



Report of Test LLI-20010-3

LED Roadway Lighting - Roadway luminaire. Product ID: QB 00 660M X 5 30 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 900 ma.
Operating at 120v AC and 60 Hz.



Performance Summary

Total Light Output	16645 lm	Min Power Factor	0.95 @ 277 V
Luminaire Power	113.7 W	Max THD(i)*	6.3 % @ 277 V
Luminous Efficacy	146.4 lm/W	0-90° Zonal Flux %	100.0 %
CCT	3010 K	80-90° Zonal Flux %	1.1 %
CIE(x,y) 1931	(0.437, 0.405)	BUG Rating*	B3-U0-G3
CRI	72	Street Classification*	Type III Medium

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



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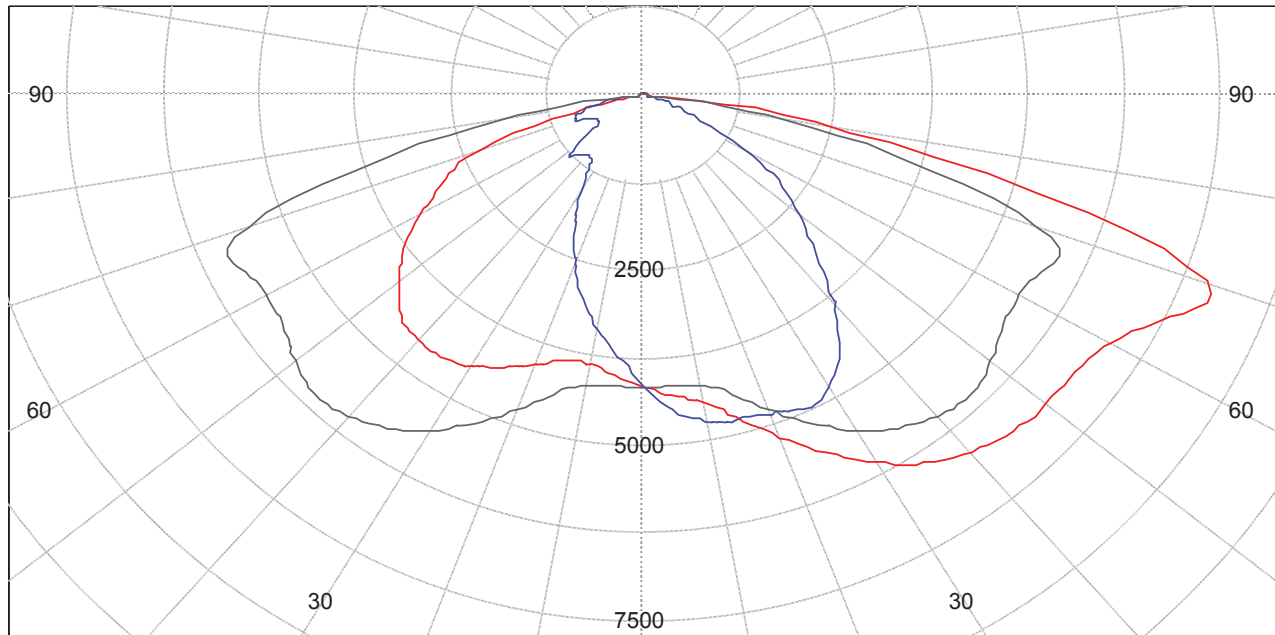




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Polar Light Distribution Curves



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 %	66.9 %	66.9 %
House Side	0.0 %	33.1 %	33.1 %
	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

13-Jan-2020
14-Jan-2020



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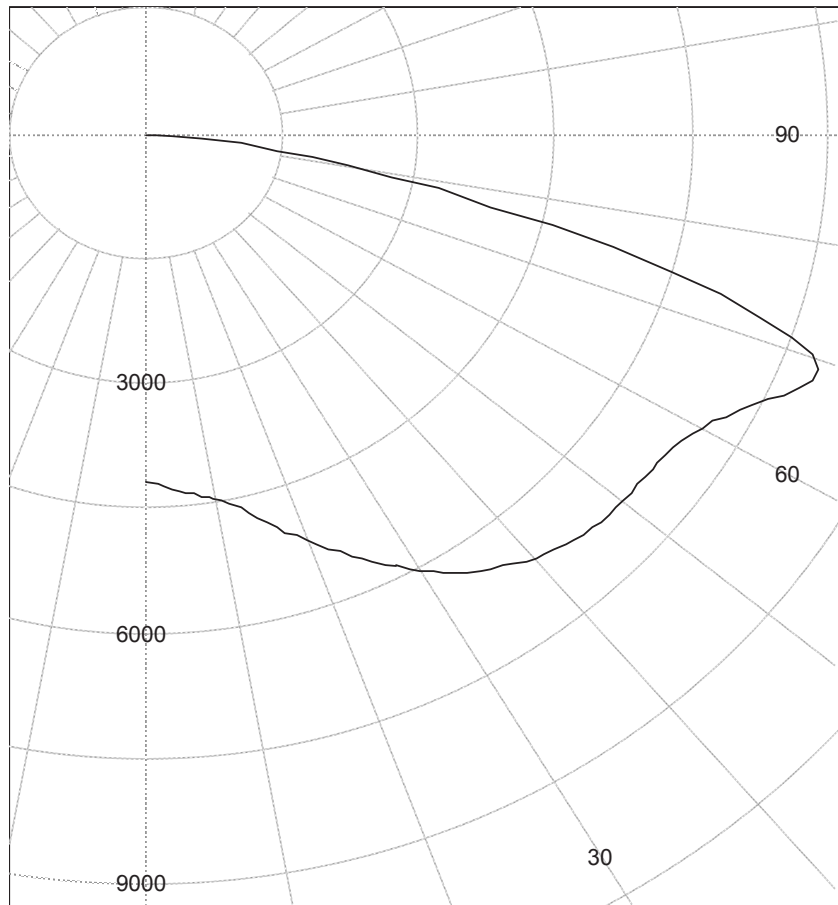
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Operating at 120v AC and 60 Hz.

Intensity in principal plane
(based on overall max intensity)

Vertical Angle (°)	Intensity (cd)
0.0	4162.5
10.0	4449.4
20.0	5194.0
30.0	6055.3
35.0	6404.6
40.0	6657.0
45.0	6803.8
47.5	6844.4
50.0	6848.1
52.5	6851.0
55.0	6873.8
57.5	6926.6
60.0	7053.8
62.5	7262.7
65.0	7546.1
67.5	7872.1
70.0	7787.8
72.5	6875.1
75.0	5325.7
77.5	3578.9
80.0	2283.2
82.5	1250.6
85.0	299.3
87.5	9.9
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



House side max intensity
6032.8 cd @ (90.0°, 44.0°)

Street side max intensity
7928.5 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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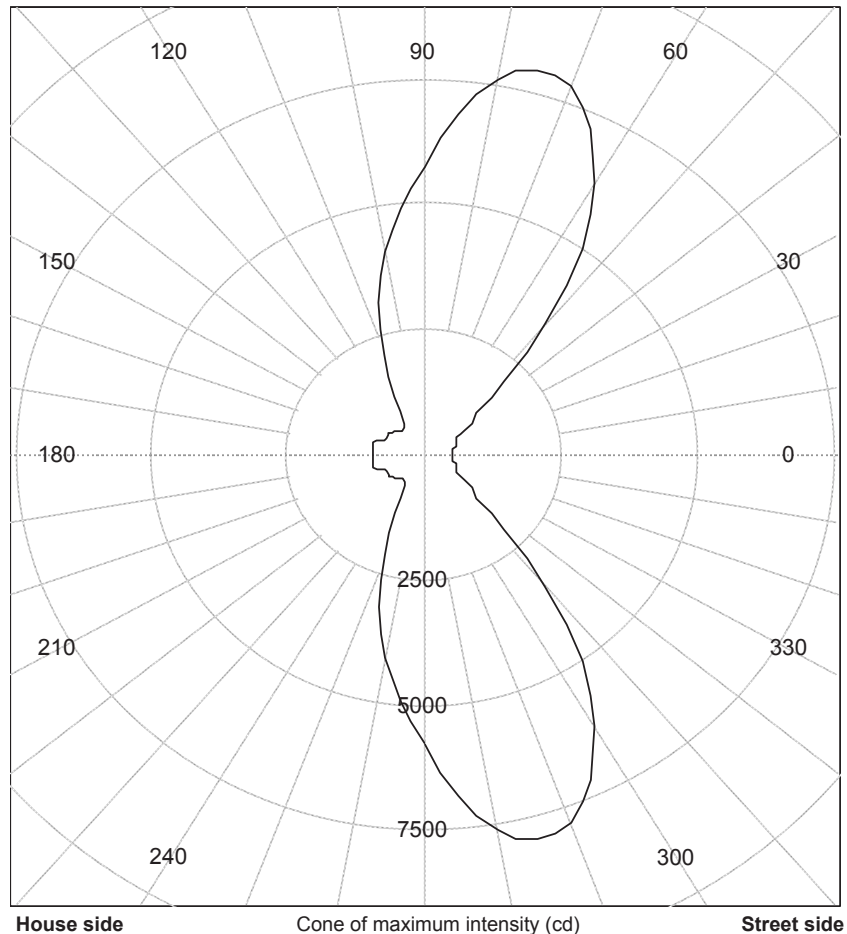
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Operating at 120v AC and 60 Hz.

Intensity in principal cone
(based on overall max intensity)

Lateral Plane (°)	(V68.5) (cd)
0	516.6
15	568.7
30	665.6
40	1270.6
45	2045.9
50	3427.6
55	5032.5
60	6256.1
65	7148.8
70	7797.7
75	7921.1
80	7610.9
85	6849.5
90	5766.6
95	4924.4
100	4120.1
105	3136.5
110	2115.5
115	1276.7
120	725.1
125	621.6
130	638.9
135	684.2
140	728.6
150	758.2
165	952.8
180	948.6

Principal Conical Surface



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6032.8 cd @ (90.0°, 44.0°)

Street side max intensity
7928.5 cd @ (72.5°, 68.5°)

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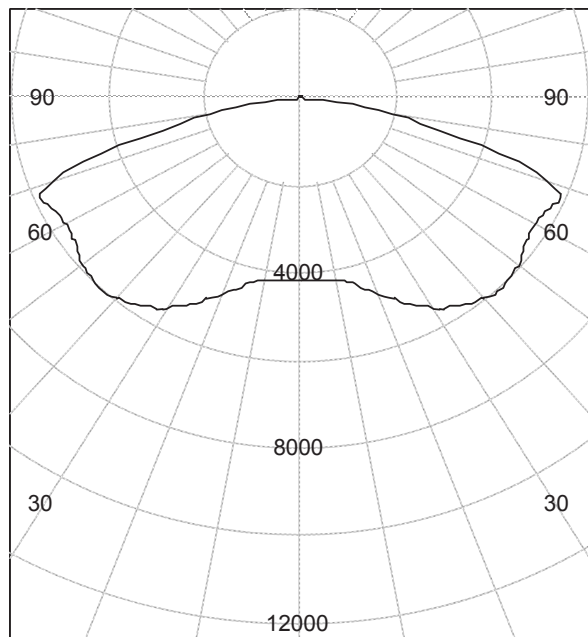
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Polar curve through L90 / L270

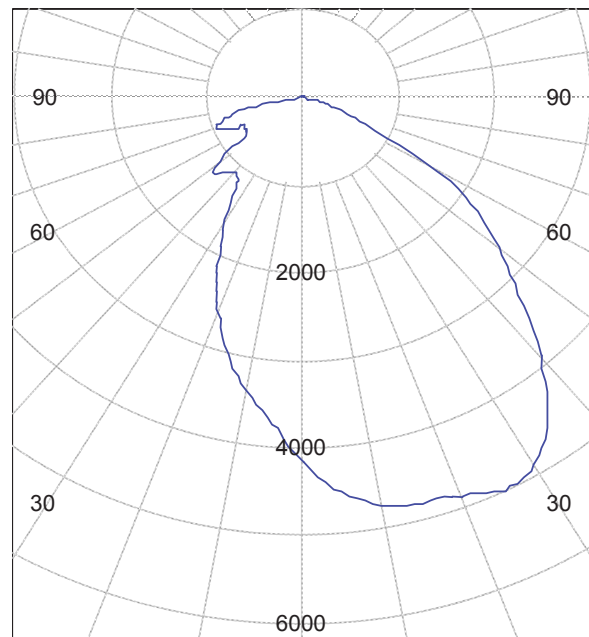


(L90)

(cd)

(L270)

Polar curve through L0 / L180



House side (L180)

(cd)

Street side (L0)



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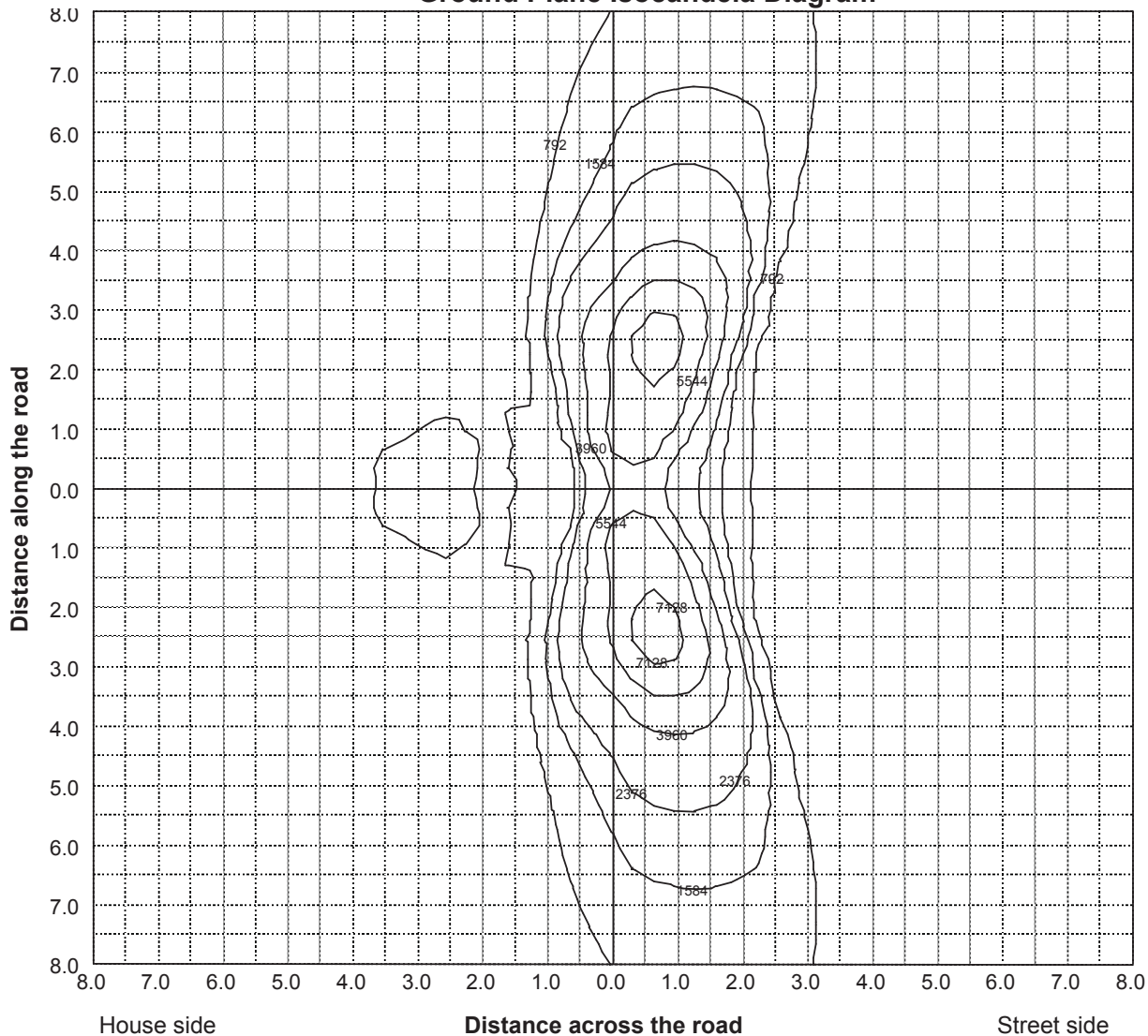
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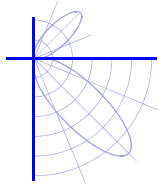
Ground Plane Isocandela Diagram



The isocandela contour units are expressed as cd

Upstream and downstream sides have been averaged.

RT



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Intensity data (cd)

Vertical	L-Plane								
	L0	L15	L30	L40	L45	L50	L55	L60	L65
0.0	4163	4163	4163	4163	4163	4163	4163	4163	4163
10.0	4718	4732	4706	4674	4650	4632	4593	4562	4520
20.0	4832	4840	4897	5020	5089	5157	5203	5236	5239
30.0	4827	4948	5253	5515	5627	5725	5833	5942	6023
35.0	4451	4630	5172	5706	5915	6068	6165	6276	6376
40.0	3848	4071	4831	5622	5995	6309	6482	6573	6650
45.0	3178	3453	4350	5380	5894	6327	6642	6752	6810
47.5	2895	3161	4107	5208	5786	6296	6652	6828	6864
50.0	2660	2882	3846	5021	5679	6261	6647	6858	6893
52.5	2408	2595	3580	4812	5561	6195	6609	6851	6922
55.0	2140	2283	3284	4510	5341	6104	6550	6841	6917
57.5	1862	1977	2903	4112	5109	5927	6469	6769	6904
60.0	1493	1645	2451	3670	4756	5658	6324	6703	6964
62.5	1060	1242	1911	3138	4189	5263	6091	6645	7072
65.0	721	854	1312	2466	3421	4699	5746	6552	7180
67.5	571	621	796	1613	2461	3858	5274	6377	7210
70.0	432	489	565	829	1431	2680	4537	5986	6942
72.5	313	376	468	477	668	1451	3297	5185	6199
75.0	230	282	344	363	381	611	1676	3745	4826
77.5	178	214	235	276	275	313	531	2015	3133
80.0	131	165	155	185	200	205	235	743	1690
82.5	79	104	93	111	114	127	131	244	722
85.0	35	45	43	48	49	51	52	69	152
87.5	10	11	11	11	11	11	11	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								
	L70	L75	L80	L85	L90	L95	L100	L105	L110
0.0	4163	4163	4163	4163	4163	4163	4163	4163	4163
10.0	4477	4420	4353	4275	4196	4113	4027	3947	3878
20.0	5218	5163	5075	4947	4773	4581	4384	4201	4012
30.0	6057	6034	5943	5783	5528	5232	4941	4655	4327
35.0	6415	6378	6270	6084	5798	5474	5141	4804	4411
40.0	6676	6623	6503	6288	5976	5615	5234	4830	4384
45.0	6830	6763	6627	6382	6027	5631	5199	4763	4252
47.5	6875	6792	6627	6373	5992	5580	5118	4629	4099
50.0	6881	6784	6598	6315	5916	5483	5008	4490	3936
52.5	6884	6783	6575	6263	5824	5369	4876	4334	3744
55.0	6900	6808	6569	6224	5743	5251	4731	4155	3515
57.5	6937	6871	6619	6220	5678	5135	4577	3954	3257
60.0	7061	7012	6735	6290	5661	5047	4444	3759	2986
62.5	7250	7237	6959	6444	5709	5013	4339	3570	2718
65.0	7500	7540	7278	6690	5816	5029	4278	3407	2467
67.5	7780	7868	7585	6881	5849	5008	4203	3241	2238
70.0	7622	7800	7453	6604	5479	4659	3891	2887	1865
72.5	6763	6867	6566	5654	4580	3854	3188	2229	1291
75.0	5251	5284	5011	4334	3438	2803	2223	1413	717
77.5	3515	3582	3438	3086	2413	1838	1313	709	371
80.0	2160	2314	2267	2122	1660	1157	685	325	235
82.5	1217	1259	1261	1143	909	594	296	149	138
85.0	309	310	304	282	245	154	67	58	48
87.5	10	10	9	9	8	8	7	8	7
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	4163	4163	4163	4163	4163	4163	4163	4163	4163
10.0	3807	3752	3702	3653	3610	3571	3503	3434	3400
20.0	3824	3627	3444	3267	3119	2995	2811	2640	2573
30.0	3981	3630	3276	2912	2578	2302	1965	1696	1604
35.0	4000	3563	3109	2650	2228	1889	1496	1256	1205
40.0	3910	3394	2845	2271	1771	1410	1140	1094	1102
45.0	3682	3075	2402	1739	1265	1063	1020	1114	1200
47.5	3510	2849	2130	1465	1086	995	1003	1191	1278
50.0	3301	2585	1849	1225	991	971	1003	1165	1137
52.5	3055	2296	1561	1038	958	951	997	984	879
55.0	2776	1986	1281	917	907	922	954	849	730
57.5	2468	1674	1045	851	863	892	899	779	687
60.0	2160	1389	894	813	833	860	826	737	696
62.5	1874	1162	798	771	792	824	768	725	709
65.0	1632	981	723	718	749	782	731	793	805
67.5	1397	802	651	663	701	743	746	936	916
70.0	1060	619	574	602	655	707	765	939	945
72.5	673	487	491	532	600	664	722	827	865
75.0	417	382	403	450	515	570	582	689	780
77.5	289	285	307	347	390	414	403	542	657
80.0	212	197	214	243	263	269	239	383	499
82.5	122	118	123	139	154	162	134	199	313
85.0	44	45	48	54	64	69	65	48	89
87.5	7	7	8	8	9	9	11	2	1
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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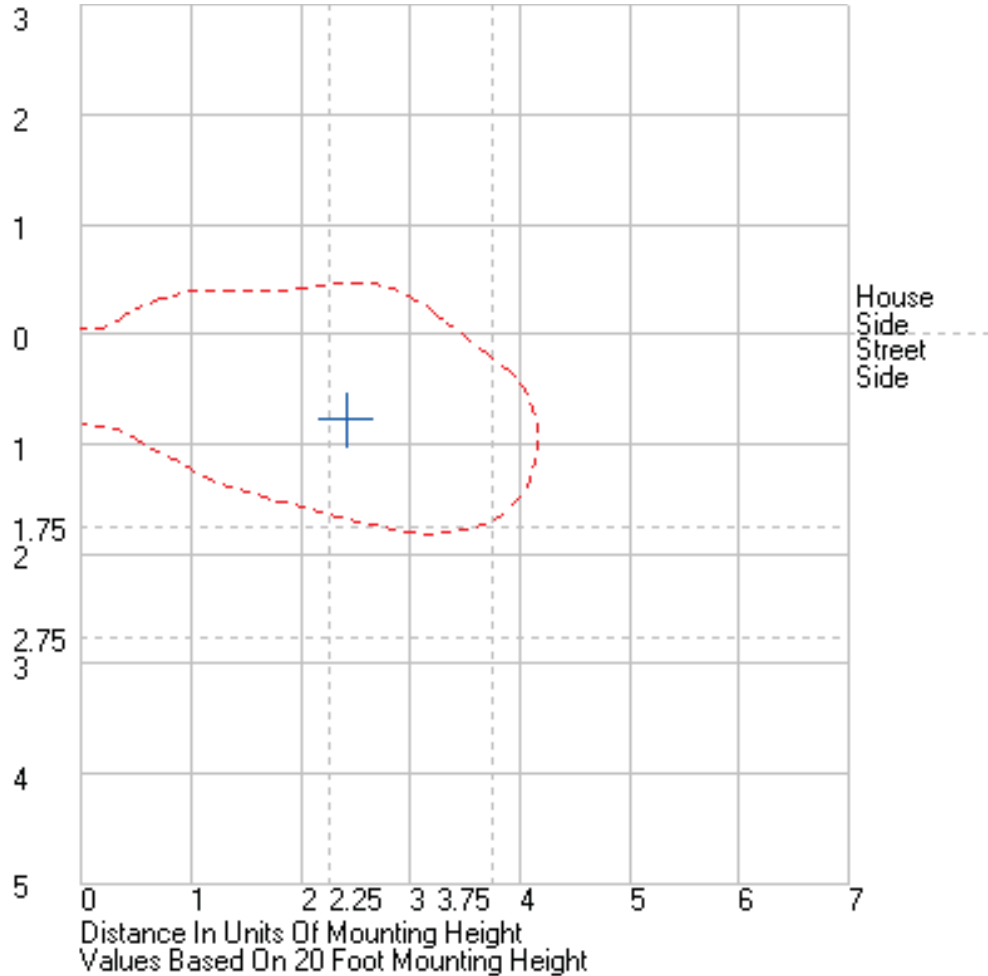
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LM-79 Performance Data

Spectral	CIE 1931 (x, y) ⁽¹⁾	(0.437, 0.405)
	CIE 1976 (u', v') ⁽¹⁾	(0.250, 0.522)
	Correlated Color Temperature (CCT) ⁽¹⁾	3010 K
	Spatial Δ (u', v') Uniformity ⁽²⁾	1.98E-03
	Color Rendering Index (Ra) ⁽¹⁾	71.5
	Special CRI 9 (R ₉) ^{(1),(3)}	-40.1
	Distance from Planckian Locus (Duv) ^{(1),(3)}	5.64E-04
	Scotopic/Photopic Ratio ^{(1),(3)}	1.23

Electrical	Voltage	120.0 V	(Setpoint 1)
	Frequency	60.0 Hz	
	Current	0.950 A	
	Power	114 W	
	Power Factor	1.00	
	Current THD	3.1 %	
	Voltage	277.0 V	(Setpoint 2)
	Frequency	60.0 Hz	
	Current	0.426 A	
	Power	112 W	
	Power Factor	0.95	
	Current THD	6.3 %	

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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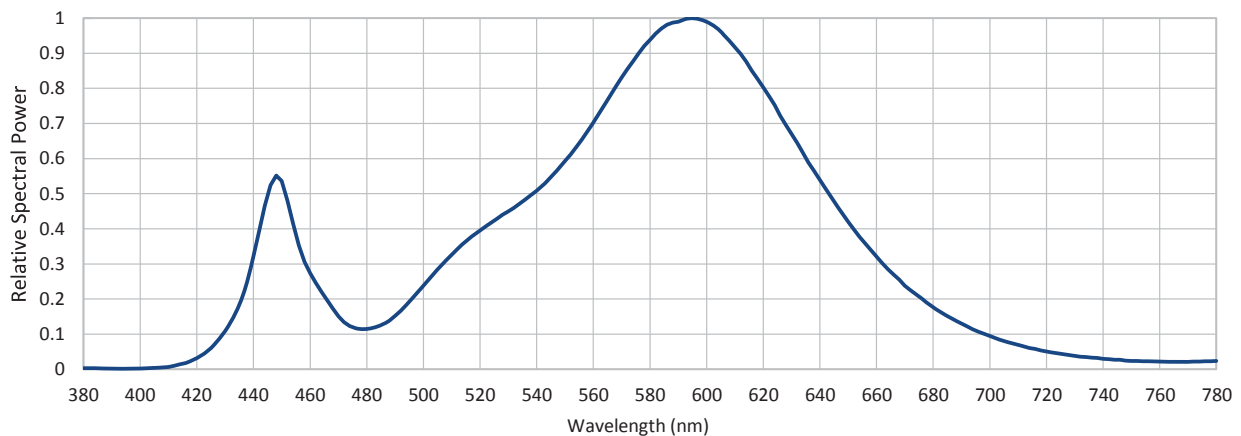
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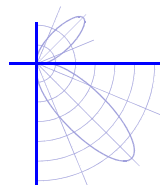
LM-79 Performance Data

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	0.273	540	0.509	620	0.803	700	0.095
385	0.002	465	0.209	545	0.547	625	0.737	705	0.081
390	0.002	470	0.151	550	0.593	630	0.670	710	0.069
395	0.002	475	0.120	555	0.644	635	0.602	715	0.059
400	0.002	480	0.115	560	0.703	640	0.540	720	0.051
405	0.004	485	0.126	565	0.766	645	0.477	725	0.044
410	0.007	490	0.152	570	0.830	650	0.421	730	0.038
415	0.016	495	0.192	575	0.889	655	0.368	735	0.034
420	0.032	500	0.239	580	0.938	660	0.321	740	0.030
425	0.062	505	0.284	585	0.975	665	0.278	745	0.027
430	0.109	510	0.326	590	0.990	670	0.238	750	0.024
435	0.186	515	0.364	595	1.000	675	0.207	755	0.023
440	0.321	520	0.396	600	0.990	680	0.176	760	0.022
445	0.495	525	0.424	605	0.961	685	0.152	765	0.021
450	0.536	530	0.450	610	0.917	690	0.130	770	0.021
455	0.384	535	0.478	615	0.863	695	0.111	775	0.022
								780	0.024





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Operating at 120v AC and 60 Hz.

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, 0.523)	(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 0.5 / 2.5 hours

Equipment and uncertainties

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

Luminous Intensity	± 4 %	Temperature	± 1 °C
Luminous Flux	± 4 %	Luminous Efficacy	± 4.5 %
Horiz., Vert. Angles	± 0.25°		

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)

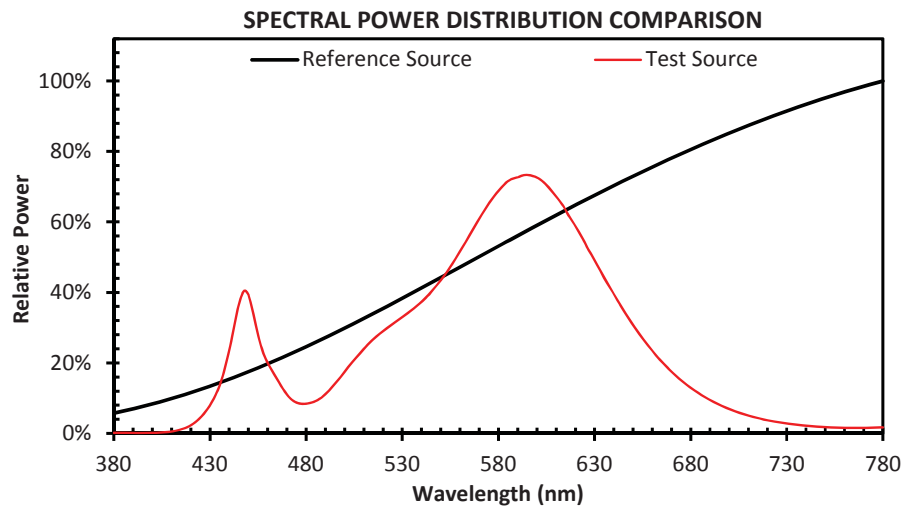
Page 14 of 16



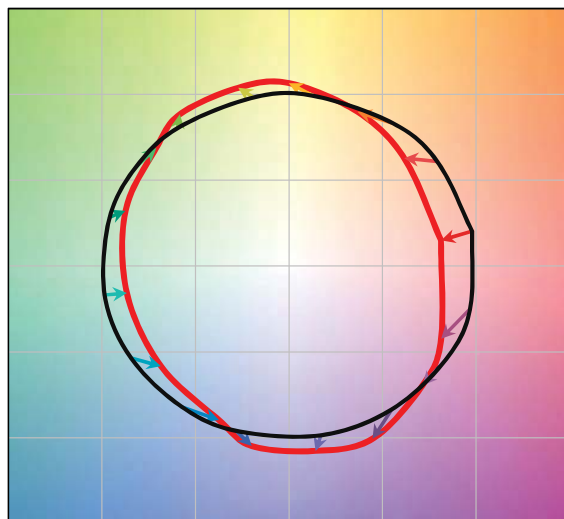
Test Report No. LLI-20010-3

LED Roadway Lighting - Roadway luminaire. Product ID: QB 00 660M X 5 30 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 900 ma.
Operating at 120v AC and 60 Hz.

R_f	73
R_g	93



COLOR VECTOR GRAPHIC

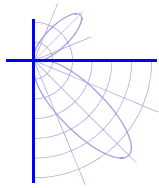


— Test Source

→ Series1

COLOR DISTORTION GRAPHIC





Test Report No. LLI-20010-3

LED Roadway Lighting - Roadway luminaire. Product ID: QB 00 660M X 5 30 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 900 ma.
Operating at 120v AC and 60 Hz.

Test Distance 8.0 m
Test Temperature 25.2 °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.