
<b>Test item</b>	: Total Luminous Flux, Luminous Distribution Intensity, Luminous Efficacy, Correlated Color Temperature, Color Rendering Index, Chromaticity Coordinate, Electrical parameters
<b>Reference Standard</b>	: IESNA LM-79-2008 Approved Method for the Electrical and Photometric Measurements of Solid-State Lighting Products ANSI/IES TM-30-18 IES Method for Evaluating Light Source Color Rendition

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## SAMPLE PHOTO



Figure 1- Overview of the sample

### Equipment Under Test(EUT)

<b>Name</b>	: LED Lamp
<b>Model</b>	: 6MR16DIM/827FL35/R
<b>Electrical Ratings</b>	: 12V, 60Hz, 6W
<b>Product Description</b>	: 2700K
<b>Manufacturer</b>	: GREEN CREATIVE LTD
<b>Address</b>	: 756 North Zhongshan Rd., Unit B301 Zhabei District, Shanghai

## TEST RESULTS

Test ambient temperature was 25.0°C.

Base orientation was base up. Test was conducted without a dimmer in the circuit.

The stabilization time of the sample was 60 minutes, and the total operating time including stabilization was 65 minutes.

### Sphere-Spectroradiometer Method

Parameter	Result
Test Voltage (V)	12.0
Voltage frequency (Hz)	60
Test Current (A)	0.523
Power Factor	0.9200
Test Power (W)	5.80
THD A%	23.02
Luminous Efficacy (lm/W)	106.8
Total Luminous Flux (lm)	619.5
Color Rendering Index (CRI)	82.2
R9	6.3
Correlated Color Temperature (CCT)(K)	2753
Chromaticity Chroma x	0.4583
Chromaticity Chroma y	0.4147
Chromaticity Chroma u	0.2596
Chromaticity Chroma v	0.3525
Duv	0.0015
Chromaticity Chroma u'	0.2596
Chromaticity Chroma v'	0.5287

Special Color Rendering Indices	
R1	80.3
R2	91.1
R3	95.9
R4	80.1
R5	80.7
R6	90.3
R7	82.2
R8	57.3
R9	6.3
R10	80.6
R11	79.6
R12	76
R13	82.8
R14	98.3

Table 2: Test data per Sphere-Spectroradiometer Method

Note: According to CIE 1976 ( $u', v'$ ) diagram,  $u' = u / (-2x + 12y + 3)$ ,  $v' = 3v / 2 = 9y / (-2x + 12y + 3)$ .

### Goniophotometer Method

Test ambient temperature was 24.7°C.

The photometric distance is 2.47 m.

Luminous data was taken at 0.5 vertical intervals and 10 horizontal intervals.

Parameter	Result
Test Voltage (V)	12.0
Voltage frequency (Hz)	60
Test Current (A)	0.530
Power Factor	0.9230
Power (W)	5.86
Luminous Efficacy (lm/W)	107.0
Total Luminous Flux (lm)	627.2
Beam Angle (°)	32.0 (0°-180°) / 31.6 (90°-270°)
Center Beam Candle Power (cd)	1815
Maximum Beam Candle Power (cd)	1815 (At: C=0.0, Gamma=0.0)
Spacing Criteria	0.51 (0°-180°) / 0.51 (90°-270°)
Zonal Lumens in the 0°-60° Zone	96.80%
Zonal Lumens in the 60°-90° Zone	2.99%
Zonal Lumens in the 90°-120° Zone	0.17%
Zonal Lumens in the 120°-180° Zone	0.03%

Table 3: Test data per Goniophotometer Method

### Spectral Power Distribution - Sphere Spectroradiometer Method

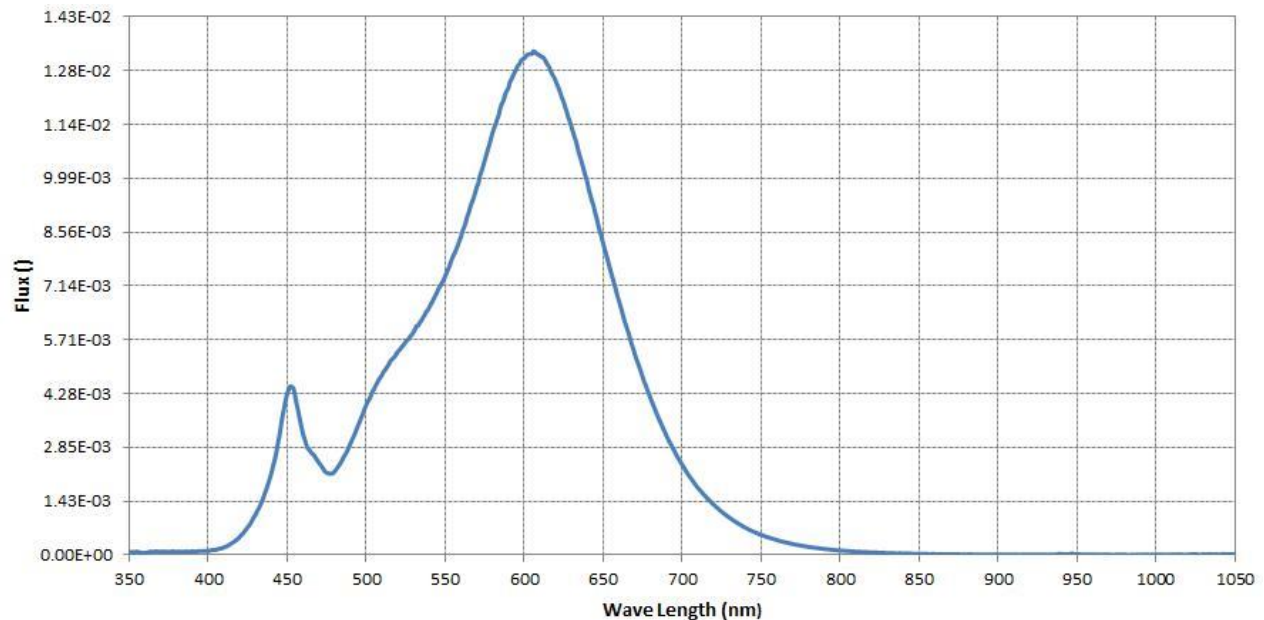


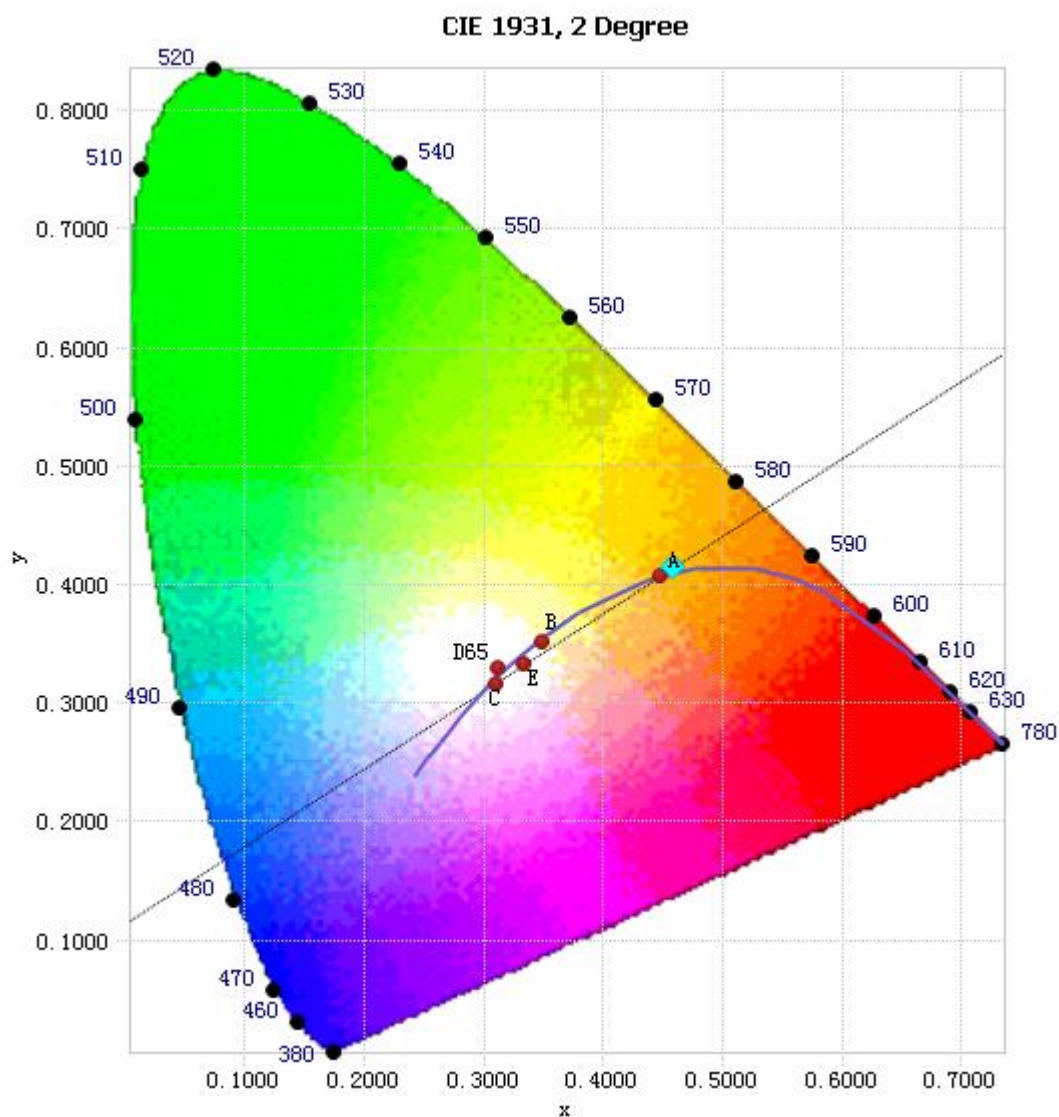
Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	9.12E-05	485	2.53E-03	590	1.24E-02	695	2.76E-03
385	8.28E-05	490	2.95E-03	595	1.29E-02	700	2.40E-03
390	9.48E-05	495	3.44E-03	600	1.32E-02	705	2.07E-03
395	1.04E-04	500	3.97E-03	605	1.33E-02	710	1.78E-03
400	1.14E-04	505	4.40E-03	610	1.32E-02	715	1.55E-03
405	1.41E-04	510	4.77E-03	615	1.30E-02	720	1.33E-03
410	2.04E-04	515	5.12E-03	620	1.26E-02	725	1.15E-03
415	3.15E-04	520	5.39E-03	625	1.20E-02	730	9.92E-04
420	4.80E-04	525	5.65E-03	630	1.14E-02	735	8.49E-04
425	7.36E-04	530	5.91E-03	635	1.06E-02	740	7.25E-04
430	1.06E-03	535	6.22E-03	640	9.89E-03	745	6.23E-04
435	1.52E-03	540	6.57E-03	645	9.06E-03	750	5.34E-04
440	2.16E-03	545	6.98E-03	650	8.26E-03	755	4.61E-04
445	3.12E-03	550	7.39E-03	655	7.49E-03	760	3.98E-04
450	4.27E-03	555	7.91E-03	660	6.74E-03	765	3.40E-04
455	4.22E-03	560	8.43E-03	665	6.02E-03	770	2.96E-04
460	3.22E-03	565	9.09E-03	670	5.33E-03	775	2.54E-04
465	2.73E-03	570	9.75E-03	675	4.72E-03	780	2.17E-04
470	2.46E-03	575	1.04E-02	680	4.15E-03		
475	2.19E-03	580	1.12E-02	685	3.64E-03		
480	2.21E-03	585	1.19E-02	690	3.17E-03		

Table 4: Spectral Power Distribution Numerical Data per Sphere - Spectroradiometer Method



## Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.4583, 0.4147)

Chart 2: Chromaticity Diagram per Sphere - Spectroradiometer Method

Note: The location on the diagram of the tristimulus coordinates are indicated by the blue diamond.



### Nominal CCT Quadrangles – Sphere Spectroradiometer Method

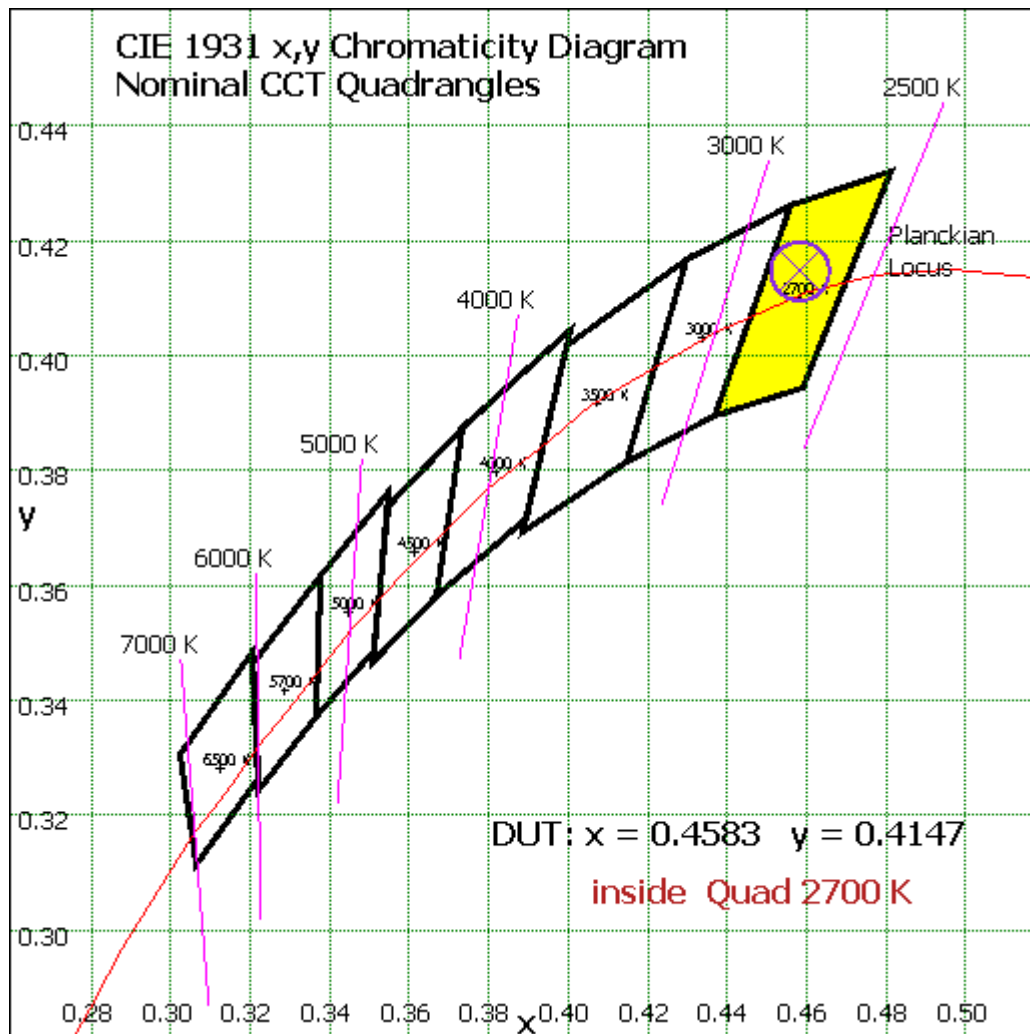
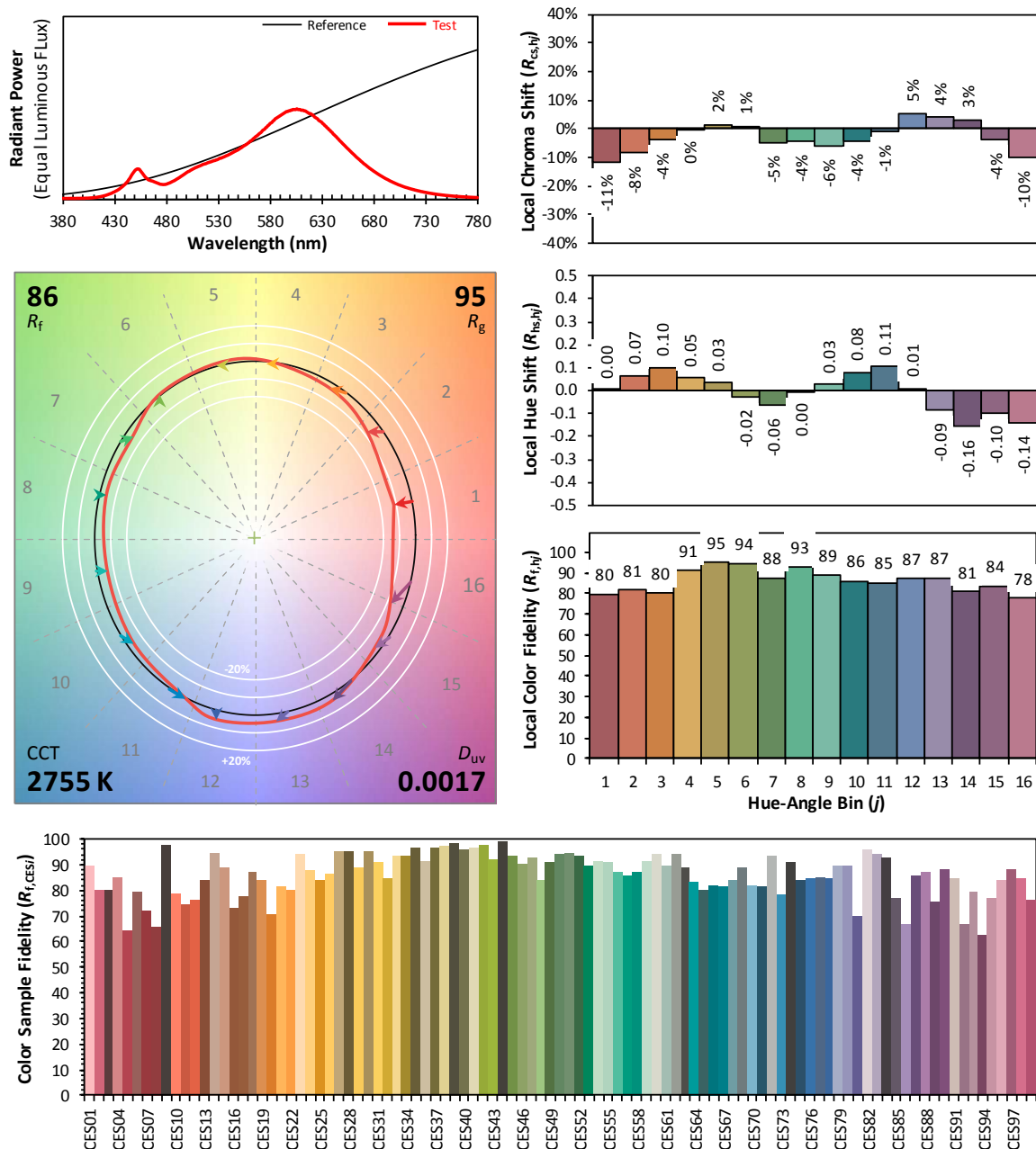


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

## Color Rendition Report – Sphere Spectroradiometer Method



**Notes:** This is a recommended method for displaying ANSI/IES TM-30-18 information.

$x$  0.4583  
 $y$  0.4147  
 $u'$  0.2596  
 $v'$  0.5287

Chart 4: Full Report Created with the IES TM-30 Calculator

Note: The values in this diagram might be a little different from the values in Table 2 due to rounding.

### Zonal Lumen Tabulation- Goniophotometer Method

$\gamma(^{\circ})$	Lumens	% Total
0- 10	157.912	25.18%
10- 20	269.004	42.89%
20- 30	124.463	19.84%
30- 40	33.85	5.40%
40- 50	12.699	2.02%
50- 60	9.2	1.47%
60- 70	8.706	1.39%
70- 80	6.592	1.05%
80- 90	3.485	0.56%
90-100	0.961	0.15%
100-110	0.112	0.02%
110-120	0	0.00%
120-130	0.005	0.00%
130-140	0.013	0.00%
140-150	0.028	0.00%
150-160	0.057	0.01%
160-170	0.068	0.01%
170-180	0.027	0.00%
Total	627.2	100%

$\gamma(^{\circ})$	Lumens	% Total
0- 60	607.128	96.80%
60- 90	18.783	2.99%
0-90	625.911	99.80%
90- 180	1.271	0.20%
0- 180	627.2	100%

Table 5: Zonal Lumen

## Illuminance Plots- Goniophotometer Method

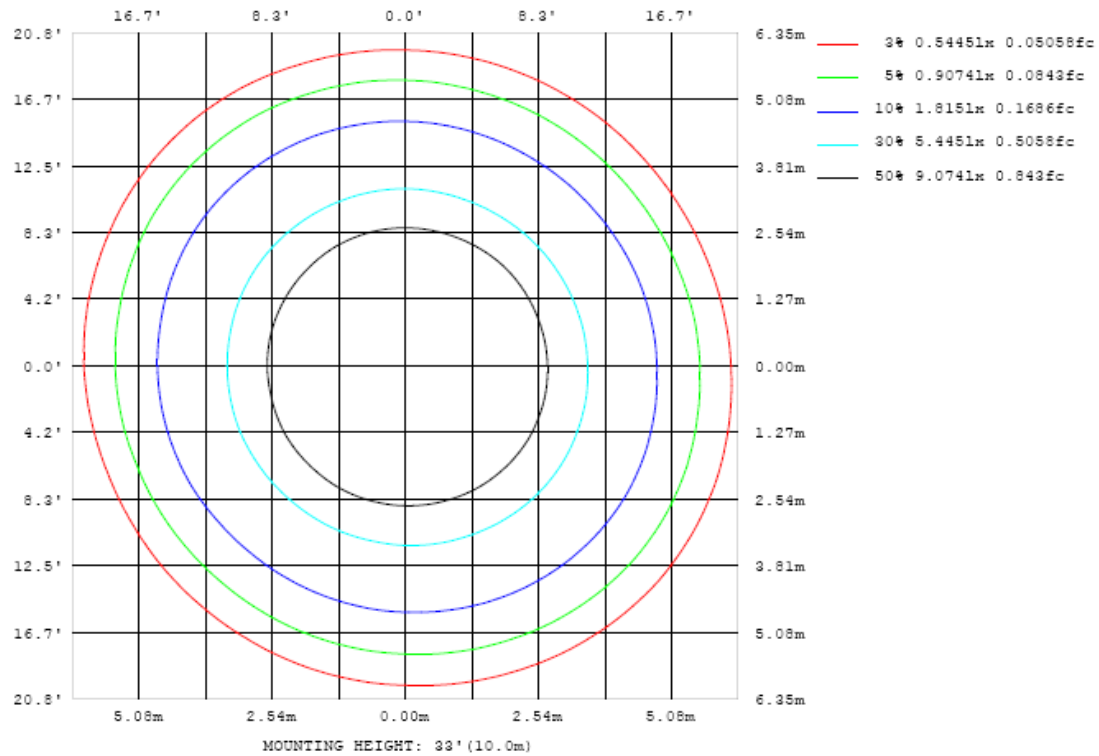


Chart 5: Illuminance Plot (Footcandles)

## Luminous Intensity Distribution Plots- Goniophotometer Method

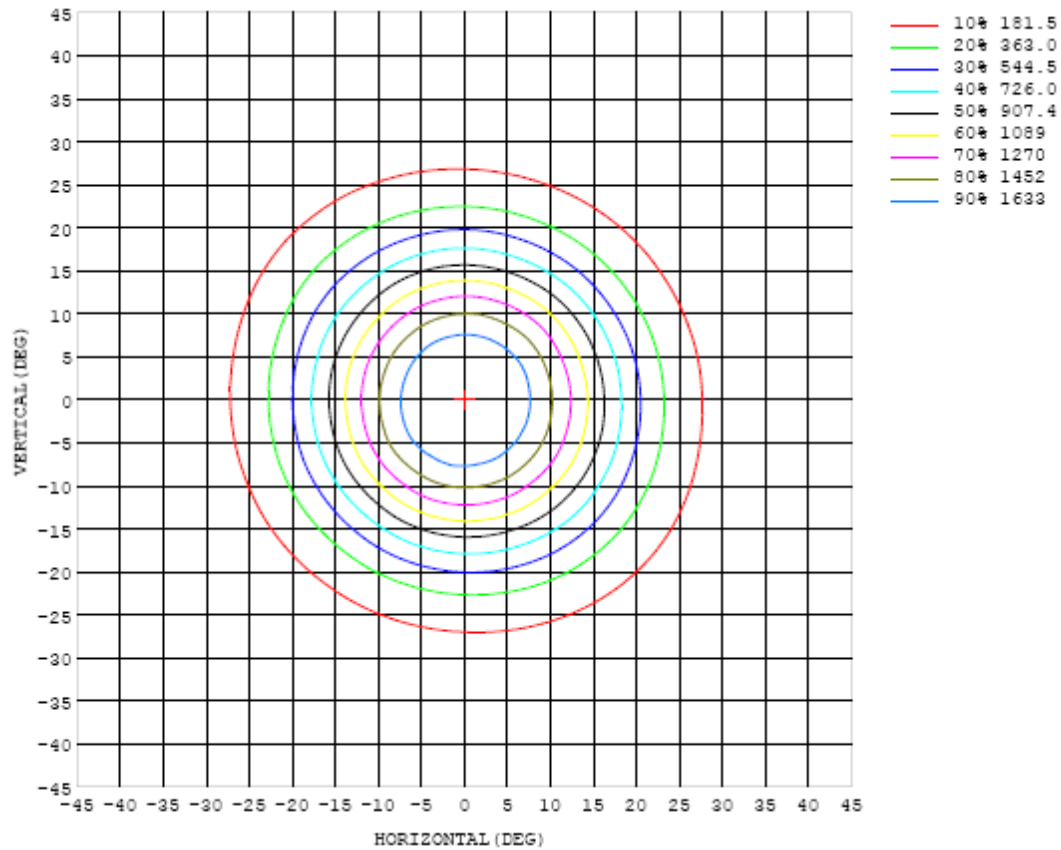


Chart 6: Isocandela Plot

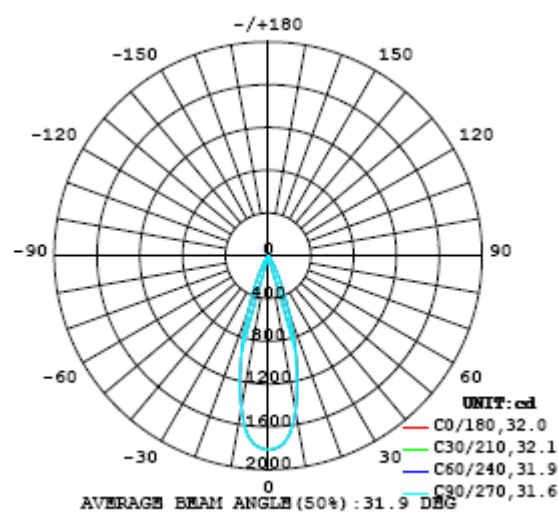


Chart 7: Polar Candela Distribution

## Luminous Intensity Data- Goniophotometer Method

Table--1

UNIT: cd

C (DEG) y (DEG)	0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180
0	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815
5	1749	1750	1752	1752	1748	1747	1755	1751	1751	1755	1752	1756	1759	1757	1754	1750	1744	1748	1742
10	1468	1468	1475	1476	1476	1473	1477	1472	1469	1468	1470	1466	1460	1458	1460	1462	1449	1444	1443
15	1026	1033	1032	1037	1032	1025	1020	1012	1005	1000	993	989	986	980	980	983	978	977	983
20	581	591	595	601	598	591	581	569	559	549	538	533	529	524	527	532	540	541	546
25	274	281	286	290	288	281	275	266	257	251	245	240	237	237	239	247	251	255	258
30	122	127	131	134	133	129	124	119	114	109	106	104	103	102	103	104	105	109	114
35	52.4	56.3	59.0	59.4	59.4	57.7	54.9	52.4	50.2	48.4	47.2	45.9	45.2	44.5	44.1	44.7	45.5	46.6	48.3
40	26.4	28.1	29.0	29.7	29.4	28.5	27.4	26.1	25.4	24.7	24.2	23.8	23.5	23.0	22.9	23.3	23.7	24.0	24.7
45	16.3	17.0	17.6	18.0	17.8	17.4	16.7	16.1	15.5	15.1	14.8	14.8	14.6	14.5	14.7	14.8	15.0	15.4	15.8
50	12.0	12.4	12.7	12.9	12.8	12.5	12.1	11.7	11.4	11.1	11.1	10.9	11.0	11.0	11.1	11.2	11.4	11.5	11.8
55	10.3	10.6	10.6	10.5	10.4	10.2	10.1	9.71	9.65	9.58	9.48	9.45	9.47	9.50	9.63	9.75	9.91	10.1	10.2
60	9.62	9.79	9.87	9.83	9.57	9.53	9.42	9.30	9.20	9.12	8.97	8.90	8.97	9.08	9.24	9.32	9.44	9.64	9.73
65	8.83	8.90	8.93	9.10	9.02	8.91	8.71	8.64	8.63	8.67	8.55	8.47	8.52	8.56	8.66	8.76	8.97	8.99	9.09
70	7.77	7.76	7.69	7.86	7.85	7.85	7.74	7.63	7.54	7.63	7.54	7.24	7.41	7.51	7.74	7.66	7.92	7.88	7.90
75	6.04	6.21	6.14	6.32	6.25	6.23	6.15	6.14	6.08	6.07	6.08	5.85	6.01	5.97	6.16	6.10	6.35	6.24	6.21
80	4.77	4.82	4.69	4.91	5.00	5.02	4.95	4.88	4.75	4.76	4.77	4.62	4.75	4.80	4.73	4.74	4.96	4.79	4.74
85	3.18	3.19	3.19	3.18	3.30	3.25	3.32	3.25	3.12	3.14	3.11	3.13	3.05	3.23	3.22	3.12	3.28	3.40	3.28
90	1.61	1.56	1.57	1.58	1.59	1.62	1.65	1.55	1.52	1.54	1.62	1.67	1.61	1.53	1.63	1.70	1.64	1.64	1.60
95	0.82	0.80	0.81	0.84	0.84	0.84	0.92	0.87	0.77	0.81	0.84	0.86	0.88	0.81	0.75	0.75	0.77	0.74	0.76
100	0.30	0.31	0.33	0.32	0.33	0.33	0.33	0.33	0.32	0.32	0.33	0.32	0.29	0.33	0.28	0.27	0.27	0.26	0.27
105	0.09	0.10	0.10	0.10	0.11	0.10	0.10	0.11	0.10	0.10	0.09	0.09	0.09	0.09	0.09	0.08	0.08	0.08	0.08
110	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	0.00	0.00	0.00
115	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	0.00	0.00	0.00
120	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	0.00	0.00	0.00
125	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	0.01	0.01	0.01	0.01	0.00
130	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
135	0.01	0.01	0.02	0.01	0.01	0.01	0.02	0.02	0.01	0.01	0.01	0.02	0.01	0.02	0.02	0.02	0.02	0.02	0.02
140	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.03
145	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
150	0.07	0.07	0.07	0.06	0.06	0.07	0.07	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.07	0.07	0.07	0.08
155	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.12
160	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.18
165	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24
170	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.28
175	0.29	0.30	0.30	0.30	0.30	0.31	0.31	0.31	0.31	0.31	0.30	0.30	0.30	0.29	0.29	0.28	0.27	0.26	0.25
180	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24

Table 6: Luminous Intensity Data

Table--2

UNIT: cd

C (DEG) y (DEG)	190	200	210	220	230	240	250	260	270	280	290	300	310	320	330	340	350		
0	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815		
5	1740	1744	1742	1740	1744	1750	1749	1749	1750	1751	1754	1754	1753	1753	1752	1758	1753		
10	1441	1439	1442	1441	1441	1445	1447	1449	1452	1458	1455	1456	1462	1466	1466	1463	1466		
15	983	980	978	975	974	978	976	976	974	974	975	981	995	1001	1005	1012	1019		
20	547	550	552	548	540	536	531	530	529	525	523	526	534	539	549	562	573		
25	261	265	267	266	262	257	252	246	242	239	236	236	239	243	251	260	267		
30	117	119	121	120	118	115	109	106	103	101	101	101	102	103	107	111	117		
35	50.1	51.1	51.7	52.1	51.1	49.3	46.8	45.6	44.6	43.9	43.6	43.6	44.2	44.6	45.6	47.1	49.2		
40	25.4	26.0	26.7	26.8	25.9	25.0	24.1	23.8	23.5	23.3	23.0	22.9	23.0	23.1	23.5	24.2	25.0		
45	16.1	16.6	16.9	16.6	16.4	15.8	15.4	15.2	15.1	15.0	14.5	14.5	14.6	14.6	14.9	15.2	15.8		
50	12.0	12.3	12.5	12.4	12.2	11.9	11.7	11.6	11.5	11.5	11.2	11.3	11.3	11.3	11.4	11.5	11.7		
55	10.3	10.7	10.7	10.6	10.5	10.3	9.96	10.1	10.1	10.0	9.97	9.99	9.94	9.98	10.1	10.2	10.2		
60	9.70	10.1	10.3	10.1	10.1	9.74	9.47	9.73	9.70	9.61	9.54	9.47	9.52	9.61	9.48	9.32	9.36		
65	9.18	9.31	9.36	9.34	9.35	9.24	9.22	9.06	9.01	8.98	8.74	8.79	8.86	8.85	8.82	8.76	8.75		
70	7.96	7.84	7.93	7.87	8.03	8.01	7.88	7.83	7.73	7.67	7.33	7.54	7.53	7.50	7.43	7.50	7.69		
75	6.43	6.29	6.37	6.20	6.49	6.33	6.22	6.31	6.21	6.19	5.95	6.16	6.11	6.24	6.22	6.07	6.21		
80	4.96	4.80	4.87	4.86	5.01	4.89	4.91	4.97	4.95	4.91	4.68	4.77	4.83	4.95	5.02	4.86	4.94		
85	3.35	3.19	3.32	3.51	3.42	3.26	3.30	3.31	3.37	3.18	3.11	3.04	3.16	3.20	3.23	3.23	3.21		
90	1.70	1.63	1.85	1.77	1.76	1.90	1.78	1.59	1.55	1.54	1.42	1.45	1.52	1.57	1.53	1.50	1.64		
95	0.75	0.72	0.79	0.84	0.83	0.95	1.03	0.90	0.86	0.88	0.81	0.88	0.88	0.90	0.83	0.80	0.77		
100	0.26	0.29	0.26	0.26	0.27	0.29	0.34	0.34	0.32	0.34	0.33	0.32	0.32	0.32	0.33	0.33	0.31		
105	0.08	0.08	0.08	0.08	0.08	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.10	0.09	0.09		
110	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	0.00		
115	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	0.00		
120	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	0.00		
125	0.00	0.01	0.01	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01		
130	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01		
135	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02		
140	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03		
145	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.04		
150	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.08	0.08	0.08	0.08	0.07		
155	0.14	0.15	0.15	0.15	0.15	0.15	0.15	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.12		
160	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.20	0.21	0.21	0.21	0.21	0.21	0.21	0.18		
165	0.26	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.26	0.24		
170	0.28	0.30	0.29	0.29	0.28	0.28	0.28	0.28	0.29	0.29	0.30	0.30	0.30	0.30	0.31	0.29	0.29		
175	0.24	0.24	0.24	0.22	0.22	0.23	0.23	0.23	0.23	0.24	0.25	0.26	0.27	0.27	0.27	0.28	0.29		
180	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24		

Table 7: Luminous Intensity Data



## EQUIPMENT LIST

Test Equipment	Model	Equipment No.	Calibration Date	Calibration Due date
Goniophotometer system	GO-R5000	HZTE011-01	Aug. 14, 2018	Aug. 13, 2019
Digital Power Meter	PF2010A	HZTE028-01	Sep. 12, 2018	Sep. 11, 2019
AC Power Supply	DPS1060	HZTE001-06	Aug. 09, 2018	Aug. 08, 2019
DC Power Supply	WY12010	HZTE004-03	Aug. 09, 2018	Aug. 08, 2019
Temperature recorder	JM624U	HZTE018-08	Aug. 09, 2018	Aug. 08, 2019
Temperature and humidity recorder	JR900	HZTE018-01	Aug. 09, 2018	Aug. 08, 2019
Standard source	D908	HZTE012-01	Aug. 14, 2018	Aug. 13, 2019
Integrate Sphere system	3M	HZTE015-04	Aug. 16, 2018	Aug. 15, 2019
Digital Power Meter	WT210	HZTE008-01	Aug. 02, 2018	Aug. 01, 2019
AC Power Supply	PCR 500L	HZTE001-07	Aug. 09, 2018	Aug. 08, 2019
DC Power Supply	IT6154	HZTE004-04	Aug. 09, 2018	Aug. 08, 2019
Standard source	SCL-1400	HZTE012-02	Aug. 16, 2018	Aug. 15, 2019
Temperature and humidity recorder	JR900	HZTE018-02	Aug. 09, 2018	Aug. 08, 2019
Temperature Meter	TES1310	HZTE017-01	Aug. 09, 2018	Aug. 08, 2019

Table 8: Test Equipment List

## TEST METHODS

### Seasoning of SSL Product

For the purpose of rating new SSL products, SSL products shall be tested with no seasoning. Therefore, no seasoning was performed.

### Sphere-Spectroradiometer Method- Photometric and Electrical Measurements

A Labsphere Model CDS 2100 Spectroradiometer and Two Meter Sphere was used to measure correlated color temperature, chromaticity coordinates, and the color rendering index for each SSL unit. The coating reflectance of each sphere is 98%. The measure geometry is  $4\pi$ . Self-absorption correction is conducted in testing. Bandwidth of spectroradiometer is 350nm-1050nm.

Ambient temperature was measured at a position inside the sphere. Each SSL unit was operated on the client provided driver at the rated input voltage in its designated orientation.

The stabilization time typically ranges from 30 min (small integrated LED lamps) to 2 or more hours for large SSL luminaires). It can be judged that stability is reached when the variation (maximum – minimum) of at least 3 readings of the light output and electrical power over a period of 30 min, taken 15 minutes apart, is less than 0.5 %.

Electrical measurements including voltage, current, and power were measured using the Yokogawa Power Analyzer.

The standard reference of the integrated sphere system is halogen incandescent lamp, the intensity distribution type is omni-directional, and is traceable to the National Institute of Standards and Technology.

The uncertainty of integrating sphere system reported in this document is expanded uncertainty is 2.1% with a coverage factor  $k=2$ .

## **Goniophotometer Method**

### **Photometric and Electrical Measurements**

An EVERFINE Type C Model GO-R5000 Goniophotometer was used to measure the intensity at each angle of distribution for each sample. The photometric distance is 2.475m for near-field measurement or 30m for far-field measurement. Bandwidth of spectroradiometer is 380nm-780nm.

Ambient temperature was measured at the same height of the sample mounted on the Goniophotometer equipment. Each SSL unit was operated on the client provided driver at the rated input voltage in its designated orientation.

The stabilization time typically ranges from 30 min (small integrated LED lamps) to 2 or more hours for large SSL luminaires). It can be judged that stability is reached when the variation (maximum – minimum) of at least 3 readings of the light output and electrical power over a period of 30 min, taken 15 minutes apart, is less than 0.5 %.

Electrical measurements including voltage, current, and power were measured using the Everfine Digital Power Meter.

Some graphics were created with Photometric Plus software.

The standard reference of the Goniophotometer system is halogen incandescent lamp, the intensity distribution type is omni-directional, and is traceable to the National Institute of Metrology P.R. China.

The uncertainty of goniophotometer system reported in this document is expanded uncertainty is 2.3% with a coverage factor  $k=2$ .

### **Color Characteristics Measurements**

The color characteristics of SSL products include chromaticity coordinates, correlated color temperature, and color rendering index. These characteristics of SSL products may be spatially non-uniform, and thus, in order that they can be specified accurately, the color quantities shall be measured as values that are spatially average, weighted to intensity, over the angular range where light is intentionally emitted from the SSL product. The color characteristics measurements are using gonio-spectroradiometer.

### **Color Spatial Uniformity**

The characteristics of SSL products may be spatially non-uniform, the chromaticity coordinate shall be measured at two vertical planes ( $C=0^\circ/180^\circ$  and  $C=90^\circ/270^\circ$ ) and at  $10^\circ$  or less intervals for vertical angle until the light output dropped to below 10% of the peak intensity. The averaged weighted chromaticity coordinate

was calculated from these points. The data was then analyzed to check for delta color differences of the  $u'$ ,  $v'$  chromaticity coordinates. The spatial non-uniformity of chromaticity,  $\Delta u'v'$ , is determined as the maximum deviation (distance on the CIE ( $u'$ ,  $v'$ ) diagram) among all measured points from the spatially averaged chromaticity coordinate.

The geometry for the chromaticity measurement using gonio-spectroradiometer is shown as following.



\*\*\* End of Report \*\*\*

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