



Report of Test LLI-20010-5

LED Roadway Lighting - Roadway luminaire. Product ID: QB 00 660M X 5 40 X 3G2S XXXX

Grey cast aluminum top housing and white plastic bottom housing with clear flat glass lens.

60 LEDs in three 4 x 5 arrays with clear plastic sheets of individual lenses.

One Osram Optotronic LED driver. Model: QT180W/UNV/1250C/2DIM/P6 set to 1200 ma.

Operating at 120v AC and 60 Hz.



Performance Summary

Total Light Output	21432 lm	Min Power Factor	0.97 @ 277 V
Luminaire Power	154.0 W	Max THD(i)*	5.4 % @ 277 V
Luminous Efficacy	139.2 lm/W	0-90° Zonal Flux %	100.0 %
CCT	3020 K	80-90° Zonal Flux %	1.1 %
CIE(x,y) 1931	(0.437, 0.405)	BUG Rating*	B3-U0-G3
CRI	71	Street Classification*	Type III Medium

PREPARED FOR : LED Roadway Lighting Ltd, 115 Chain Lake Drive, Halifax. NS Canada



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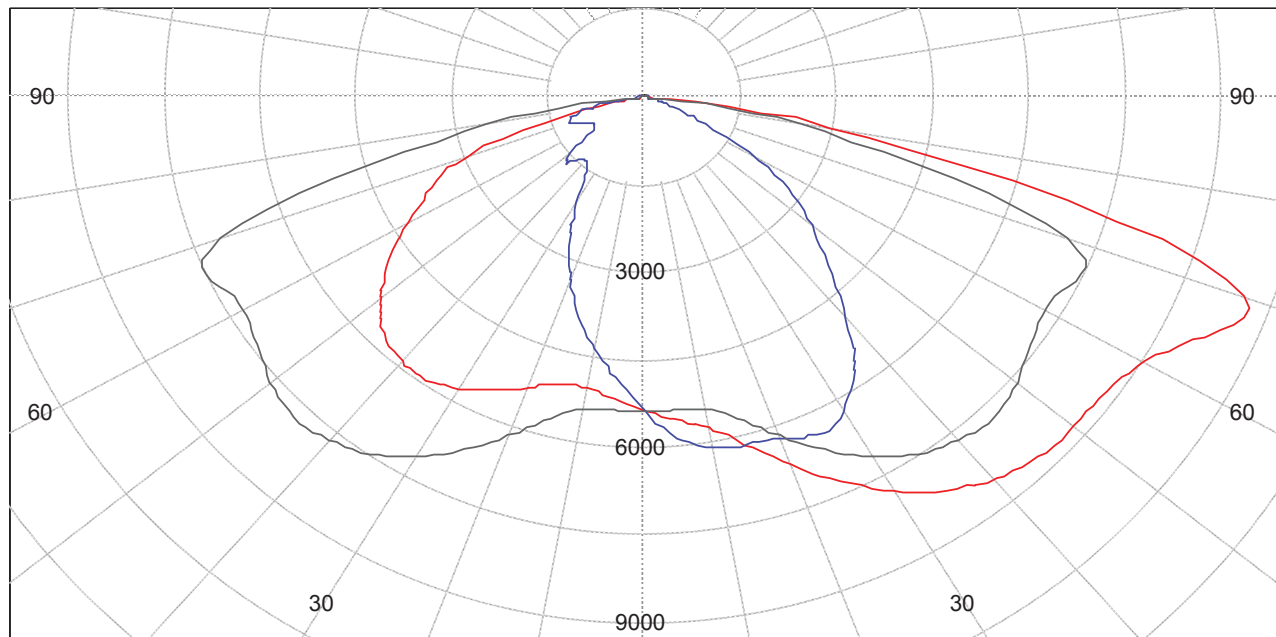
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Polar Light Distribution Curves



House side / L270

L90 / 270 - Black, Plane of maximum - Red, L0 / 180 - Blue (cd)

Street side / L90

Percentage Outputs

	Upward	Downward	Total
Street Side	0.0 %	66.8 %	66.8 %
House Side	0.0 %	33.2 %	33.2 %
	0.0 %	100.0 %	100.0 %

Report data based on absolute values as measured.

Signed:

Ryder Tunney
Ryder Tunney
Authorized Signatory

Date of test
Date of report

10-Jan-2020
14-Jan-2020



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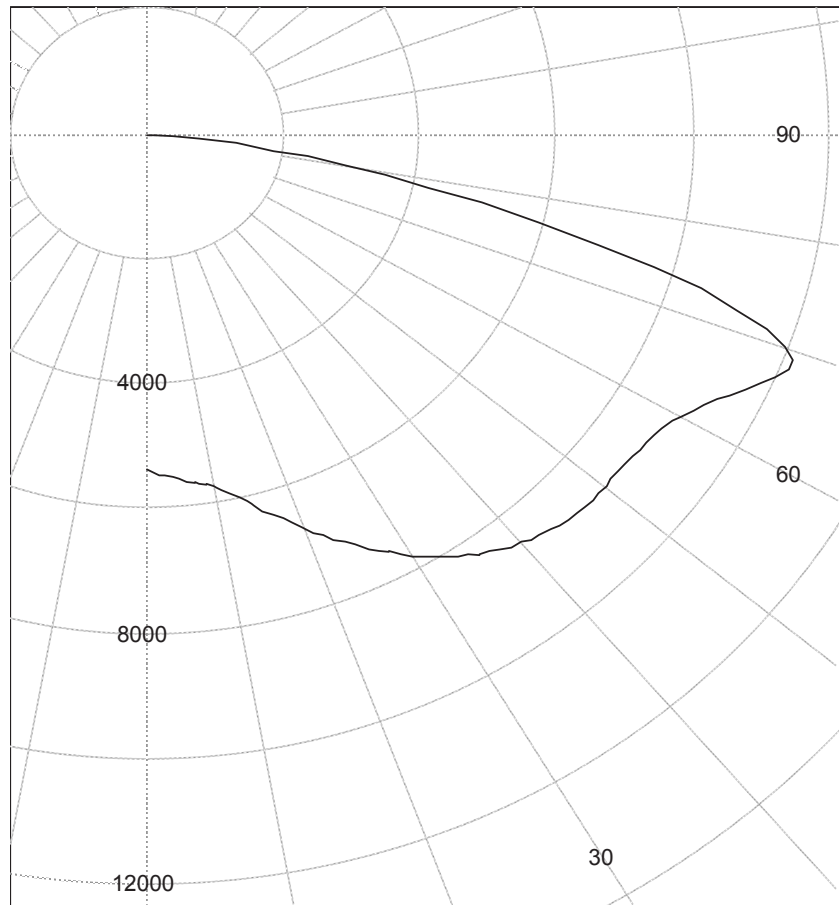
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Operating at 120v AC and 60 Hz.

Intensity in principal plane
(based on overall max intensity)

Vertical Angle (°)	Intensity (cd)
0.0	5370.9
10.0	5743.7
20.0	6709.5
30.0	7791.1
35.0	8232.1
40.0	8538.0
45.0	8720.4
47.5	8769.5
50.0	8768.0
52.5	8767.3
55.0	8807.6
57.5	8867.9
60.0	9034.2
62.5	9298.4
65.0	9663.6
67.5	10065.3
70.0	9965.7
72.5	8808.1
75.0	6851.3
77.5	4613.7
80.0	2934.5
82.5	1605.8
85.0	379.5
87.5	12.0
90.0	0.0
92.5	0.0
95.0	0.0
97.5	0.0
100.0	0.0
102.5	0.0
105.0	0.0
120.0	0.0
135.0	0.0
150.0	0.0
165.0	0.0
180.0	0.0

Principal Vertical Plane



Plane of maximum intensity (cd)

House side max intensity
7742.1 cd @ (90.0°, 44.0°)

Street side max intensity
10137.5 cd @ (72.5°, 68.5°)

Coordinates expressed in the C Type coordinate system

Data for the two symmetric halves of the luminaire has been averaged.



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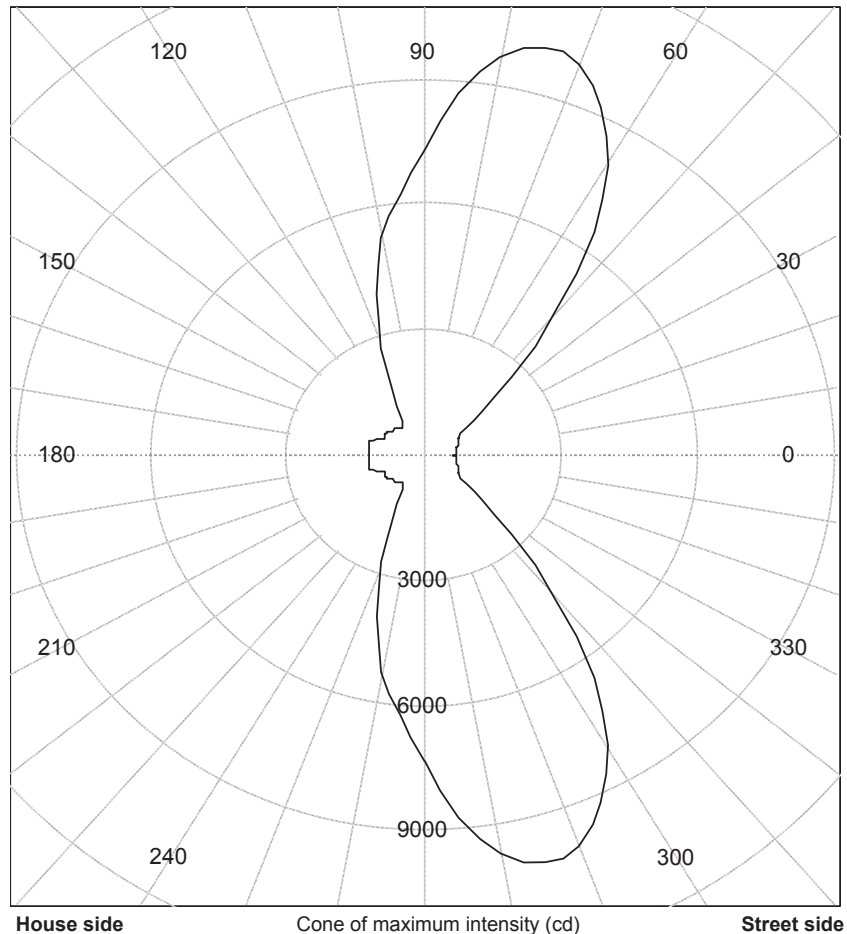
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Intensity in principal cone
(based on overall max intensity)

Lateral Plane (°)	(V68.5) (cd)
0	650.5
15	718.1
30	839.4
40	1626.2
45	2652.8
50	4463.2
55	6516.9
60	8054.0
65	9199.6
70	10002.1
75	10127.2
80	9696.3
85	8709.1
90	7370.0
95	6293.7
100	5273.8
105	4021.0
110	2725.9
115	1664.5
120	954.5
125	806.8
130	826.6
135	882.9
140	942.1
150	986.7
165	1246.5
180	1237.0

Principal Conical Surface



House side

Cone of maximum intensity (cd)

Street side

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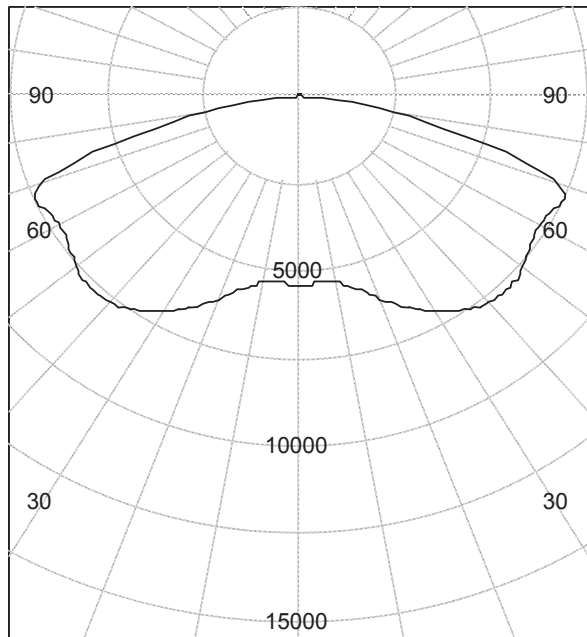
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Polar curve through L90 / L270

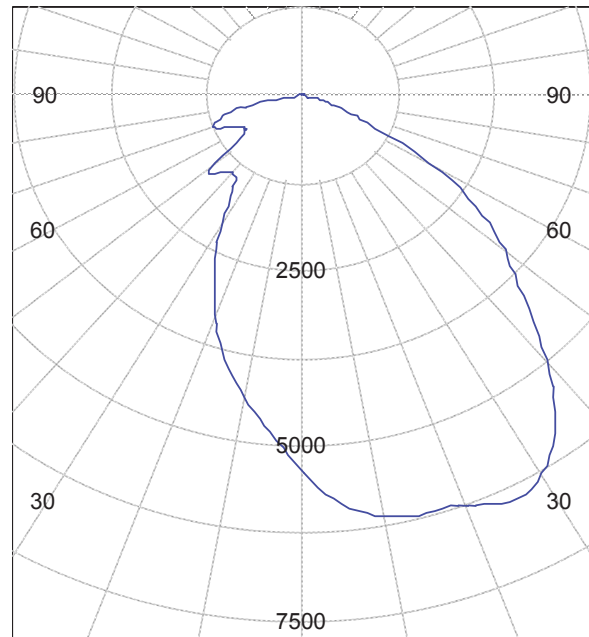


(L90)

(cd)

(L270)

Polar curve through L0 / L180



House side (L180)

(cd)

Street side (L0)



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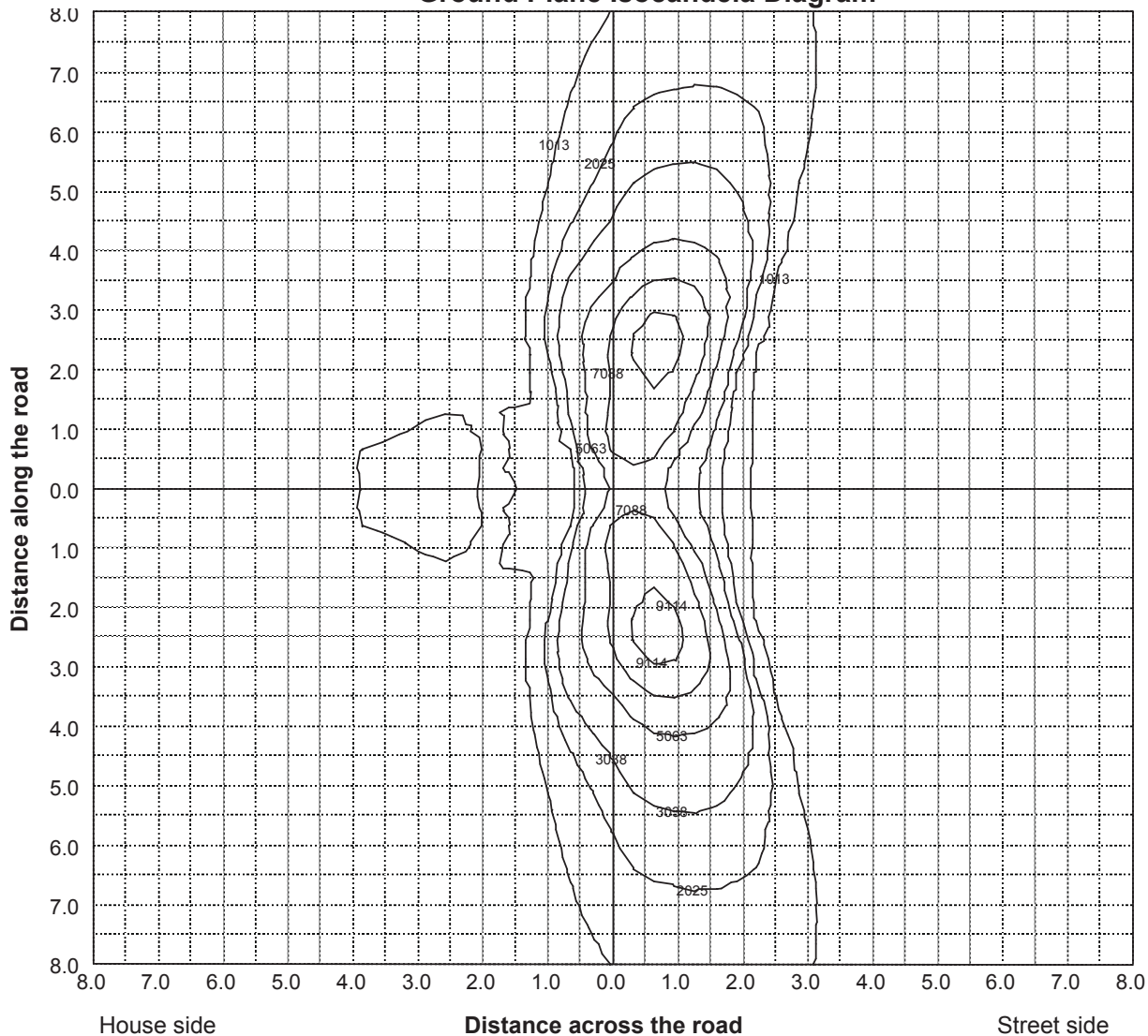
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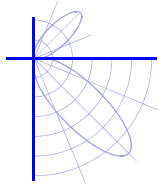
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Ground Plane Isocandela Diagram



The isocandela contour units are expressed as cd

Upstream and downstream sides have been averaged.



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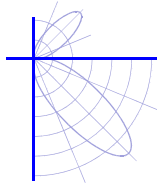
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Intensity data (cd)

Vertical	L-Plane								
	L0	L15	L30	L40	L45	L50	L55	L60	L65
0.0	5371	5371	5371	5371	5371	5371	5371	5371	5371
10.0	6093	6108	6078	6031	6012	5979	5942	5895	5840
20.0	6227	6237	6311	6466	6566	6650	6716	6757	6770
30.0	6219	6386	6802	7111	7254	7369	7507	7652	7760
35.0	5715	5946	6664	7359	7638	7810	7928	8067	8200
40.0	4929	5227	6206	7235	7725	8135	8340	8450	8543
45.0	4053	4414	5595	6911	7580	8141	8545	8682	8748
47.5	3702	4033	5273	6693	7435	8095	8554	8781	8812
50.0	3407	3681	4934	6461	7300	8043	8545	8819	8845
52.5	3085	3320	4579	6190	7143	7961	8497	8816	8886
55.0	2745	2927	4196	5793	6868	7841	8421	8799	8884
57.5	2381	2532	3708	5291	6579	7614	8314	8714	8873
60.0	1900	2100	3133	4723	6112	7273	8137	8630	8954
62.5	1343	1581	2437	4032	5394	6791	7838	8542	9074
65.0	910	1077	1668	3163	4430	6067	7399	8425	9223
67.5	723	784	1004	2068	3189	5001	6811	8214	9271
70.0	542	616	715	1051	1843	3516	5890	7714	8940
72.5	392	473	593	599	844	1922	4308	6684	7984
75.0	288	354	431	456	476	785	2239	4842	6251
77.5	224	269	293	346	344	389	742	2636	4094
80.0	162	206	192	231	248	254	309	975	2201
82.5	98	129	115	137	141	156	160	325	938
85.0	42	54	52	58	59	62	64	86	192
87.5	11	13	13	13	13	13	13	12	12
90.0	0	0	0	0	0	0	0	0	0
92.5	0	0	0	0	0	0	0	0	0
95.0	0	0	0	0	0	0	0	0	0
97.5	0	0	0	0	0	0	0	0	0
100.0	0	0	0	0	0	0	0	0	0
102.5	0	0	0	0	0	0	0	0	0
105.0	0	0	0	0	0	0	0	0	0
120.0	0	0	0	0	0	0	0	0	0
135.0	0	0	0	0	0	0	0	0	0
150.0	0	0	0	0	0	0	0	0	0
165.0	0	0	0	0	0	0	0	0	0
180.0	0	0	0	0	0	0	0	0	0

RT



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Intensity data (cd)

Vertical	L-Plane								
	L70	L75	L80	L85	L90	L95	L100	L105	L110
0.0	5371	5371	5371	5371	5371	5371	5371	5371	5371
10.0	5781	5703	5618	5520	5419	5322	5220	5122	5024
20.0	6741	6668	6553	6382	6170	5937	5694	5448	5199
30.0	7803	7768	7649	7439	7126	6760	6392	6018	5592
35.0	8250	8198	8055	7811	7461	7050	6632	6196	5693
40.0	8570	8499	8337	8058	7674	7219	6739	6224	5650
45.0	8758	8663	8489	8171	7733	7231	6689	6129	5479
47.5	8808	8703	8490	8156	7691	7160	6582	5957	5279
50.0	8819	8686	8448	8083	7587	7034	6437	5777	5063
52.5	8822	8683	8410	8004	7460	6890	6265	5576	4819
55.0	8843	8720	8405	7952	7353	6735	6079	5344	4526
57.5	8905	8791	8462	7947	7271	6582	5878	5088	4194
60.0	9052	8963	8603	8020	7240	6465	5701	4832	3844
62.5	9290	9252	8879	8207	7291	6414	5560	4588	3497
65.0	9617	9644	9286	8511	7429	6431	5473	4368	3172
67.5	9965	10056	9670	8751	7469	6399	5375	4151	2875
70.0	9776	9978	9503	8406	7021	5977	4989	3710	2413
72.5	8691	8808	8404	7233	5902	4976	4106	2889	1699
75.0	6761	6799	6438	5545	4430	3638	2882	1855	954
77.5	4533	4629	4424	3943	3103	2388	1715	942	490
80.0	2787	2984	2911	2702	2119	1498	892	430	305
82.5	1564	1638	1602	1463	1167	767	390	195	180
85.0	387	395	388	360	310	196	90	75	62
87.5	12	12	12	11	11	10	10	10	10
90.0	0	0	0	0	0	0	0	0	0
92.5	0	0	0	0	0	0	0	0	0
95.0	0	0	0	0	0	0	0	0	0
97.5	0	0	0	0	0	0	0	0	0
100.0	0	0	0	0	0	0	0	0	0
102.5	0	0	0	0	0	0	0	0	0
105.0	0	0	0	0	0	0	0	0	0
120.0	0	0	0	0	0	0	0	0	0
135.0	0	0	0	0	0	0	0	0	0
150.0	0	0	0	0	0	0	0	0	0
165.0	0	0	0	0	0	0	0	0	0
180.0	0	0	0	0	0	0	0	0	0



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Intensity data (cd)

Vertical	L-Plane								
	L115	L120	L125	L130	L135	L140	L150	L165	L180
0.0	5371	5371	5371	5371	5371	5371	5371	5371	5371
10.0	4938	4860	4791	4731	4664	4620	4526	4435	4393
20.0	4952	4705	4459	4235	4030	3876	3634	3415	3328
30.0	5152	4707	4248	3787	3349	2990	2545	2200	2079
35.0	5174	4619	4035	3452	2902	2459	1938	1627	1559
40.0	5051	4396	3698	2967	2315	1840	1475	1409	1418
45.0	4757	3983	3129	2283	1657	1380	1314	1435	1549
47.5	4535	3693	2776	1927	1418	1283	1293	1538	1659
50.0	4262	3351	2414	1611	1284	1249	1296	1520	1495
52.5	3947	2978	2042	1362	1236	1228	1292	1284	1158
55.0	3585	2579	1681	1195	1170	1192	1237	1105	951
57.5	3192	2178	1372	1102	1114	1153	1171	1013	891
60.0	2793	1811	1168	1048	1073	1113	1074	960	903
62.5	2423	1515	1037	996	1023	1063	999	942	920
65.0	2108	1283	937	928	967	1010	949	1027	1047
67.5	1814	1053	845	857	904	961	970	1219	1194
70.0	1394	816	746	780	846	916	1001	1229	1243
72.5	898	637	637	690	776	864	950	1090	1158
75.0	552	497	525	586	671	750	772	918	1042
77.5	376	372	400	455	514	551	539	732	876
80.0	276	257	281	320	349	359	324	523	674
82.5	160	155	163	184	206	218	184	282	432
85.0	59	60	66	74	87	96	91	73	132
87.5	10	10	11	12	13	14	17	3	2
90.0	0	0	0	0	0	0	0	0	0
92.5	0	0	0	0	0	0	0	0	0
95.0	0	0	0	0	0	0	0	0	0
97.5	0	0	0	0	0	0	0	0	0
100.0	0	0	0	0	0	0	0	0	0
102.5	0	0	0	0	0	0	0	0	0
105.0	0	0	0	0	0	0	0	0	0
120.0	0	0	0	0	0	0	0	0	0
135.0	0	0	0	0	0	0	0	0	0
150.0	0	0	0	0	0	0	0	0	0
165.0	0	0	0	0	0	0	0	0	0
180.0	0	0	0	0	0	0	0	0	0



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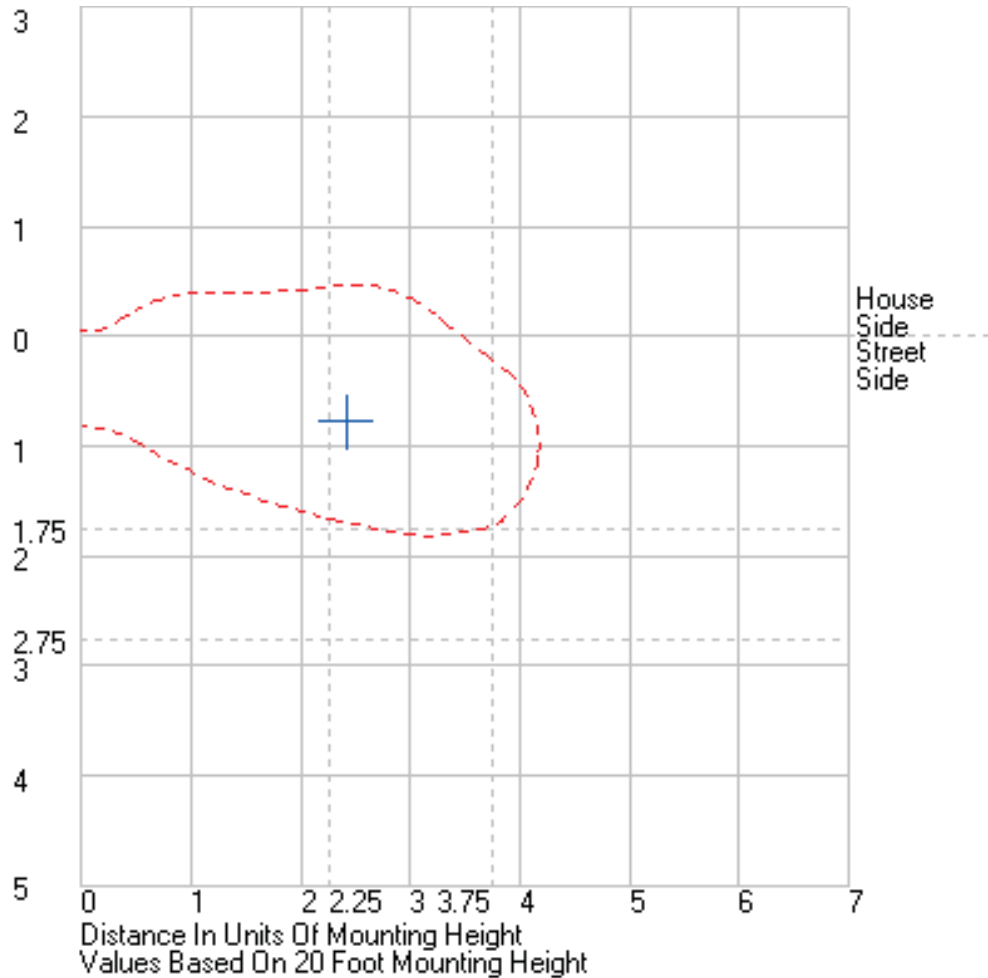
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LM-79 Performance Data

Spectral	CIE 1931 (x, y) ⁽¹⁾	(0.437, 0.405)
	CIE 1976 (u', v') ⁽¹⁾	(0.250, 0.522)
	Correlated Color Temperature (CCT) ⁽¹⁾	3020 K
	Spatial Δ (u', v') Uniformity ⁽²⁾	2.21E-03
	Color Rendering Index (Ra) ⁽¹⁾	71.4
	Special CRI 9 (R ₉) ^{(1),(3)}	-39.8
	Distance from Planckian Locus (Duv) ^{(1),(3)}	4.74E-04
	Scotopic/Photopic Ratio ^{(1),(3)}	1.23

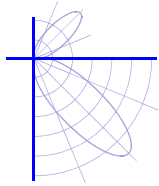
Electrical	Voltage	120.0 V	(Setpoint 1)
	Frequency	60.0 Hz	
	Current	1.290 A	
	Power	154 W	
	Power Factor	1.00	
	Current THD	2.7 %	
	Voltage	277.0 V	(Setpoint 2)
	Frequency	60.0 Hz	
	Current	0.562 A	
	Power	151 W	
	Power Factor	0.97	
	Current THD	5.4 %	

Performance data in accordance with IESNA LM-79-08. Spectral calculations are for a CIE 2° observer
Photometric and spectral values were measured at Setpoint 1

(1) Value is computed from the weighted average of the spatial measurements

(2) Value is the maximum deviation of the spatial u' and v' measurements from the weighted average

(3) Quantity is in addition to the scope of IESNA LM-79-08



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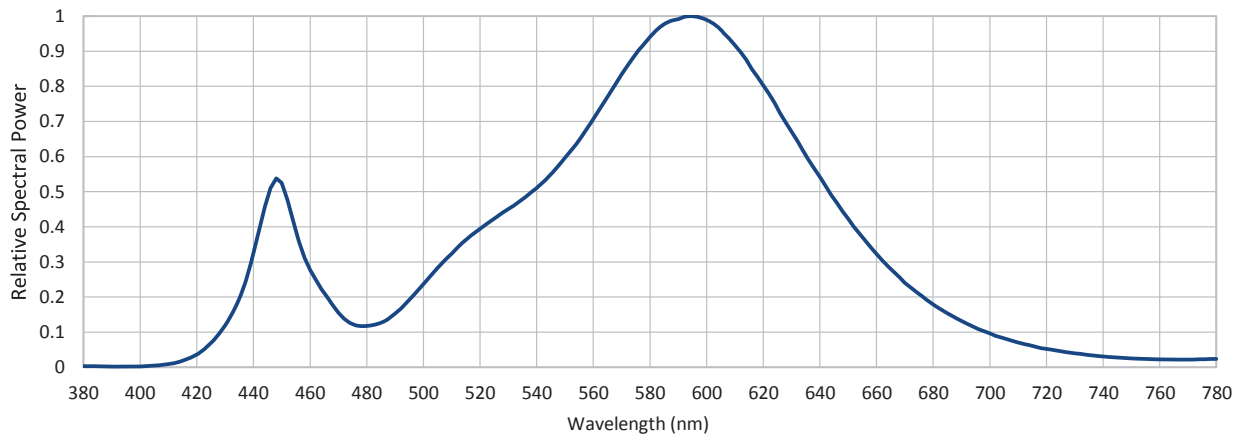
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LM-79 Performance Data

Relative spectral power distribution

(Relative to peak = 1, weighted average of spatial measurements)

λ (nm)	Relative Power	λ (nm)	Relative Power	λ (nm)	Relative Power	λ (nm)	Relative Power	λ (nm)	Relative Power
380	0.003	460	0.277	540	0.511	620	0.803	700	0.097
385	0.003	465	0.211	545	0.550	625	0.738	705	0.082
390	0.002	470	0.155	550	0.596	630	0.671	710	0.071
395	0.002	475	0.123	555	0.648	635	0.604	715	0.061
400	0.003	480	0.118	560	0.707	640	0.542	720	0.052
405	0.005	485	0.127	565	0.770	645	0.479	725	0.046
410	0.009	490	0.153	570	0.834	650	0.423	730	0.040
415	0.019	495	0.191	575	0.892	655	0.370	735	0.035
420	0.037	500	0.237	580	0.940	660	0.323	740	0.031
425	0.070	505	0.282	585	0.977	665	0.280	745	0.028
430	0.119	510	0.324	590	0.991	670	0.241	750	0.025
435	0.197	515	0.363	595	1.000	675	0.209	755	0.024
440	0.325	520	0.395	600	0.990	680	0.179	760	0.022
445	0.484	525	0.423	605	0.960	685	0.154	765	0.022
450	0.525	530	0.451	610	0.917	690	0.132	770	0.022
455	0.388	535	0.479	615	0.863	695	0.113	775	0.023
								780	0.024





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LM-79 Performance Data

Spatial measurements

Vert. angle (°)	CIE 1976 (u',v') coordinates	
	Horiz. 0.0° plane	Horiz. ° plane
0.0	(0.249, 0.521)	(0.249, 0.521)
10.0	(0.250, 0.521)	(0.250, 0.521)
20.0	(0.251, 0.523)	(0.250, 0.521)
30.0	(0.250, 0.522)	(0.250, 0.522)
40.0	(0.250, 0.522)	(0.250, 0.522)
50.0	(0.250, 0.522)	(0.250, 0.522)
60.0	(0.251, 0.522)	(0.250, 0.523)
70.0	(0.248, 0.521)	I <= 10% peak
80.0	(0.251, 0.521)	I <= 10% peak
-	-	-

Spatial measurements

Vert. angle (°)	CIE 1976 (u',v') coordinates	
	Horiz. 0.0° plane	Horiz. ° plane
-	-	-
-	-	-
-	-	-
-	-	-
-	-	-
-	-	-
-	-	-
-	-	-
-	-	-
-	-	-
-	-	-

Test procedure

All measurements were performed in an environmentally controlled laboratory employing suitable baffling to minimize stray light. The sample was mounted in its normal operating orientation on a rotating mirror goniophotometer and operated from a stabilized supply. The photometric output was monitored and measurements were performed once stability was achieved.

The goniophotometer was used to measure the spatial distribution of both luminous intensity and, in conjunction with a spectroradiometer, spectral irradiance. The distribution locus comprises points in two or more planes (as indicated in the table above) at no more than 10° vertical intervals. The CIE (x,y) coordinates and other derived metrics (CIE (u', v'), CCT and CRI) are calculated from the weighted sum (weighted for intensity and represented solid angle) of the measured spectral irradiances.

Sample Orientation

Horizontal

Stabilization & total operation time 1.25 / 64.25 hours

Equipment and uncertainties

LightLab International R80A C-gamma rotating mirror goniophotometer with a test distance of 8 m.

Luminous Intensity ± 4 %
Luminous Flux ± 4 %
Horiz., Vert. Angles ± 0.25°

Temperature ± 1 °C
Luminous Efficacy ± 4.5 %

PhotoResearch PR-670 spectroradiometer (grating with 380 - 780 nm range, 2 nm / pixel, 5 nm bandwidth, incandescent/halogen calibration source). Measured at a distance from the sample deemed >5 times the maximum observed luminous opening dimension.

CIE (x, y) coordinates ± 0.003 CCT ± 100 K
CIE (u', v') coordinates ± 0.002 CRI (Ra) ± 2
Spatial Δ (u', v') uniformity ± 0.001 Scotopic / Photopic Ratio * ± 0.02
Rel. Spectral Irradiance * ± 2 % R9 * ± 2
Duv * ± 5E-04

Yokogawa WT210 power meter connected in circuit to the sample electrical supply

Voltage ± 0.5 % Frequency * ± 0.1 Hz
Current ± 0.5 % Power ± 0.5 %
Current THD * ± 3 % Power Factor ± 0.02

This report contains data that are not covered by the NVLAP accreditation. Quantities marked with * are not covered.

Calculator / report version 1.0.10 / 5.9 (14th Dec 2017)

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Test Report No. LLI-20010-5

LED Roadway Lighting - Roadway luminaire. Product ID: QB 00 660M X 5 40 X 3G2S XXXX

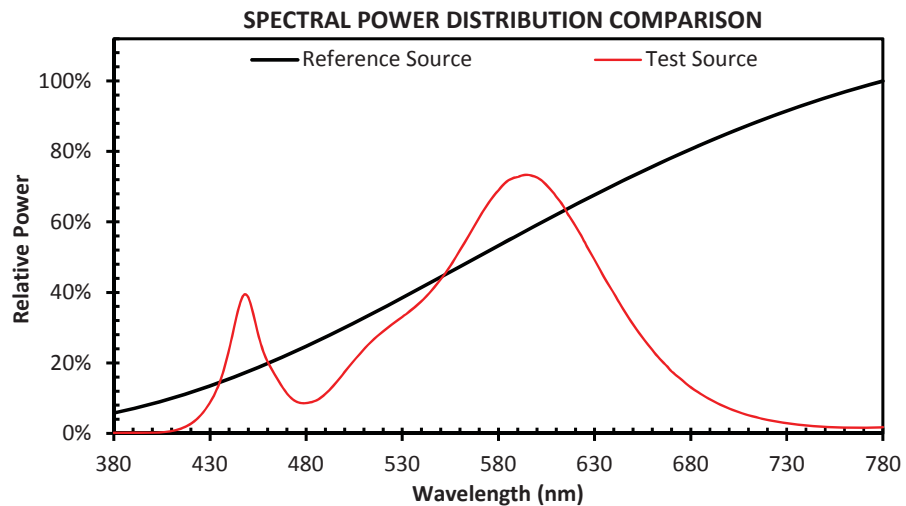
Grey cast aluminum top housing and white plastic bottom housing with clear flat glass lens.

60 LEDs in three 4 x 5 arrays with clear plastic sheets of individual lenses.

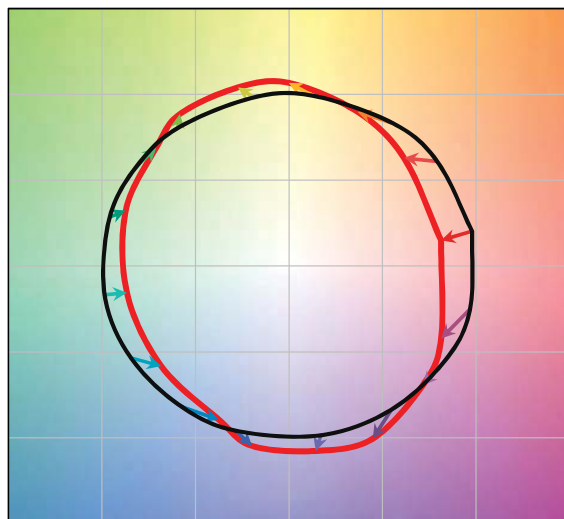
One Osram Optotronic LED driver. Model: QT180W/UNV/1250C/2DIM/P6 set to 1200 ma.

Operating at 120v AC and 60 Hz.

R_f	73
R_g	93



COLOR VECTOR GRAPHIC



— Test Source

→ Series1

COLOR DISTORTION GRAPHIC





Test Report No. LLI-20010-5

LED Roadway Lighting - Roadway luminaire. Product ID: QB 00 660M X 5 40 X 3G2S XXXX
Grey cast aluminum top housing and white plastic bottom housing with clear flat glass lens.
60 LEDs in three 4 x 5 arrays with clear plastic sheets of individual lenses.
One Osram Optotronic LED driver. Model: QT180W/UNV/1250C/2DIM/P6 set to 1200 ma.
Operating at 120v AC and 60 Hz.

Test Distance 8.0 m
Test Temperature 25.3 °C

Notes The laboratory has not participated in the selection of samples to be tested. All testing is performed on the understanding that the significance of the report is limited to the extent that the test sample is representative of production units.

Tested in accordance with the applicable sections of publications: IES LM-79-08 (Sec. 12), IES LM-16-93, IES LM-58-13, CIE 13.3:1995, CIE 15:2004, ANSI C78.377:2015, ANSI C82.77-10:2014.

The luminous intensity values, and other derived quantities, contained in this report are based on the absolute data, as measured.

Prorating the performance of the sample for the use of other component combinations (such as lamp / LED / Ballast / driver), or for use in different environmental conditions than that tested, may produce erroneous results.

This report is free of erasures and corrections.

Photometric intensity values are reported using the IESNA Type C coordinate system (L, V) as defined in IESNA publication LM-75.

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This report must not be used by the customer to claim product certification, approval or endorsement by NVLAP, NIST, or any agency of the Federal Government.