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Test report of

IES LM-79-08

Approved Method: Electrical and Photometric Measurements of Solid-State Lighting Products

Rendered to:

La Luce di Marletta SNC

Via Archimede, 365, 97100, Ragusa, Italy

For products:

LED Wall Wash Luminaires

Models No.: LL-WW-1000-XX

No Objection

Test Date: Oct. 10, 2019

Test Item: Total luminous flux, Luminous Efficacy, Electrical values, Luminous Intensity Distribution, Chromaticity coordinates, CCT and CRI, Spectral Power Distribution.

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Template No.: LC-RT-PL/LM79-08/01

Test Note: *This version was updated the model number.*

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1. General

1.1 Product Information

Brand Name	-
Product Type	LED Wall Wash Luminaires
Model Number	LL-WW-1000-XX
Rated Inputs	120-277VAC, 50/60Hz
Rated Power	12W
Rated Light output	1200lm
Declared CCT	3000K
Power Supply	LED driver
LED Package, Array or Module	Not provided
Receipt Samples	1 unit
Sample Code of lab.	170922101003
Date of Receipt Samples	Sep. 22, 2019
Note	-

1.2 Standards or methods

The following standards are partly or totally used or referenced for test:

No.	Name
ANSI/NEMA/ ANSLG C78.377-2015	Specifications for the Chromaticity of Solid State Lighting Products
ANSI C82.77-2002	Harmonic Emission Limits—Related Power Quality Requirements for Lighting Equipment
CIE Pub. No. 13.3-1995	Method of Measuring and Specifying Color Rendering of Light Sources
CIE Pub. No. 15:2004	Colorimetry
IES LM-79-08	Electrical and Photometric Measurements of Solid-State Lighting Products

1.3 Equipment list

Instrument	ID	Model name	Cal. date	Next cal. Date
AC Power supply	LC-I-923	CHP-500	2018-02-04	2019-02-03
AC Power supply	LC-I-987	APW-110N	2018-02-04	2019-02-03
Power analyzer	LC-I-928	WT210	2018-01-19	2019-01-19
Power analyzer	LC-I-954	WT210	2018-02-04	2019-02-03
Multimeter	LC-I-972	Fluke 17B	2018-08-10	2019-08-09
Photometric colorimetric electric system (2 meter sphere)	LC-I-900	SPR3000	Before use	Before use
Standard lamp	LC-PL-I-011	D204C	2018-09-07	2019-09-06
Luminous Flux Standard Lamp	LC-PL-I-003	24V100W	2018-10-08	2019-10-07
Goniophotometer(with mirror)	LC-I-902	GMS2000	2018-05-07	2019-05-07
Wireless temperature transmitter	LC-I-978	DWRF-B	2018-02-10	2019-02-10
Wireless temperature transmitter	LC-I-979	DWRF-B	2018-02-10	2019-02-10

2. Test conducted and method

The luminaire was operated at least 2 hours to reach stabilization and temperature equilibrium before test.

2.1 Ambient Condition

The ambient temperature in which measurements are being taken was maintained at $25^{\circ}\text{C} \pm 1^{\circ}\text{C}$; the air flow around the sample(s) being tested did not affect the performance.

2.2 Power Supply Characteristics

The AC power supply had a sinusoidal voltage wave shape at the prescribed frequency (60 Hz) such that the RMS summation of the harmonic components does not exceed 3 percent of the fundamental during operation of the test item.

The voltage of AC power supply (RMS voltage) applied to the device under test was regulated to within ± 0.2 percent under load.

2.3 Seasoning and Stabilization

No seasoning was performed in accordance with IESNA LM-79-08. And before the measurement, the sample was stabilized until the light output and power variations were less than 0.5% in 30 minutes intervals (3 readings, 15 minutes apart).

2.4 Electrical Instrumentation

The calibration uncertainties of the instruments for AC voltage and current were less than 0.2 percent, and the calibration uncertainty of the AC power meter was less than 0.5 percent (95 % confidence interval, $k=2$).

2.5 Color Measurement Method

Spectral radiant flux was measured by a sphere (2 meter)-spectroradiometer system, and the color characteristics (Color rendering index, correlated color temperature, chromaticity coordinate) were calculated from these by software automatically.

2.6 Total Luminous Flux Measurement Method

Total luminous flux was measured by both sphere-spectroradiometer system and type C goniophotometer system.

Light intensity distribution was measured by a type C goniophotometer (with mirror) which can keep the sample in burn position when the tests conduct, and the total luminous flux was calculated from the intensity data by software automatically.

Spectral radiant flux was measured by a sphere (2 meter)-spectroradiometer system, and the total luminous flux was calculated from these by software automatically.

2.7 Luminous Intensity Distribution Measurement Method

Luminous intensity distribution was measured by a mirror-type goniophotometer (Type C) which can keep the sample in burn position when the tests conduct, and the kinds of graph were generated by software automatically.

2.8 Spatial Non-uniformity of Chromaticity

The customer did not require this measurement.

3. Test Result Summary

3.1 Electrical data

Criteria Item	Result(Sphere)	Result(Goniophotometer)
Input Voltage & Frequency	120.00 V~60Hz	119.99 V~60Hz
Input Current(A)	0.315	0.315
Total Power(W)	36.81	36.82
Power Factor	0.975	0.973
I-THD	16.64%	-
Off-state Power(W)	-	-

3.2 Photometric data

Criteria Item	Result(Sphere)	Result(Goniophotometer)
Total Lumens(lm)	1210.45	1235.52
Luminaire Efficacy(Lm/W)	92.65	93.31
Correlated Color Temperature (CCT)(K)	2979	-
Color Rendering Index (CRI)	82.0	-
R9	10	-
Chromaticity Coordinate (x,y)	x = 0.4398 y = 0.4073	-
Chromaticity Coordinate (u,v)	u = 0.2510 v = 0.3487	-
Chromaticity Coordinate (u',v')	u' = 0.2510 v' = 0.5231	-
Duv	0.0009	-
Zone Lumens between 0-60 °	-	97.00%
Beam Angle	-	[C0/180]Total=10.3° [C90/270]Total=33.3°

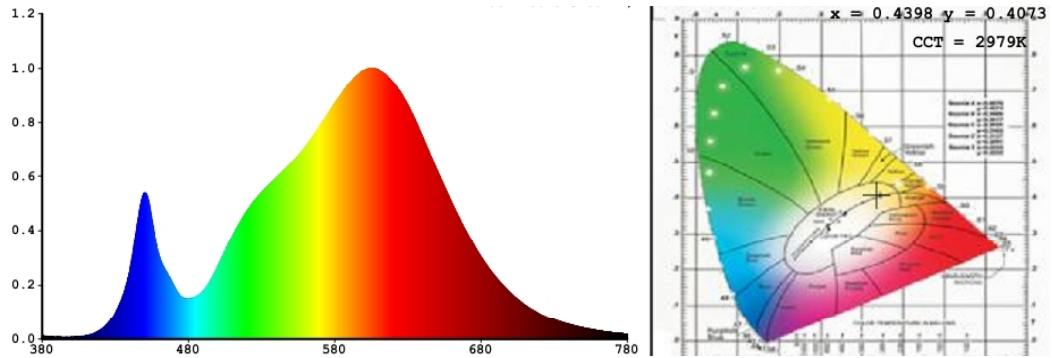
3.3 Color Rendering Details

R1	R2	R3	R4	R5	R6	R7	R8
80	88	95	81	80	85	85	62
R9	R10	R11	R12	R13	R14	R15	-
10	73	79	64	82	97	74	-

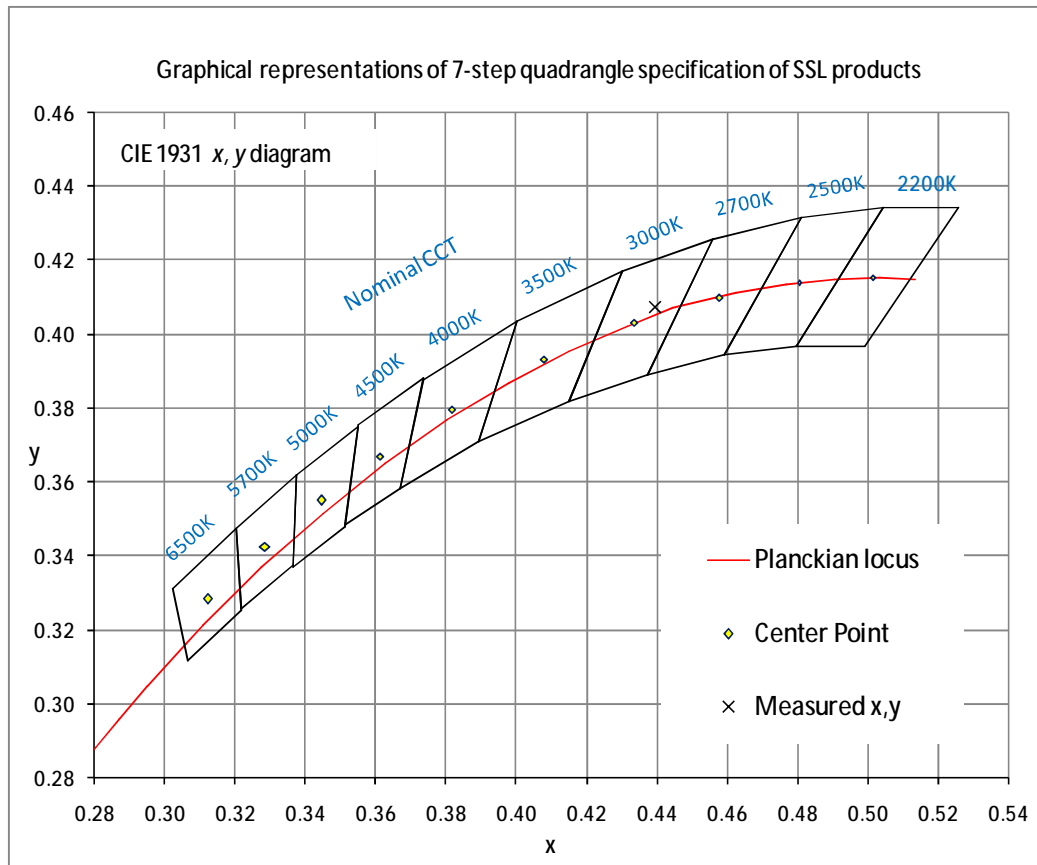
Note: N.A.

4. Test Data

4.1 Spectral Distribution



4.2 ANSI Chromaticity Quadrangles Diagram



4.3 Goniometry Test Data

CIE Type	Direct	Basic Luminous Shape	Rectangular
Spacing Criteria (0-180)	0.58	Luminous Length	1.22 m
Spacing Criteria (90-270)	0.20	Luminous Width	0.02 m
Spacing Criteria (Diagonal)	0.26	Luminous Height	0.00 m
Test Distance	29.79 m		

4.4 Zonal Lumen Summary

Zone	Lumens	%Lamp	%Fixt
0-20	2544.73	74.10	74.10
0-30	2939.54	85.60	85.60
0-40	3110.23	90.50	90.50
0-60	3333.78	97.00	97.00
0-80	3415.96	99.40	99.40
0-90	3419.58	99.50	99.50
10-90	2067.84	60.20	60.20
20-40	565.50	16.50	16.50
20-50	694.00	20.20	20.20
40-70	281.36	8.20	8.20
60-80	82.18	2.40	2.40
70-80	24.37	0.70	0.70
80-90	3.62	0.10	0.10
90-110	0.49	0.00	0.00
90-120	0.80	0.00	0.00
90-130	1.36	0.00	0.00
90-150	5.04	0.10	0.10
90-180	15.94	0.50	0.50
110-180	15.45	0.40	0.40
0-180	3435.52	100.00	100.00

Total Luminaire Efficiency = 100.00%

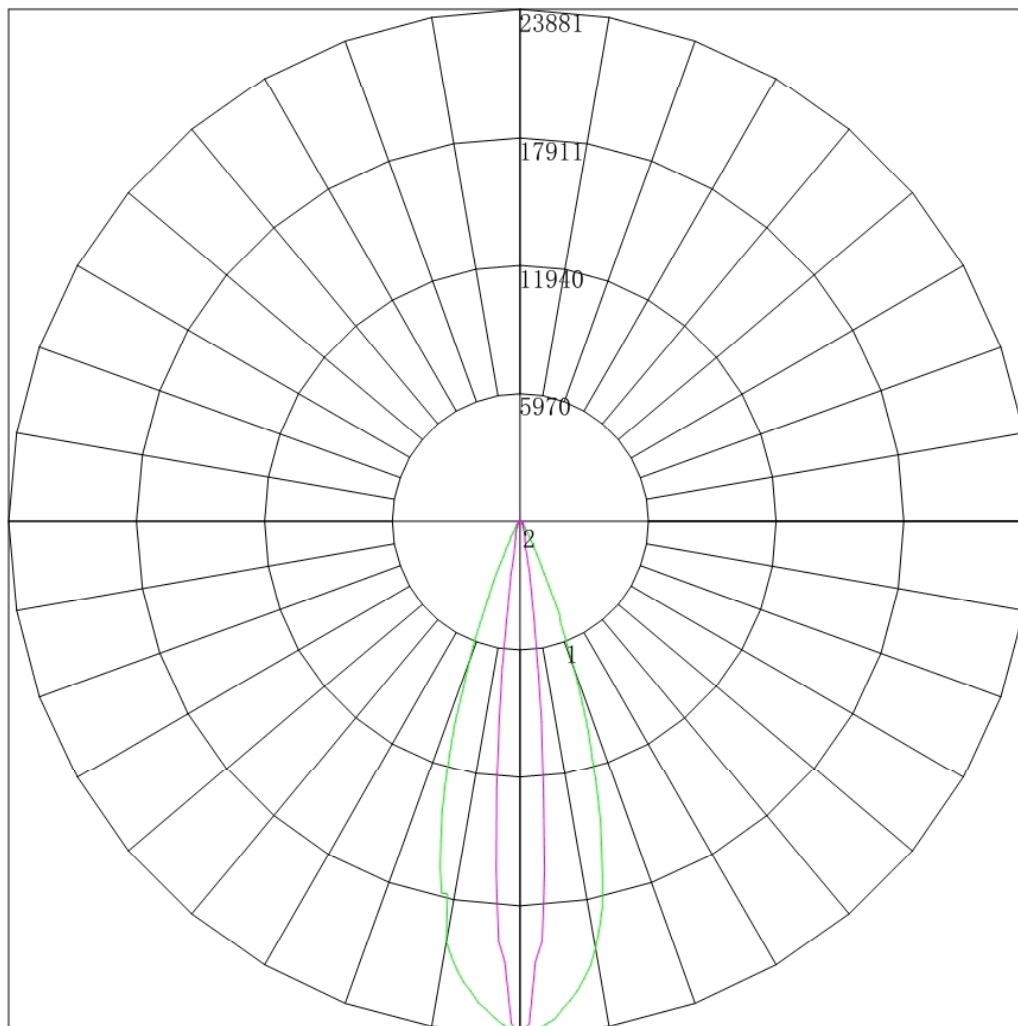
ZONAL LUMEN SUMMARY

Zone	Lumens
0-10	1351.74
10-20	1192.99
20-30	394.82
30-40	170.68
40-50	128.50
50-60	95.06
60-70	57.81
70-80	24.37
80-90	3.62
90-100	0.24
100-110	0.25
110-120	0.31
120-130	0.56
130-140	0.87
140-150	2.81
150-160	5.02
160-170	4.33
170-180	1.55



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4.5 Polar Curves



Maximum Candela = 23880.75 Located At Horizontal Angle = 30, Vertical Angle = 1

1 - Vertical Plane Through Horizontal Angles (0 - 180)

2 - Vertical Plane Through Horizontal Angles (90 - 270)

4.6 Candela Tabulation

	0	15	30	45	60	75	90	105	120	135
0	23796.80123796.80123796.80123796.80123796.80123796.80123796.80123796.80123796.80123796.80123796.801									
1	23760.97123716.60023880.75023787.58023796.46123712.17023392.75023064.46123099.94923277.410									
2	23663.36923552.46123543.59023184.25023135.44922802.72120543.74019793.56121147.97122212.689									
3	23432.68023281.84023015.66022177.19921423.02021068.11919615.66017340.27018682.69919630.750									
4	23210.85922793.85021906.58020593.43018929.81118100.21116311.93015139.41016355.85017449.850									
5	22776.10022354.65020779.76018672.50016170.41014866.13012513.99011296.66013269.94016015.140									
6	22438.93921547.24019315.77015908.67012900.84010771.4009378.395 8208.979 9729.309 13525.920									
7	22021.93020903.97117865.09013029.4909866.391 8025.315 6836.380 5861.275 7408.667 11113.000									
8	21489.57020140.93015868.74010682.6707328.812 5855.952 4635.518 4163.493 5543.190 8472.940									
9	20966.08019045.15014067.5908748.437 5478.864 4653.707 3168.336 2342.602 3838.754 6564.876									
10	20194.16018038.10911800.6306375.001 4662.580 3437.710 2512.824 1708.873 2431.640 5041.885									
11	19395.61916946.77010052.7205159.448 2876.514 1869.468 1600.804 1442.294 1708.474 3871.139									
12	18419.63115407.3608446.767 4604.907 1857.046 1393.007 1245.188 1210.496 1477.519 2733.221									
13	16964.52014213.9906689.981 3017.590 1448.904 1163.649 1070.486 1014.011 1181.838 1726.752									
14	15766.71012377.3505492.172 2045.590 1192.928 1007.933 947.156 911.532 1031.535 1578.800									
15	14471.30010971.0404808.979 1498.591 1007.490 903.680 852.973 825.290 918.231 1230.016									
16	12918.5809706.684 3789.067 1220.877 896.138 810.517 788.424 761.096 818.857 1053.273									
17	11569.9408025.315 2775.366 1040.319 798.095 742.198 724.763 700.274 739.092 913.839									
18	10239.0406774.271 2154.724 886.822 729.776 689.849 679.069 653.382 682.351 810.828									
19	8730.691 5643.007 1606.394 791.441 672.991 647.704 638.166 614.786 628.894 728.223									
20	7497.392 4769.051 1276.331 713.361 617.537 597.130 590.386 574.815 588.434 665.893									
21	5971.296 3963.415 995.068 646.373 572.286 566.963 544.781 535.775 549.927 605.159									
22	4959.813 2819.286 842.015 587.813 535.465 525.705 497.179 490.303 515.501 561.240									
23	4658.143 2272.730 738.205 539.901 501.749 476.018 444.742 442.524 484.447 519.671									
24	3257.151 1835.308 636.613 502.636 474.243 453.836 412.978 399.403 450.908 481.652									
25	2638.727 1410.752 574.504 471.582 455.167 415.728 369.724 363.956 417.591 451.707									
26	2133.873 1153.889 510.178 455.611 420.564 356.415 341.775 334.100 378.641 417.414									
27	1669.833 955.141 469.363 413.732 368.659 329.575 320.214 312.850 347.764 391.462									
28	1361.065 779.019 456.498 379.927 338.714 307.349 297.988 293.729 316.976 369.191									
29	1056.733 664.118 395.499 355.084 305.219 289.825 280.553 275.629 294.971 343.682									
30	912.996 548.774 369.857 331.438 285.123 269.684 264.893 261.388 275.806 323.275									
31	774.583 489.327 344.082 310.099 269.507 256.597 250.741 245.994 259.747 298.609									
32	664.562 453.836 324.917 290.713 256.198 244.663 239.340 234.904 248.523 280.332									
33	555.428 388.578 307.216 271.370 240.538 231.177 228.515 225.410 235.569 263.607									
34	495.981 357.346 287.918 252.915 230.024 221.816 218.445 214.541 225.277 245.551									
35	454.280 331.216 274.032 238.231 220.175 212.766 209.306 206.201 214.807 232.952									
36	422.959 305.352 260.723 226.652 210.548 203.938 201.454 198.126 205.313 222.704									
37	361.206 287.164 245.506 215.827 200.655 196.086 193.025 190.052 197.594 211.435									
38	338.935 266.801 235.125 206.067 194.666 187.790 186.104 183.265 190.718 204.249									
39	316.931 254.157 224.877 197.461 187.568 181.623 179.228 177.054 183.132 194.844									
40	292.177 241.780 212.544 190.452 180.071 176.211 173.682 171.775 177.897 187.834									
41	275.673 227.495 203.273 183.043 174.259 170.178 167.871 166.584 172.130 180.470									
42	257.928 217.380 192.537 175.501 168.536 165.031 162.946 160.773 165.919 173.372									
43	244.619 207.709 184.374 169.068 163.745 159.752 157.889 156.869 160.994 167.516									
44	232.730 197.195 177.098 163.390 158.199 154.917 153.808 152.344 155.138 160.551									
45	221.107 188.500 168.226 157.401 152.166 150.658 149.859 146.931 150.347 154.207									
46	208.685 178.873 161.837 151.057 147.464 146.665 146.088 143.205 144.846 148.706									
47	198.659 169.113 154.074 145.290 142.805 141.563 142.184 139.168 139.700 143.693									
48	185.793 161.970 147.286 139.434 137.970 137.792 138.724 135.219 135.308 136.728									
49	176.832 152.255 140.942 134.421 132.868 133.755 134.864 130.827 130.472 131.582									
50	166.628 144.979 132.957 128.121 128.077 130.073 130.783 126.347 124.794 126.080									
51	158.111 137.970 127.012 122.487 123.596 125.903 126.923 122.487 120.003 120.225									
52	149.948 129.984 121.112 116.897 117.651 121.555 122.265 118.450 115.300 114.812									
53	140.099 123.596 114.235 110.819 112.993 117.696 117.918 113.304 109.888 108.734									
54	133.977 115.699 108.646 105.585 108.291 112.638 113.836 109.134 104.520 103.189									
55	127.234 110.642 103.766 100.261 103.366 107.758 108.380 104.254 99.862 97.555									
56	118.539 105.363 97.821 95.070 97.732 103.588 104.165 100.084 95.470 93.074									
57	112.417 99.019 93.296 90.679 93.340 98.753 99.108 95.159 90.945 88.505									
58	106.383 93.917 88.682 85.665 88.948 93.828 94.671 89.303 85.044 83.137									

59	99.817	89.259	83.004	81.185	83.359	88.904	90.146	84.379	80.830	79.100
60	94.316	83.935	78.612	76.837	78.922	83.847	84.423	79.765	76.394	74.841
61	88.017	79.588	73.332	72.800	74.442	79.233	79.854	74.841	70.626	70.094
62	82.871	73.687	69.650	68.009	69.295	73.155	74.841	70.405	66.678	65.702
63	78.079	69.562	64.637	63.883	65.347	68.763	69.650	65.303	62.552	61.133
64	73.554	65.436	60.866	60.112	61.399	64.682	65.258	60.822	58.515	57.450
65	67.343	61.221	57.273	56.164	57.495	59.536	60.157	56.741	54.034	53.325
66	63.351	57.229	52.837	52.127	53.768	55.454	55.765	52.082	50.397	49.465
67	58.382	53.458	49.288	48.445	48.977	51.417	51.461	47.602	46.537	46.005
68	54.389	49.332	46.005	44.718	45.384	46.981	46.227	43.831	43.077	42.677
69	49.776	45.872	42.323	41.524	41.968	43.387	42.278	40.016	39.173	38.862
70	46.138	41.391	39.128	37.709	37.576	39.173	38.197	36.600	35.890	35.535
71	42.500	38.152	36.200	34.648	34.870	35.535	34.071	32.518	32.296	32.341
72	39.040	35.136	32.563	31.498	31.320	32.296	30.744	29.368	28.880	29.235
73	34.426	31.720	29.723	28.437	28.348	28.836	27.283	26.263	26.041	26.174
74	30.611	28.570	26.307	25.243	24.577	25.598	24.089	23.379	23.246	23.468
75	27.417	25.642	23.601	22.492	21.915	22.714	21.117	19.830	20.496	20.939
76	24.400	22.359	21.250	19.786	19.342	19.342	17.790	17.302	17.390	18.145
77	21.294	19.697	18.677	17.346	16.902	16.769	15.394	14.729	15.084	15.527
78	18.189	17.036	15.616	14.684	14.507	14.418	13.132	12.466	12.954	13.265
79	15.527	13.841	13.398	12.422	11.801	11.490	10.514	10.292	10.736	11.046
80	12.422	11.579	10.692	10.425	9.849	9.582	8.695	8.207	8.651	9.228
81	10.026	9.494	8.828	8.385	8.118	7.764	6.965	6.610	7.009	7.320
82	8.074	7.320	6.610	6.433	6.166	6.033	5.279	5.013	5.412	5.634
83	5.767	5.678	5.146	4.836	4.703	4.481	3.948	3.682	4.170	4.303
84	4.348	4.215	3.771	3.593	3.549	3.283	2.884	2.662	2.662	3.150
85	3.105	2.839	2.706	2.484	2.484	2.307	1.952	1.863	1.952	1.996
86	1.863	1.908	1.730	1.641	1.553	1.508	1.287	1.065	1.375	1.375
87	1.242	1.065	0.976	0.932	0.932	0.932	0.843	0.754	0.887	0.932
88	0.621	0.621	0.532	0.577	0.532	0.577	0.532	0.488	0.532	0.621
89	0.355	0.355	0.355	0.311	0.399	0.266	0.355	0.444	0.355	0.444
90	0.089	0.177	0.177	0.177	0.177	0.177	0.222	0.266	0.355	0.355
91	0.089	0.133	0.177	0.133	0.133	0.089	0.133	0.355	0.355	0.399
92	0.089	0.089	0.177	0.133	0.089	0.133	0.177	0.222	0.311	0.311
93	0.000	0.089	0.133	0.089	0.089	0.089	0.089	0.266	0.355	0.266
94	0.089	0.044	0.089	0.089	0.044	0.133	0.222	0.222	0.355	0.266
95	0.089	0.089	0.089	0.044	0.089	0.044	0.133	0.222	0.177	0.311
96	0.089	0.089	0.044	0.089	0.089	0.089	0.177	0.222	0.222	0.266
97	0.177	0.133	0.089	0.089	0.044	0.089	0.177	0.266	0.266	0.311
98	0.089	0.089	0.133	0.044	0.044	0.089	0.133	0.266	0.266	0.266
99	0.177	0.133	0.133	0.089	0.089	0.133	0.133	0.266	0.266	0.311
100	0.089	0.133	0.089	0.089	0.089	0.044	0.177	0.355	0.266	0.266
101	0.177	0.177	0.133	0.044	0.089	0.089	0.177	0.266	0.311	0.355
102	0.089	0.133	0.089	0.089	0.133	0.089	0.133	0.311	0.266	0.311
103	0.177	0.177	0.133	0.089	0.089	0.089	0.177	0.311	0.266	0.355
104	0.089	0.133	0.089	0.089	0.044	0.044	0.133	0.222	0.266	0.399
105	0.177	0.133	0.133	0.133	0.089	0.044	0.222	0.266	0.355	0.399
106	0.177	0.133	0.133	0.089	0.089	0.133	0.222	0.266	0.311	0.399
107	0.089	0.133	0.089	0.177	0.089	0.089	0.177	0.222	0.355	0.355
108	0.177	0.133	0.133	0.089	0.044	0.133	0.177	0.311	0.311	0.355
109	0.177	0.133	0.133	0.089	0.044	0.177	0.222	0.355	0.355	0.399
110	0.177	0.133	0.133	0.133	0.133	0.133	0.177	0.311	0.311	0.355
111	0.177	0.222	0.133	0.089	0.089	0.089	0.133	0.266	0.399	0.399
112	0.177	0.133	0.133	0.089	0.089	0.044	0.222	0.311	0.311	0.355
113	0.266	0.177	0.177	0.089	0.044	0.044	0.177	0.311	0.311	0.266
114	0.266	0.177	0.177	0.133	0.133	0.089	0.222	0.311	0.355	0.399
115	0.266	0.222	0.222	0.177	0.089	0.133	0.222	0.266	0.311	0.355
116	0.355	0.311	0.177	0.133	0.133	0.133	0.222	0.266	0.311	0.311
117	0.532	0.399	0.222	0.222	0.089	0.133	0.266	0.355	0.355	0.355
118	0.799	0.665	0.311	0.222	0.133	0.177	0.266	0.355	0.311	0.355
119	0.887	0.843	0.399	0.266	0.177	0.222	0.222	0.266	0.311	0.355

120	1.065	1.020	0.577	0.311	0.266	0.222	0.266	0.311	0.311	0.399
121	1.242	1.065	0.799	0.311	0.266	0.266	0.355	0.355	0.311	0.399
122	1.420	1.242	0.887	0.399	0.266	0.311	0.311	0.355	0.399	0.399
123	1.508	1.287	0.976	0.532	0.355	0.266	0.311	0.355	0.355	0.399
124	1.508	1.420	1.153	0.621	0.355	0.355	0.266	0.311	0.355	0.444
125	1.686	1.508	1.198	0.577	0.399	0.311	0.355	0.311	0.355	0.399
126	1.686	1.508	1.198	0.621	0.399	0.311	0.266	0.266	0.355	0.399
127	1.597	1.508	1.198	0.621	0.444	0.311	0.355	0.355	0.311	0.399
128	1.508	1.508	1.153	0.665	0.444	0.444	0.444	0.355	0.355	0.399
129	1.508	1.508	1.198	0.665	0.444	0.355	0.355	0.311	0.355	0.399
130	1.508	1.375	1.198	0.665	0.488	0.399	0.399	0.355	0.311	0.355
131	1.331	1.331	1.065	0.665	0.444	0.444	0.399	0.399	0.311	0.355
132	1.420	1.464	1.109	0.754	0.444	0.444	0.355	0.355	0.399	0.355
133	1.686	1.641	1.198	0.754	0.532	0.444	0.311	0.355	0.355	0.488
134	1.952	1.952	1.375	0.843	0.488	0.532	0.444	0.399	0.355	0.488
135	2.307	2.174	1.686	0.887	0.577	0.532	0.444	0.355	0.444	0.621
136	2.484	2.529	1.996	1.065	0.665	0.532	0.444	0.444	0.488	0.710
137	2.839	2.928	2.351	1.331	0.710	0.577	0.488	0.444	0.488	0.843
138	3.372	3.194	2.795	1.730	0.887	0.665	0.488	0.488	0.577	1.109
139	3.727	3.593	3.239	2.129	1.109	0.710	0.577	0.532	0.665	1.331
140	4.081	4.215	3.860	2.706	1.331	0.799	0.665	0.621	0.843	1.641
141	4.525	4.569	4.259	3.283	1.819	1.020	0.754	0.710	1.020	2.085
142	4.969	5.102	4.791	3.904	2.307	1.242	0.932	0.843	1.375	2.529
143	5.412	5.634	5.324	4.525	2.972	1.775	1.109	1.065	1.730	2.972
144	5.856	6.078	5.812	5.279	3.904	2.396	1.464	1.375	2.263	3.372
145	6.300	6.654	6.433	5.900	4.747	3.105	2.085	1.952	2.884	4.037
146	6.743	7.142	6.965	6.521	5.545	4.170	2.795	2.529	3.549	4.525
147	7.364	7.675	7.630	7.231	6.521	5.146	3.727	3.327	4.481	5.102
148	7.897	8.296	8.163	7.985	7.497	6.388	4.791	4.303	5.191	5.723
149	8.252	8.873	8.828	8.740	8.252	7.586	5.989	5.057	5.767	6.300
150	8.961	9.538	9.449	9.494	9.094	8.651	7.187	6.033	6.610	6.876
151	9.494	10.070	10.070	10.159	9.982	9.627	8.163	6.876	7.231	7.409
152	9.937	10.692	10.869	10.958	10.869	10.514	9.139	7.675	7.897	7.985
153	10.470	11.268	11.490	11.490	11.534	11.490	10.115	8.562	8.562	8.606
154	11.180	11.845	12.244	12.200	12.244	12.333	10.958	9.228	9.139	9.183
155	11.623	12.510	12.910	12.954	12.998	12.998	11.579	9.937	9.716	9.804
156	12.067	13.176	13.398	13.575	13.664	13.620	12.200	10.514	10.381	10.292
157	12.510	13.708	14.108	14.196	14.241	14.285	12.777	11.046	10.825	10.736
158	13.043	14.063	14.640	14.817	14.950	14.817	13.309	11.490	11.401	11.224
159	13.398	14.462	15.217	15.394	15.483	15.394	13.753	12.067	11.889	11.623
160	13.664	14.817	15.705	15.971	16.193	16.015	14.329	12.466	12.377	12.200
161	14.019	15.172	16.193	16.503	16.681	16.459	14.773	13.043	12.777	12.644
162	14.196	15.394	16.592	16.991	17.124	17.036	15.128	13.353	13.220	13.043
163	14.374	15.527	16.947	17.435	17.701	17.479	15.572	13.841	13.664	13.486
164	14.462	15.660	17.169	17.834	18.100	17.923	16.015	14.152	14.196	13.797
165	14.640	15.838	17.346	18.145	18.411	18.322	16.459	14.596	14.462	14.152
166	14.906	15.971	17.612	18.278	18.810	18.810	16.858	14.995	14.684	14.507
167	14.995	16.015	17.612	18.499	19.032	19.209	17.213	15.394	15.084	14.729
168	15.172	16.015	17.568	18.544	19.165	19.564	17.657	15.793	15.394	14.906
169	15.261	16.104	17.568	18.455	19.254	19.830	18.056	16.015	15.572	15.039
170	15.350	16.104	17.435	18.411	19.254	20.052	18.233	16.326	15.616	15.084
171	15.527	16.104	17.169	18.189	18.943	20.008	18.366	16.414	15.572	14.995
172	15.616	16.104	16.947	17.834	18.721	19.786	18.455	16.370	15.483	14.995
173	15.705	16.104	16.681	17.390	18.056	19.387	18.233	16.237	15.350	14.950
174	15.882	16.015	16.459	16.947	17.479	18.766	17.878	15.882	15.128	14.906
175	15.971	16.148	16.193	16.459	16.858	17.745	17.213	15.483	14.950	14.906
176	16.060	16.193	16.060	16.015	16.281	16.636	16.148	14.950	14.862	14.862
177	16.237	16.281	16.104	15.793	15.705	15.793	15.438	14.507	14.773	14.995
178	16.414	16.370	16.104	15.749	15.483	15.172	14.684	14.374	15.084	15.261
179	16.592	16.503	16.148	15.660	15.438	14.684	14.152	14.551	15.217	15.572
180	15.718	15.718	15.718	15.718	15.718	15.718	15.718	15.718	15.718	15.718

Vert. Angles	Horizontal Angles		
	150	165	180
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4	21037.06122354.65022802.721		
5	18950.66021631.52922492.180		
6	17032.83020974.94922021.930		
7	15691.73020034.44921631.529		
8	13920.75018870.35921152.410		
9	12138.68018378.36920549.070		
10	10138.78016760.00019910.240		
11	8562.110 15972.99017701.830		
12	7139.824 14744.13017701.830		
13	5626.594 13140.40016572.340		
14	4591.155 11796.19015350.580		
15	3505.142 10092.64014079.130		
16	2797.991 8858.458 12767.750		
17	2111.692 7584.345 11199.950		
18	1615.222 6121.244 9877.926		
19	1347.313 5064.067 8155.744		
20	1074.345 3983.378 6953.499		
21	883.672 3179.515 5848.854		
22	765.976 2573.513 4704.281		
23	665.804 1724.711 3860.491		
24	596.021 1620.457 3033.560		
25	543.184 1333.249 2459.500		
26	488.528 1050.922 1748.090		
27	454.102 878.526 1525.830		
28	421.584 740.246 1254.771		
29	386.848 624.280 1043.069		
30	362.404 537.727 853.638		
31	336.495 468.121 727.469		
32	318.351 415.329 615.762		
33	301.404 382.012 542.563		
34	284.280 347.586 484.802		
35	270.394 321.589 423.137		
36	256.553 301.759 387.558		
37	242.756 281.707 357.745		
38	231.576 266.756 329.974		
39	219.155 249.055 308.502		
40	209.883 237.210 286.942		
41	201.010 226.963 270.439		
42	190.185 214.940 256.154		
43	182.999 204.515 238.674		
44	174.481 195.332 226.608		
45	166.806 184.684 213.565		
46	160.107 177.143 203.450		
47	152.344 168.980 192.980		
48	145.334 158.510 183.132		
49	138.901 151.634 172.573		
50	130.827 143.027 163.434		
51	124.572 135.352 155.094		
52	119.027 128.742 145.689		
53	112.372 121.112 138.325		
54	106.916 115.256 131.404		
55	101.060 109.311 122.088		
56	95.514 102.080 115.877		
57	90.989 96.978 108.424		



58	85.266	91.211	102.479
59	80.786	86.375	96.801
60	75.994	81.762	90.412
61	71.425	76.260	85.444
62	67.343	72.490	78.878
63	62.730	67.565	74.087
64	58.426	62.774	69.739
65	54.744	58.826	64.504
66	51.284	54.789	60.334
67	47.247	50.752	56.341
68	43.653	47.336	51.639
69	40.193	42.944	47.912
70	37.221	39.927	44.186
71	33.760	36.467	39.483
72	30.433	32.873	36.112
73	27.461	29.856	32.208
74	25.065	26.929	29.191
75	21.960	23.690	25.908
76	19.254	20.984	22.448
77	16.592	17.568	19.786
78	14.329	15.438	17.036
79	11.801	13.176	13.930
80	9.849	10.558	11.623
81	7.897	8.562	9.050
82	6.211	6.654	7.098
83	4.481	5.013	5.501
84	3.372	3.727	3.904
85	2.351	2.484	2.928
86	1.553	1.686	1.863
87	1.065	1.109	1.065
88	0.710	0.710	0.799
89	0.532	0.488	0.621
90	0.399	0.488	0.444
91	0.444	0.399	0.355
92	0.355	0.399	0.532
93	0.355	0.355	0.444
94	0.355	0.444	0.444
95	0.399	0.399	0.444
96	0.444	0.444	0.444
97	0.355	0.488	0.532
98	0.399	0.444	0.532
99	0.355	0.399	0.532
100	0.399	0.444	0.532
101	0.355	0.444	0.444
102	0.355	0.444	0.444
103	0.399	0.444	0.444
104	0.444	0.532	0.532
105	0.399	0.488	0.444
106	0.488	0.444	0.444
107	0.444	0.488	0.532
108	0.355	0.488	0.532
109	0.355	0.488	0.532
110	0.444	0.577	0.532
111	0.488	0.532	0.532
112	0.444	0.532	0.532
113	0.444	0.444	0.532
114	0.399	0.444	0.532
115	0.488	0.444	0.532
116	0.399	0.532	0.621
117	0.444	0.577	0.621
118	0.488	0.621	0.710



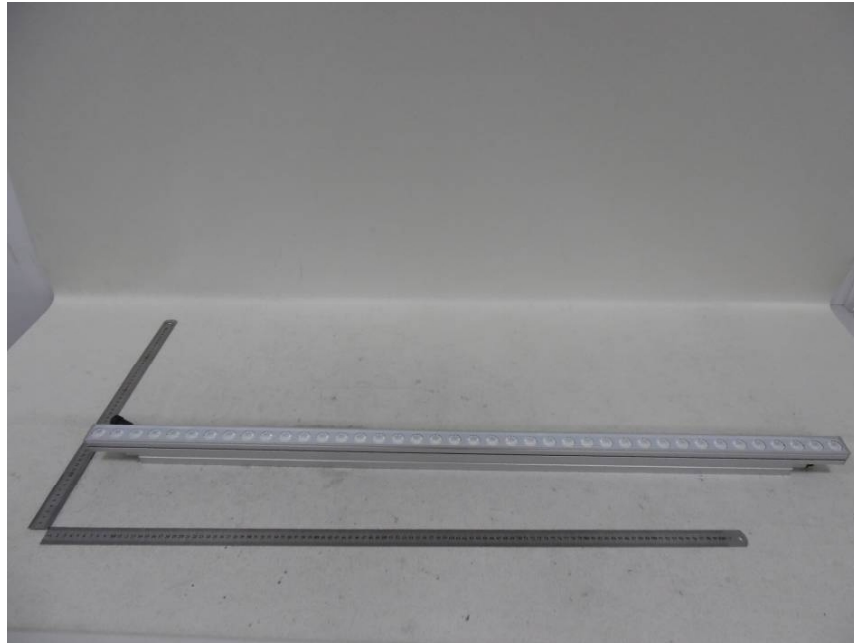
119	0.532	0.710	0.710
120	0.488	0.710	0.799
121	0.621	0.754	0.887
122	0.621	0.754	0.887
123	0.577	0.710	0.887
124	0.621	0.754	0.799
125	0.577	0.754	0.799
126	0.532	0.710	0.799
127	0.577	0.710	0.799
128	0.577	0.799	0.799
129	0.532	0.621	0.799
130	0.577	0.710	0.710
131	0.532	0.754	0.799
132	0.621	0.932	0.976
133	0.754	1.065	1.153
134	0.932	1.242	1.331
135	1.109	1.508	1.597
136	1.420	1.775	1.863
137	1.641	1.952	2.041
138	1.952	2.307	2.307
139	2.307	2.573	2.662
140	2.662	2.972	2.839
141	2.884	3.283	3.194
142	3.239	3.549	3.372
143	3.682	3.860	3.727
144	4.037	4.348	4.081
145	4.525	4.658	4.525
146	4.969	5.191	4.791
147	5.412	5.590	5.146
148	5.900	6.033	5.590
149	6.477	6.477	5.856
150	7.009	6.876	6.300
151	7.542	7.231	6.654
152	7.985	7.852	7.009
153	8.606	8.252	7.542
154	9.094	8.784	7.985
155	9.538	9.228	8.429
156	10.159	9.671	8.784
157	10.603	10.070	9.050
158	11.046	10.470	9.494
159	11.534	10.780	9.849
160	11.934	11.091	10.115
161	12.377	11.401	10.470
162	12.777	11.623	10.647
163	12.998	11.845	10.825
164	13.265	11.934	11.091
165	13.575	12.244	11.357
166	13.797	12.466	11.623
167	14.019	12.732	12.067
168	14.196	12.954	12.422
169	14.329	13.265	12.865
170	14.418	13.531	13.220
171	14.418	13.930	13.486
172	14.551	14.196	14.019
173	14.684	14.462	14.285
174	14.817	14.906	14.729
175	15.039	15.172	15.172
176	15.217	15.527	15.527
177	15.527	15.882	15.882
178	15.749	16.148	16.326
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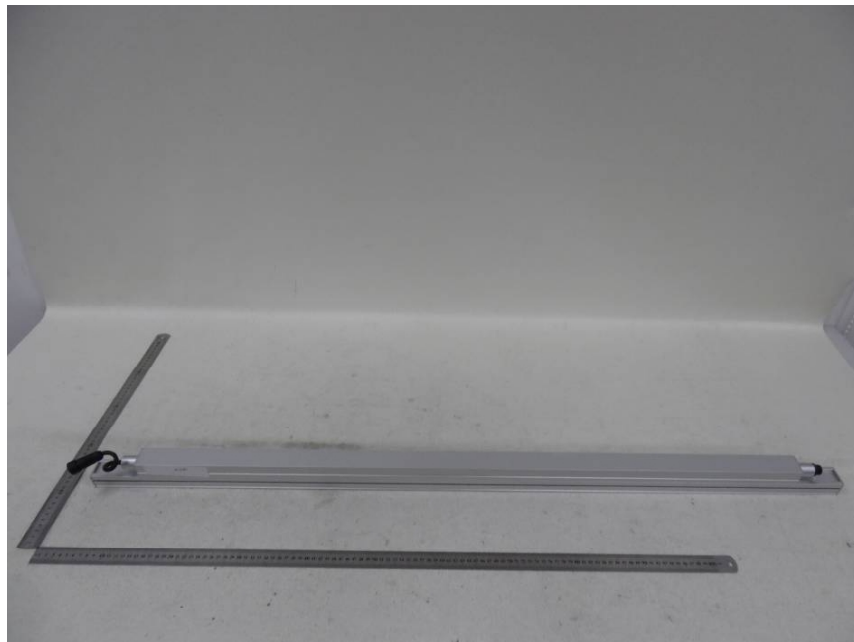
180 15.718 15.718 15.718



Appendix A Product Photo



Picture 1



Picture 2

****End of test report****