

LM-79-08 TEST REPORT

for

GREEN CREATIVE LTD

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

LED Lamp

Model: 11PAR30SNDIM/930FL40/B

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

Report No.: HZ19050046ax

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

Review by:



Engineer: April Zou
Jul. 10, 2019

Approved by:



Manager: Jim Zhang
Jul. 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: **11PAR30SNDIM/930FL40/B**

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)	Power Factor
94.1	1072.6	11.40	0.9311
CCT (K)	CRI	Stabilization Time (Light & Power)	
3132	97.1	60	

Table 1: Executive Data Summary

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

Test specifications:

Date of Receipt	: May 29, 2019
Date of Test	: Jul. 05, 2019
Test item	: Total Luminous Flux, Luminous Distribution Intensity, Luminous Efficacy, Correlated Color Temperature, Color Rendering Index, Chromaticity Coordinate, Electrical parameters
Reference Standard	: 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

TABLE OF CONTENT

LM-79-08 TEST REPORT	1
TEST SUMMARY	2
SAMPLE PHOTO	4
TEST RESULTS	5
Sphere-Spectroradiometer Method.....	5
Goniophotometer Method	6
Spectral Power Distribution - Sphere Spectroradiometer Method	7
Chromaticity Diagram - Sphere Spectroradiometer Method.....	8
Nominal CCT Quadrangles – Sphere Spectroradiometer Method	9
Color Rendition Report – Sphere Spectroradiometer Method	10
Zonal Lumen Tabulation- Goniophotometer Method	11
Illuminance Plots- Goniophotometer Method	12
Luminous Intensity Distribution Plots- Goniophotometer Method.....	13
Luminous Intensity Data- Goniophotometer Method	14
EQUIPMENT LIST	16
TEST METHODS	16
Seasoning of SSL Product.....	16
Sphere-Spectroradiometer Method- Photometric and Electrical Measurements.....	16
Goniophotometer Method	17
Photometric and Electrical Measurements	17
Color Characteristics Measurements.....	17
Color Spatial Uniformity	17

SAMPLE PHOTO



Figure 1- Overview of the sample

Equipment Under Test(EUT)

Name	: LED Lamp
Model	: 11PAR30SNDIM/930FL40/B
Electrical Ratings	: 120V, 60Hz, 11W
Product Description	: 3000K
Manufacturer	: GREEN CREATIVE LTD
Address	: 756 North Zhongshan Rd., Unit B301 Zhabei District, Shanghai

TEST RESULTS

Test ambient temperature was 26.0 °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)	120.0
Voltage frequency (Hz)	60
Test Current (A)	0.102
Power Factor	0.9311
Test Power (W)	11.40
THD A%	32.54
Luminous Efficacy (lm/W)	94.1
Total Luminous Flux (lm)	1072.6
Color Rendering Index (CRI)	97.1
R9	85.7
Correlated Color Temperature (CCT)(K)	3132
Chromaticity Chroma x	0.4303
Chromaticity Chroma y	0.4064
Chromaticity Chroma u	0.2453
Chromaticity Chroma v	0.3475
Duv	0.0019
Chromaticity Chroma u'	0.2453
Chromaticity Chroma v'	0.5213

Special Color Rendering Indices	
R1	98.2
R2	98.7
R3	97.4
R4	97.1
R5	96.8
R6	97.8
R7	96.8
R8	93.8
R9	85.7
R10	95.3
R11	98.4
R12	82
R13	98.4
R14	97.6

Table 2: Test data per Sphere-Spectroradiometer Method

Note: According to CIE 1976 (u' , v') diagram, $u' = u = 4x/(-2x+12y+3)$, $v' = 3v/2 = 9y/(-2x+12y+3)$.

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)	120.0
Voltage frequency (Hz)	60
Test Current (A)	0.103
Power Factor	0.9352
Power (W)	11.57
Luminous Efficacy (lm/W)	96.2
Total Luminous Flux (lm)	1113.2
Beam Angle (°)	36.6 (0°-180°) / 36.4(90°-270°)
Center Beam Candle Power (cd)	2074
Maximum Beam Candle Power (cd)	2092 (At: C=120.0, Gamma=2.5)
Spacing Criteria	0.60 (0°-180°) / 0.58 (90°-270°)
Zonal Lumens in the 0 °-60 °Zone	95.49%
Zonal Lumens in the 60 °-90 °Zone	4.36%
Zonal Lumens in the 90 °-120 °Zone	0.03%
Zonal Lumens in the 120 °-180 °Zone	0.13%

Table 3: Test data per Goniophotometer Method

Spectral Power Distribution - Sphere Spectroradiometer Method

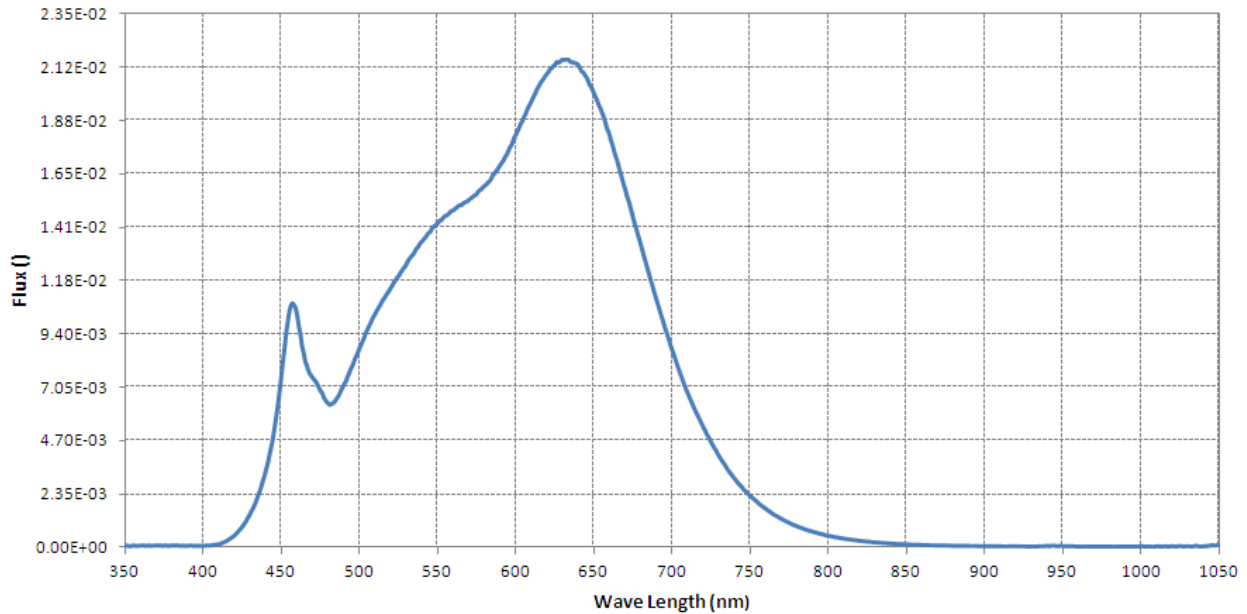
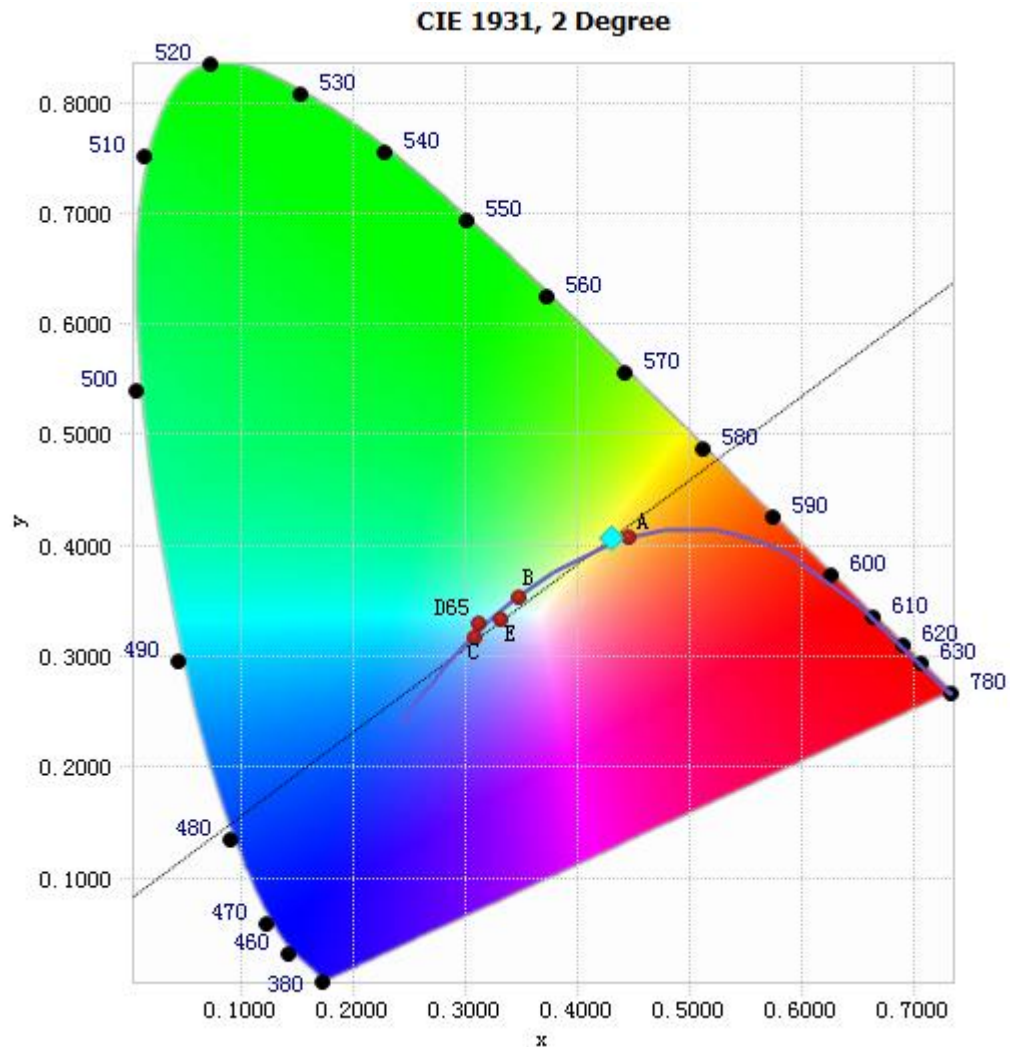


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	5.83E-05	485	6.52E-03	590	1.69E-02	695	9.73E-03
385	4.69E-05	490	7.19E-03	595	1.75E-02	700	8.68E-03
390	4.49E-05	495	7.96E-03	600	1.82E-02	705	7.66E-03
395	3.95E-05	500	8.81E-03	605	1.89E-02	710	6.76E-03
400	3.66E-05	505	9.61E-03	610	1.97E-02	715	5.96E-03
405	6.14E-05	510	1.03E-02	615	2.04E-02	720	5.26E-03
410	1.16E-04	515	1.09E-02	620	2.09E-02	725	4.59E-03
415	2.62E-04	520	1.15E-02	625	2.12E-02	730	3.99E-03
420	5.14E-04	525	1.20E-02	630	2.15E-02	735	3.46E-03
425	9.06E-04	530	1.25E-02	635	2.14E-02	740	2.99E-03
430	1.48E-03	535	1.30E-02	640	2.12E-02	745	2.59E-03
435	2.27E-03	540	1.35E-02	645	2.07E-02	750	2.24E-03
440	3.42E-03	545	1.39E-02	650	1.99E-02	755	1.93E-03
445	5.06E-03	550	1.43E-02	655	1.91E-02	760	1.67E-03
450	7.67E-03	555	1.46E-02	660	1.81E-02	765	1.42E-03
455	1.04E-02	560	1.49E-02	665	1.70E-02	770	1.23E-03
460	1.02E-02	565	1.51E-02	670	1.57E-02	775	1.05E-03
465	8.21E-03	570	1.53E-02	675	1.45E-02	780	8.98E-04
470	7.45E-03	575	1.56E-02	680	1.33E-02		
475	6.87E-03	580	1.60E-02	685	1.21E-02		
480	6.31E-03	585	1.64E-02	690	1.09E-02		

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

Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.4303, 0.4064)

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

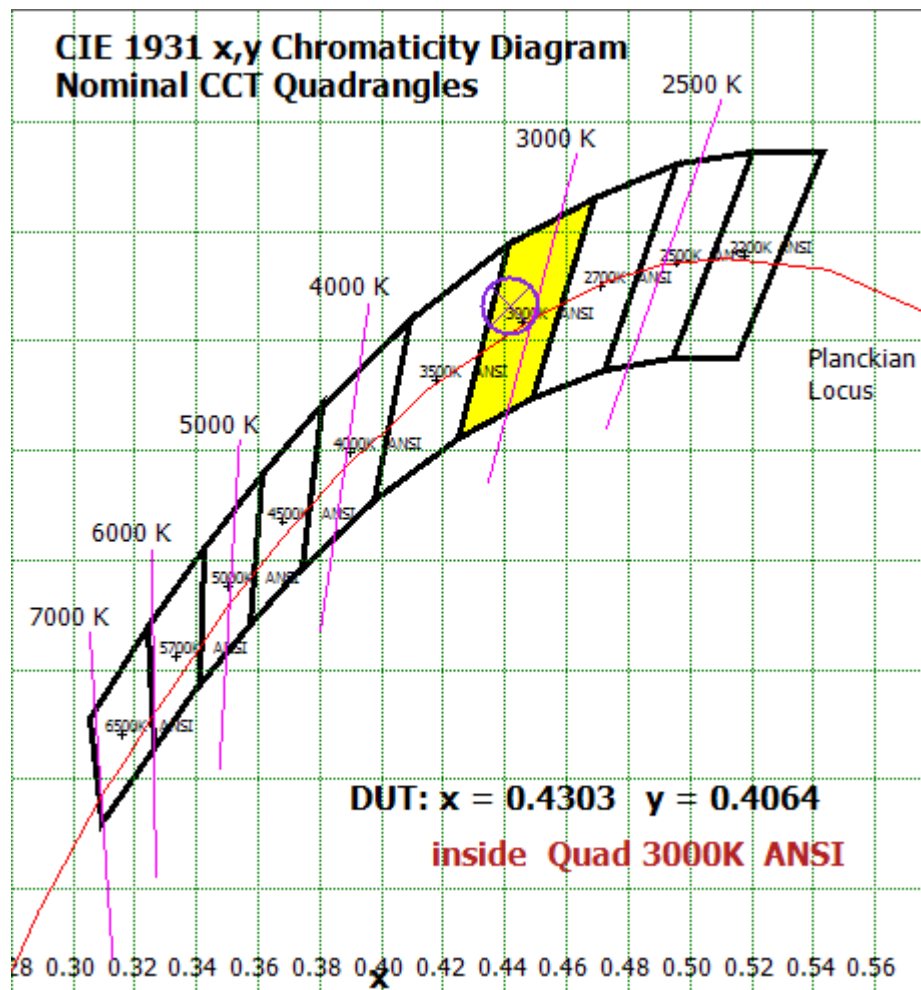
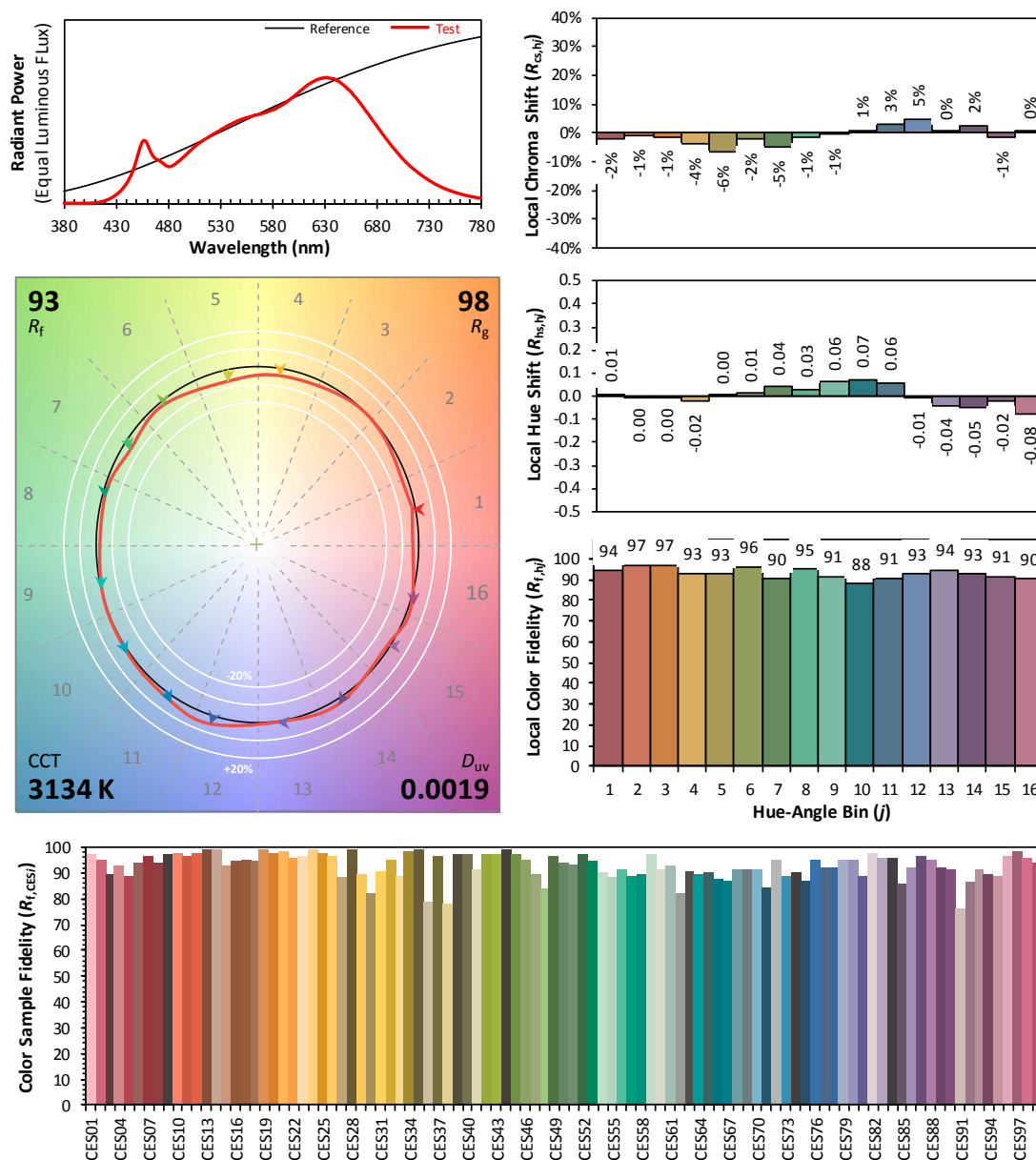


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

Color Rendition Report – Sphere Spectroradiometer Method



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

x 0.4303

y 0.4064

u' 0.2453

v' 0.5213

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	182.022	16.35%
10- 20	356.53	32.03%
20- 30	274.382	24.65%
30- 40	139.136	12.50%
40- 50	67.875	6.10%
50- 60	43.047	3.87%
60- 70	28.033	2.52%
70- 80	15.395	1.38%
80- 90	5.11	0.46%
90-100	0.268	0.02%
100-110	0.018	0.00%
110-120	0.033	0.00%
120-130	0.075	0.01%
130-140	0.193	0.02%
140-150	0.339	0.03%
150-160	0.392	0.04%
160-170	0.299	0.03%
170-180	0.101	0.01%
Total	1113.2	100%

$\gamma(^{\circ})$	Lumens	% Total
0- 60	1062.992	95.49%
60- 90	48.538	4.36%
0-90	1111.53	99.85%
90- 180	1.718	0.15%
0- 180	1113.2	100%

Table 5: Zonal Lumen

Illuminance Plots- Goniophotometer Method

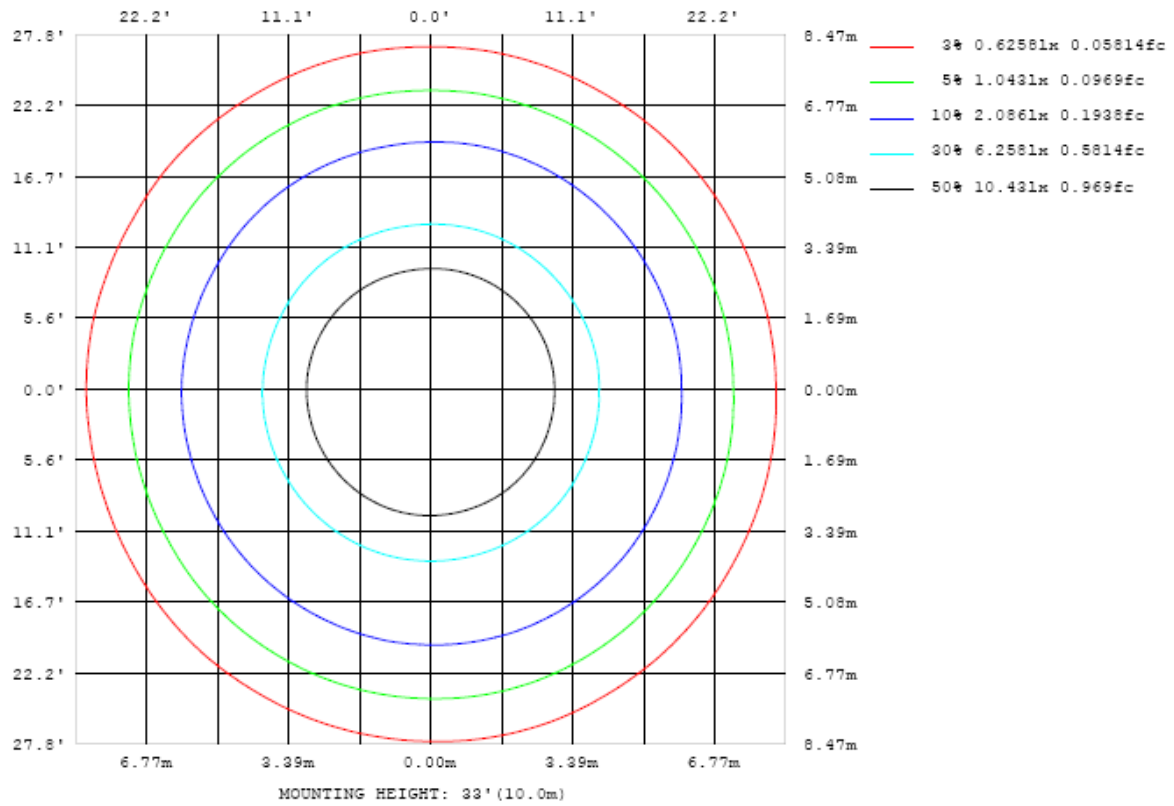


Chart 5: Illuminance Plot (Footcandles)

Luminous Intensity Distribution Plots- Goniophotometer Method

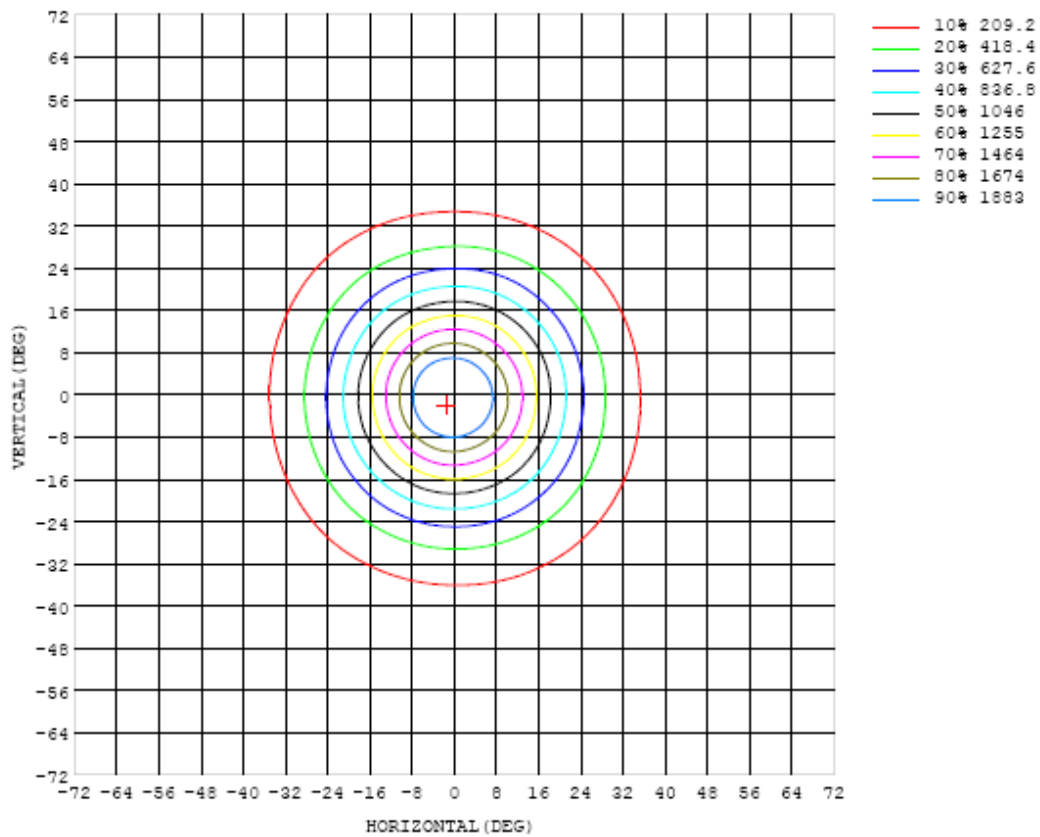


Chart 6: Isocandela Plot

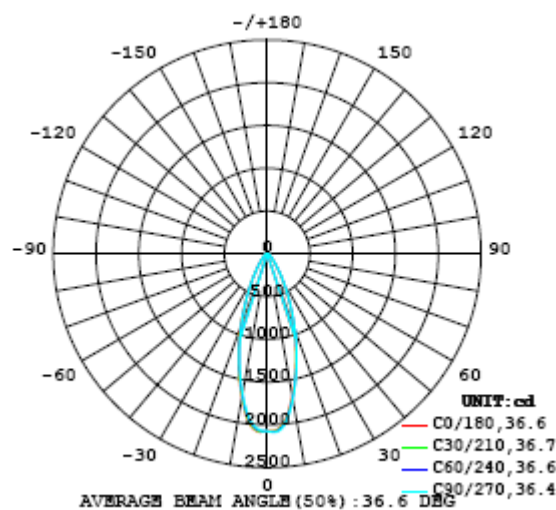


Chart 7: Polar Candela Distribution

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	2074	2074	2074	2074	2074	2074	2074	2074	2074	2074	2074	2074	2074	2074	2074	2074	2074	2074	2074
5	2005	2009	2014	2019	2023	2029	2033	2036	2040	2044	2045	2047	2049	2051	2049	2046	2043	2041	2039
10	1685	1694	1699	1707	1712	1713	1717	1720	1724	1731	1736	1733	1733	1732	1729	1725	1720	1715	1709
15	1296	1301	1306	1313	1320	1323	1323	1323	1325	1326	1329	1328	1326	1321	1316	1308	1304	1304	1303
20	915	920	926	933	941	946	947	947	948	949	951	949	943	936	931	925	923	919	915
25	601	598	606	613	621	624	627	629	626	625	625	620	617	609	603	599	594	590	589
30	362	368	373	379	385	388	389	389	388	386	385	379	375	371	366	361	358	356	356
35	214	218	222	225	229	232	233	236	235	233	232	229	225	222	219	215	212	211	211
40	130	132	134	135	138	139	140	142	142	140	139	138	136	135	133	130	128	128	129
45	84.4	85.9	87.0	87.6	89.1	89.9	90.4	91.1	90.8	90.2	90.4	89.3	88.4	87.5	86.3	84.4	84.0	83.5	83.5
50	59.4	60.2	60.9	61.1	61.8	62.3	63.0	63.6	63.8	63.3	63.4	63.1	62.7	62.5	62.1	61.3	60.9	60.7	60.7
55	47.4	47.7	48.0	47.9	48.5	48.9	49.4	49.7	50.0	49.8	49.8	49.7	49.5	49.4	49.3	48.7	48.4	48.3	48.4
60	37.1	37.2	37.4	37.4	37.6	37.8	38.0	38.1	38.3	38.4	38.3	38.4	38.3	38.3	38.3	38.2	38.0	37.9	37.9
65	27.6	27.8	27.9	28.0	28.2	28.3	28.4	28.6	28.7	28.9	29.0	29.2	29.1	29.1	29.0	28.9	28.8	28.7	28.8
70	20.3	20.4	20.6	20.7	20.8	21.0	21.1	21.3	21.4	21.5	21.5	21.6	21.6	21.6	21.5	21.5	21.4	21.3	21.4
75	14.2	14.3	14.5	14.6	14.7	14.8	14.9	15.0	15.0	15.1	15.2	15.2	15.3	15.2	15.2	15.1	15.0	14.9	14.9
80	9.17	9.34	9.41	9.47	9.52	9.52	9.55	9.51	9.56	9.61	9.65	9.72	9.72	9.64	9.57	9.52	9.48	9.44	9.25
85	4.19	4.32	4.43	4.55	4.59	4.63	4.72	4.75	4.75	4.83	4.81	4.84	4.84	4.75	4.66	4.64	4.55	4.50	4.64
90	1.18	1.23	1.28	1.32	1.36	1.39	1.40	1.43	1.44	1.44	1.46	1.46	1.43	1.42	1.40	1.35	1.32	1.30	1.29
95	0.02	0.02	0.03	0.03	0.03	0.04	0.04	0.04	0.05	0.05	0.05	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
100	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
105	0.01	0.01	0.02	0.01	0.01	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.02
110	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	0.02
115	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	0.03	0.03
120	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	0.05
125	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.07	0.07	0.07	0.07	0.07	0.07	0.10
130	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.18
135	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.32
140	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.50
145	0.39	0.39	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.39	0.38	0.70
150	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.51	0.51	0.51	0.51	0.51	0.50	0.90
155	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.65	0.65	0.63	1.06
160	0.76	0.76	0.76	0.76	0.76	0.76	0.77	0.77	0.77	0.77	0.77	0.77	0.77	0.77	0.77	0.77	0.77	0.75	1.20
165	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.87	0.87	0.87	0.87	0.88	0.88	0.88	0.87	0.87	0.87	0.85	1.27
170	0.92	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.92	0.92	0.92	0.91	0.91	0.90	0.88	1.23
175	0.93	0.93	0.94	0.94	0.94	0.95	0.95	0.96	0.96	0.97	0.98	0.98	0.99	0.99	0.99	0.99	0.98	0.97	1.10
180	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06

Table 6: Luminous Intensity Data

C (DEG) y (DEG)	190	200	210	220	230	240	250	260	270	280	290	300	310	320	330	340	350		
0	2074	2074	2074	2074	2074	2074	2074	2074	2074	2074	2074	2074	2074	2074	2074	2074	2074		
5	2034	2030	2025	2018	2011	2003	1996	1993	1990	1988	1984	1983	1984	1987	1991	1996	2001		
10	1705	1699	1692	1686	1680	1672	1666	1660	1657	1653	1651	1651	1653	1658	1664	1670	1679		
15	1301	1294	1287	1281	1274	1266	1258	1255	1258	1261	1265	1269	1271	1275	1282	1289	1294		
20	909	903	898	894	892	887	879	875	877	882	888	890	892	898	905	913	917		
25	584	581	576	574	574	572	569	567	569	574	579	579	578	578	583	588	593		
30	350	347	345	347	347	346	344	343	345	349	350	350	350	350	353	357	362		
35	210	208	207	208	207	206	206	204	203	204	205	205	206	207	208	210	213		
40	129	127	127	128	128	127	127	127	126	126	126	126	127	128	128	129	129		
45	83.3	82.9	82.4	82.8	82.3	81.9	82.2	81.8	81.7	82.0	81.8	81.5	82.0	82.4	83.0	83.7	84.6		
50	60.4	60.2	59.9	59.6	59.7	59.7	59.4	59.1	58.7	58.5	58.4	58.4	58.5	58.7	58.8	58.8	59.0		
55	48.1	48.0	47.7	47.4	47.4	47.3	46.9	46.9	46.8	46.7	46.5	46.5	46.6	46.7	46.9	47.1	47.4		
60	37.7	37.5	37.3	37.0	36.7	36.5	36.0	35.9	35.8	35.8	35.9	35.9	35.9	36.1	36.5	36.8	37.1		
65	28.5	28.4	28.3	27.9	27.6	27.4	27.0	26.9	26.9	26.8	26.9	27.0	26.9	27.1	27.2	27.3	27.5		
70	21.2	21.1	20.9	20.6	20.4	20.2	20.0	19.9	19.8	19.8	19.7	19.8	19.8	19.9	20.0	20.1	20.2		
75	14.7	14.6	14.4	14.2	14.1	13.9	13.8	13.7	13.7	13.6	13.6	13.6	13.6	13.7	13.7	13.8	14.0		
80	9.11	9.01	8.87	8.74	8.70	8.64	8.57	8.57	8.56	8.55	8.55	8.63	8.62	8.67	8.66	8.80	8.98		
85	4.54	4.46	4.39	4.30	4.27	4.18	4.09	4.06	4.02	3.94	3.93	3.99	3.96	3.99	4.05	4.05	4.15		
90	1.27	1.24	1.20	1.16	1.11	1.07	1.05	1.03	1.02	1.03	1.02	1.02	1.02	1.06	1.07	1.09	1.12	1.17	
95	0.03	0.02	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	0.02	0.02		
100	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		
105	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		
110	0.02	0.02	0.02	0.02	0.02	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03		
115	0.03	0.03	0.03	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.03	0.03		
120	0.05	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.05	0.05	0.05	0.05	0.05	0.05		
125	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.09	0.09	0.09	0.09	0.09	0.09		
130	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.18	0.18	0.18	0.17	0.17	0.17	0.16	0.16	0.16	0.16		
135	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.32	0.32	0.31	0.31	0.30	0.30	0.29	0.29	0.28		
140	0.51	0.51	0.51	0.51	0.51	0.51	0.51	0.51	0.51	0.50	0.50	0.49	0.49	0.48	0.48	0.48	0.47		
145	0.71	0.71	0.71	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.71	0.71	0.70	0.70	0.69	0.69	0.68		
150	0.90	0.91	0.91	0.92	0.92	0.92	0.92	0.92	0.93	0.92	0.92	0.92	0.91	0.91	0.91	0.91	0.89		
155	1.07	1.07	1.08	1.08	1.08	1.09	1.09	1.09	1.09	1.10	1.10	1.09	1.09	1.09	1.09	1.09	1.06		
160	1.20	1.21	1.21	1.21	1.21	1.22	1.22	1.22	1.22	1.22	1.22	1.21	1.21	1.21	1.20	1.21	1.18		
165	1.28	1.28	1.28	1.29	1.28	1.28	1.28	1.28	1.28	1.28	1.28	1.28	1.28	1.28	1.27	1.28	1.24		
170	1.24	1.24	1.24	1.25	1.25	1.25	1.26	1.26	1.26	1.27	1.27	1.27	1.27	1.27	1.27	1.28	1.24		
175	1.11	1.12	1.12	1.12	1.12	1.12	1.12	1.13	1.13	1.13	1.13	1.14	1.14	1.14	1.14	1.16	1.11		
180	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06		

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 4π . 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° 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 ***

This report is considered invalidated without the Special Seal for Inspection of the LTL. This report shall not be altered, increased or deleted. The results shown in this test report refer only to the sample(s) tested. Without written approval of LTL, this test report shall not be copied except in full and published as advertisement.