



Report of Test

LLI-20010-6

LED Roadway Lighting - Roadway luminaire. Product ID: QB 00 660M X 5 30 X 4G2S 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	17422 lm	Min Power Factor	0.95 @ 277 V
Luminaire Power	114.5 W	Max THD(i)*	7.0 % @ 277 V
Luminous Efficacy	152.2 lm/W	0-90° Zonal Flux %	100.0 %
CCT	3950 K	80-90° Zonal Flux %	1.1 %
CIE(x,y) 1931	(0.383, 0.379)	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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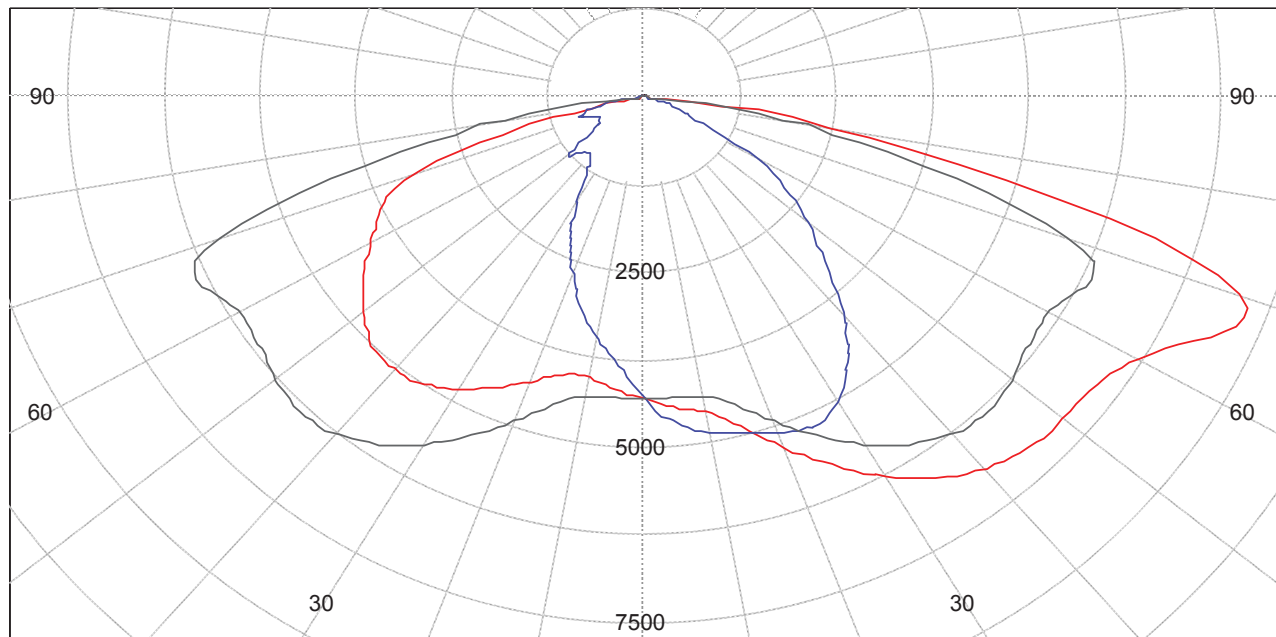




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Polar Light Distribution Curves



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 %	66.9 %	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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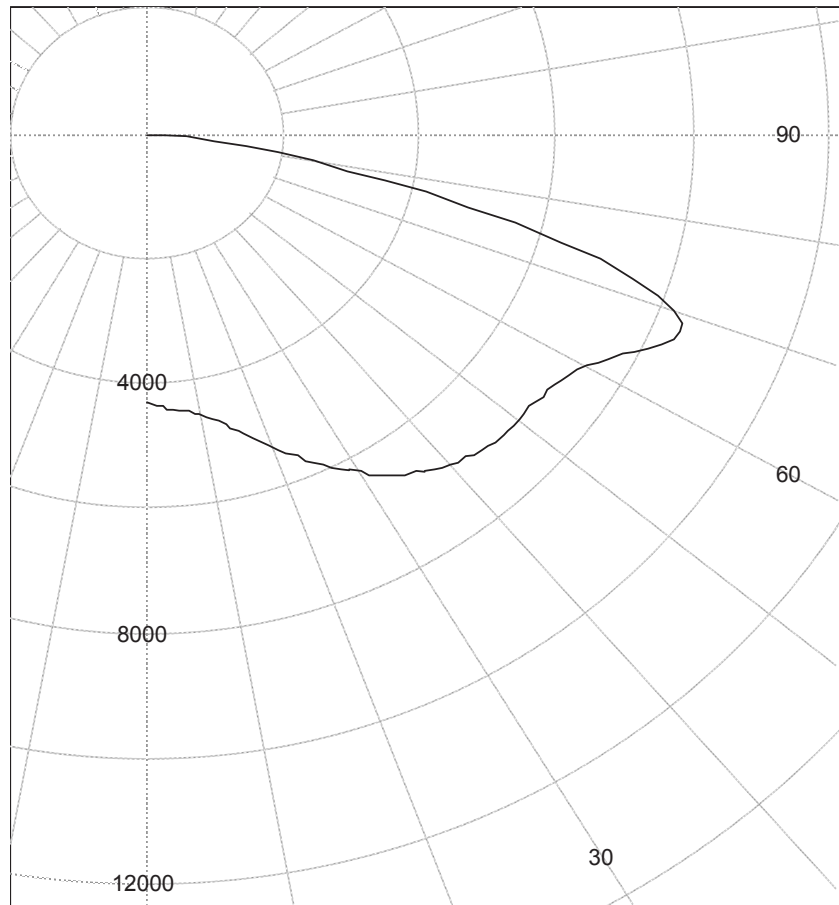
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Operating at 120v AC and 60 Hz.

Intensity in principal plane
(based on overall max intensity)

Vertical Angle (°)	Intensity (L75.0) (cd)
0.0	4310.6
10.0	4560.9
20.0	5318.5
30.0	6254.9
35.0	6641.8
40.0	6916.4
45.0	7079.3
47.5	7119.7
50.0	7121.4
52.5	7133.9
55.0	7173.2
57.5	7265.8
60.0	7438.8
62.5	7731.0
65.0	8111.2
67.5	8424.4
70.0	8222.6
72.5	7219.1
75.0	5602.7
77.5	3881.7
80.0	2465.1
82.5	1264.3
85.0	285.9
87.5	9.0
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
6387.5 cd @ (90.0°, 66.0°)

Street side max intensity
8437.3 cd @ (75.0°, 68.0°)

Coordinates expressed in the C Type coordinate system

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



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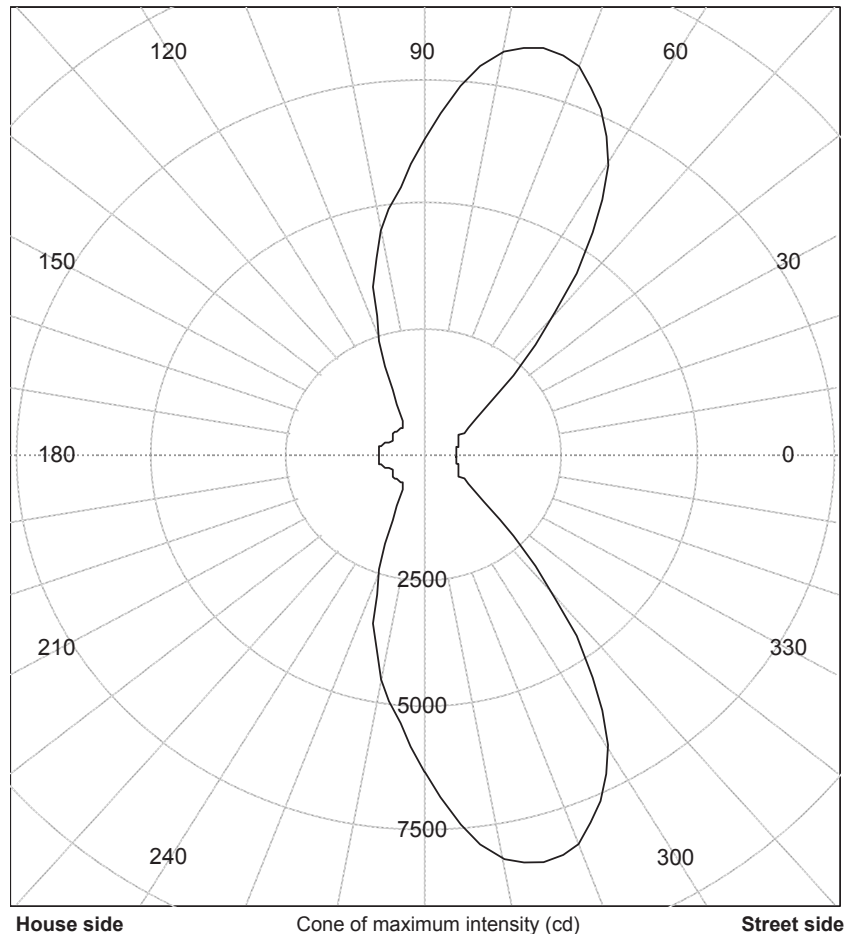
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Operating at 120v AC and 60 Hz.

Intensity in principal cone
(based on overall max intensity)

Lateral Plane (°)	(V68.0) (cd)
0	563.5
15	617.1
30	725.2
40	1444.1
45	2278.4
50	3724.6
55	5397.7
60	6689.8
65	7635.8
70	8274.8
75	8437.3
80	8161.4
85	7404.9
90	6298.5
95	5388.7
100	4539.8
105	3496.5
110	2400.3
115	1437.3
120	798.5
125	652.6
130	671.2
135	704.7
140	730.7
150	678.1
165	825.1
180	815.0

Principal Conical Surface



House side

Cone of maximum intensity (cd)

Street side

House side max intensity
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Street side max intensity
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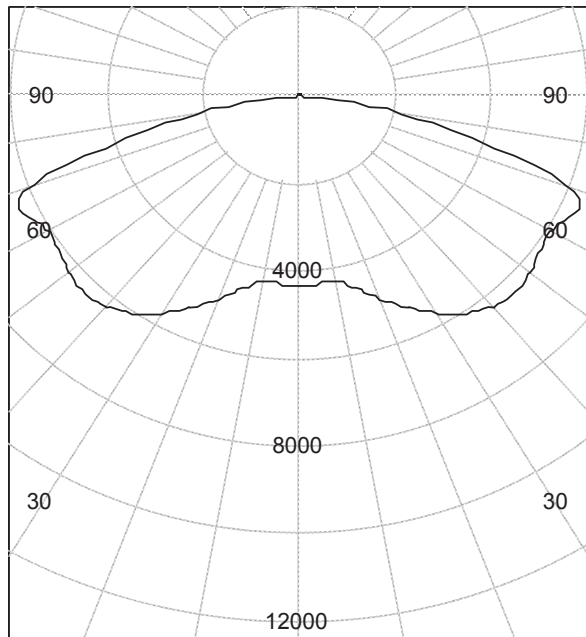
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Polar curve through L90 / L270

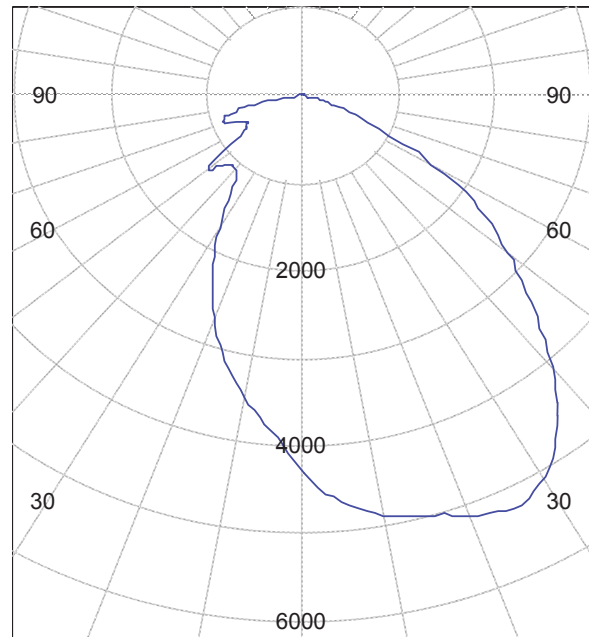


(L90)

(cd)

(L270)

Polar curve through L0 / L180



House side (L180)

(cd)

Street side (L0)



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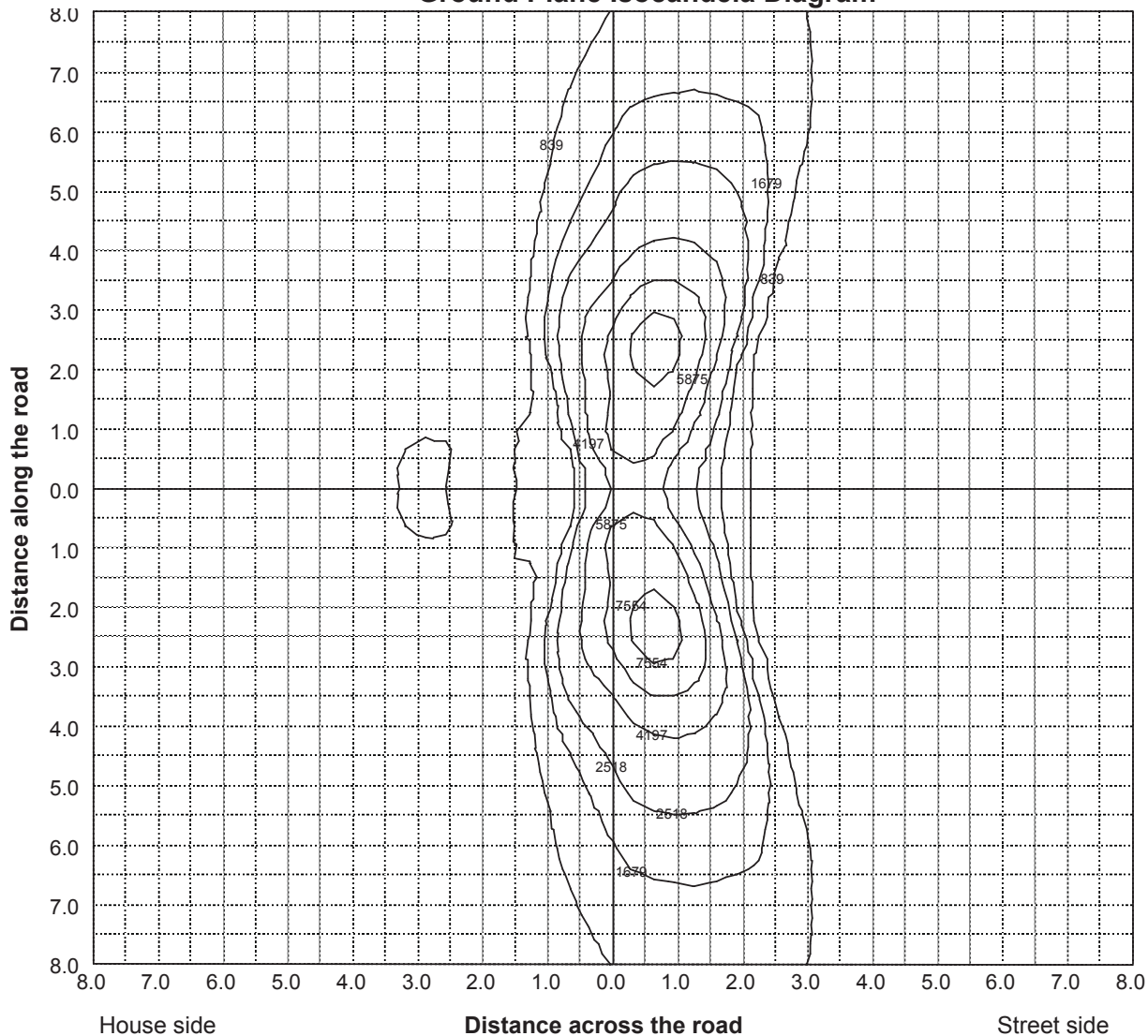
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Ground Plane Isocandela Diagram



The isocandela contour units are expressed as cd

Upstream and downstream sides have been averaged.



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Intensity data (cd)

Vertical	L-Plane								
	L0	L15	L30	L40	L45	L50	L55	L60	L65
0.0	4311	4311	4311	4311	4311	4311	4311	4311	4311
10.0	4857	4876	4845	4811	4788	4768	4727	4685	4647
20.0	5104	5107	5121	5192	5251	5317	5361	5392	5402
30.0	5030	5166	5506	5770	5904	5991	6065	6154	6227
35.0	4619	4805	5377	5939	6167	6330	6445	6539	6623
40.0	4025	4256	5019	5829	6229	6577	6762	6871	6931
45.0	3344	3637	4561	5586	6134	6584	6922	7048	7120
47.5	3033	3336	4309	5418	6025	6557	6933	7121	7182
50.0	2783	3032	4047	5249	5918	6523	6928	7165	7212
52.5	2517	2727	3785	5040	5799	6467	6891	7141	7239
55.0	2241	2400	3481	4737	5606	6366	6839	7143	7249
57.5	1944	2070	3084	4332	5358	6215	6787	7100	7248
60.0	1551	1703	2585	3868	4977	5954	6681	7086	7342
62.5	1095	1276	1987	3293	4381	5560	6446	7055	7515
65.0	745	875	1341	2534	3548	4918	6075	6955	7640
67.5	590	645	798	1616	2499	3947	5536	6766	7671
70.0	442	504	562	829	1423	2677	4642	6242	7310
72.5	318	384	464	470	660	1430	3268	5273	6387
75.0	232	289	347	354	365	584	1597	3733	4909
77.5	182	223	237	270	262	290	524	1997	3219
80.0	133	172	156	181	194	189	217	723	1754
82.5	77	104	93	107	109	118	117	229	722
85.0	33	44	41	44	44	45	45	58	140
87.5	8	9	9	9	9	9	9	9	9
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	4311	4311	4311	4311	4311	4311	4311	4311	4311
10.0	4610	4561	4498	4426	4330	4242	4157	4067	3984
20.0	5382	5319	5239	5118	4927	4722	4509	4317	4124
30.0	6269	6255	6161	6002	5729	5412	5112	4808	4469
35.0	6667	6642	6532	6347	6044	5693	5351	4998	4590
40.0	6964	6916	6796	6592	6261	5878	5482	5060	4599
45.0	7147	7079	6942	6709	6341	5928	5468	5014	4495
47.5	7197	7120	6952	6707	6319	5886	5398	4893	4358
50.0	7218	7121	6936	6666	6258	5806	5299	4762	4196
52.5	7226	7134	6927	6628	6177	5703	5178	4620	4015
55.0	7251	7173	6946	6612	6121	5603	5049	4452	3790
57.5	7312	7266	7026	6635	6081	5502	4914	4268	3537
60.0	7470	7439	7190	6745	6099	5445	4811	4095	3278
62.5	7728	7731	7468	6953	6192	5454	4741	3928	3017
65.0	8041	8111	7864	7259	6351	5509	4712	3785	2771
67.5	8269	8424	8151	7423	6345	5439	4591	3564	2475
70.0	8024	8223	7920	7049	5876	4990	4184	3114	2017
72.5	7040	7219	6958	6076	4925	4116	3406	2403	1399
75.0	5451	5603	5391	4751	3740	3029	2428	1554	793
77.5	3734	3882	3764	3419	2682	2023	1482	801	398
80.0	2324	2465	2442	2306	1843	1286	789	353	238
82.5	1234	1264	1272	1170	987	652	332	150	135
85.0	276	286	284	261	241	159	71	54	45
87.5	9	9	9	8	8	8	7	7	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	4311	4311	4311	4311	4311	4311	4311	4311	4311
10.0	3912	3854	3800	3753	3707	3673	3602	3535	3498
20.0	3932	3737	3545	3371	3218	3103	2925	2766	2699
30.0	4121	3771	3405	3037	2696	2422	2090	1827	1731
35.0	4166	3722	3252	2785	2352	2007	1597	1327	1258
40.0	4113	3580	3003	2410	1886	1499	1181	1115	1109
45.0	3911	3274	2565	1858	1335	1092	1035	1067	1129
47.5	3744	3051	2285	1563	1126	1014	1001	1136	1235
50.0	3539	2782	1992	1298	1017	991	986	1214	1260
52.5	3295	2487	1683	1083	980	969	1000	1101	1001
55.0	3010	2163	1379	945	930	941	1000	897	778
57.5	2705	1835	1109	867	883	906	917	786	690
60.0	2392	1526	933	826	847	870	835	735	675
62.5	2089	1265	821	784	812	832	768	691	645
65.0	1822	1045	742	734	773	790	717	681	666
67.5	1510	838	667	682	716	739	681	793	788
70.0	1118	643	590	619	659	682	677	897	876
72.5	723	502	505	540	586	618	687	844	854
75.0	441	393	415	447	502	550	591	693	774
77.5	298	297	315	350	390	426	420	547	652
80.0	216	205	221	248	271	280	255	388	503
82.5	123	120	128	145	160	167	141	204	334
85.0	43	45	49	56	65	71	67	52	104
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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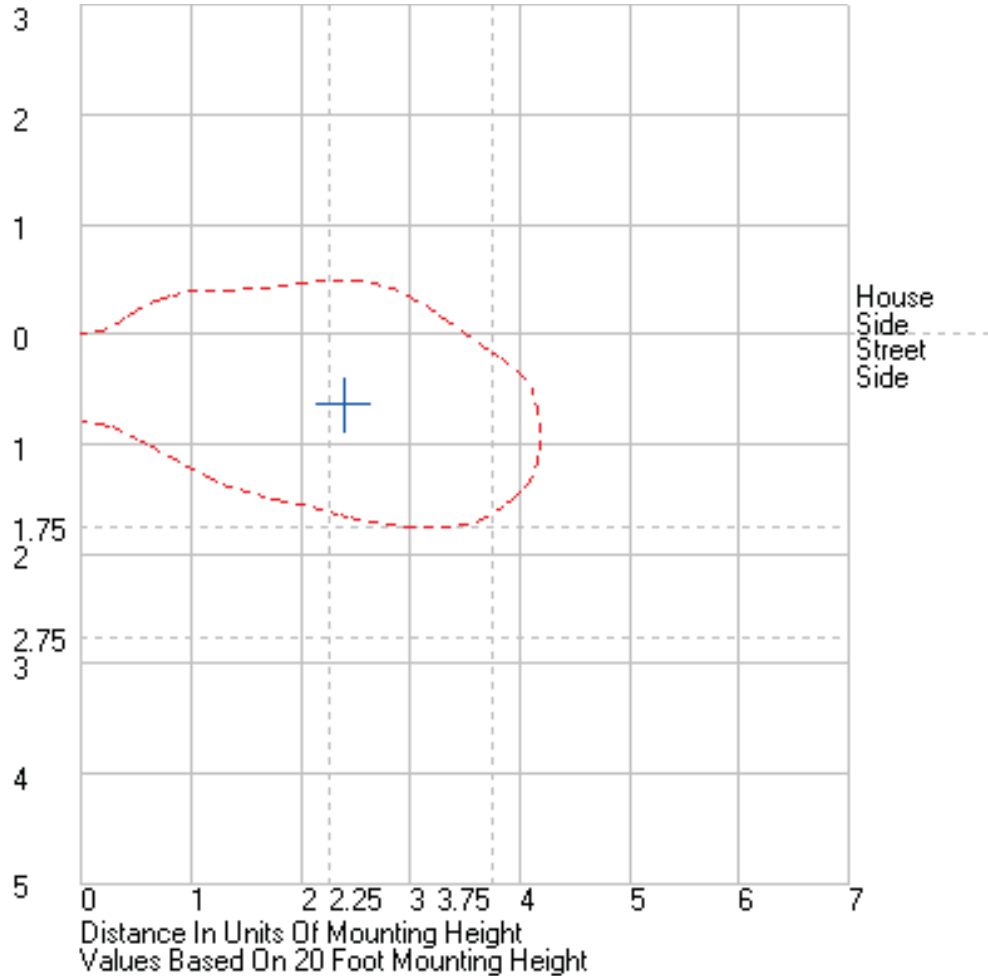
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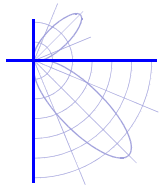
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LM-79 Performance Data

Spectral	CIE 1931 (x, y) ⁽¹⁾	(0.383, 0.379)
	CIE 1976 (u', v') ⁽¹⁾	(0.226, 0.503)
	Correlated Color Temperature (CCT) ⁽¹⁾	3950 K
	Spatial Δ (u', v') Uniformity ⁽²⁾	2.06E-03
	Color Rendering Index (Ra) ⁽¹⁾	71.4
	Special CRI 9 (R ₉) ^{(1),(3)}	-38.5
	Distance from Planckian Locus (Duv) ^{(1),(3)}	4.55E-04
	Scotopic/Photopic Ratio ^{(1),(3)}	1.51

Electrical	Voltage	120.0 V	(Setpoint 1)
	Frequency	60.0 Hz	
	Current	0.958 A	
	Power	115 W	
	Power Factor	1.00	
	Current THD	3.9 %	
	Voltage	277.0 V	(Setpoint 2)
	Frequency	60.0 Hz	
	Current	0.429 A	
	Power	113 W	
	Power Factor	0.95	
	Current THD	7.0 %	

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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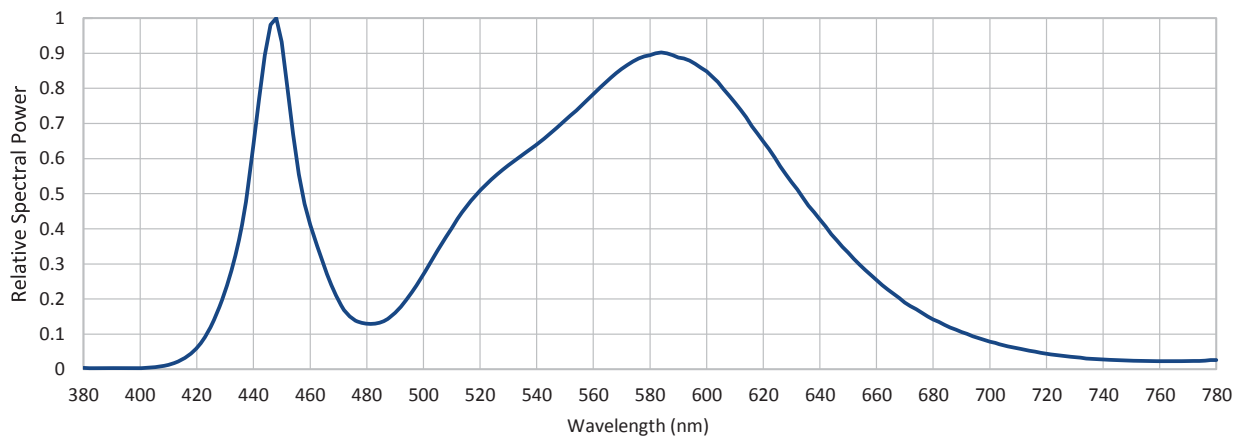
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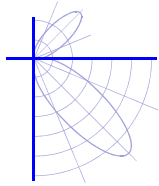
LM-79 Performance Data

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	0.004	460	0.411	540	0.640	620	0.649	700	0.079
385	0.003	465	0.293	545	0.673	625	0.590	705	0.068
390	0.003	470	0.195	550	0.709	630	0.533	710	0.059
395	0.003	475	0.145	555	0.745	635	0.477	715	0.051
400	0.003	480	0.130	560	0.784	640	0.427	720	0.044
405	0.006	485	0.134	565	0.822	645	0.376	725	0.039
410	0.013	490	0.161	570	0.855	650	0.332	730	0.035
415	0.029	495	0.209	575	0.881	655	0.291	735	0.031
420	0.061	500	0.271	580	0.895	660	0.254	740	0.028
425	0.124	505	0.338	585	0.901	665	0.221	745	0.026
430	0.222	510	0.402	590	0.888	670	0.190	750	0.025
435	0.376	515	0.461	595	0.875	675	0.166	755	0.024
440	0.638	520	0.509	600	0.848	680	0.142	760	0.023
445	0.938	525	0.548	605	0.808	685	0.123	765	0.023
450	0.932	530	0.581	610	0.759	690	0.106	770	0.024
455	0.612	535	0.611	615	0.705	695	0.091	775	0.025
								780	0.026





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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	(0.225, 0.502)	(0.225, 0.502)
10.0	(0.225, 0.502)	(0.225, 0.503)
20.0	(0.226, 0.505)	(0.226, 0.503)
30.0	(0.226, 0.503)	(0.226, 0.502)
40.0	(0.226, 0.503)	(0.225, 0.502)
50.0	(0.226, 0.504)	(0.225, 0.502)
60.0	(0.227, 0.505)	(0.225, 0.503)
70.0	(0.225, 0.501)	I <= 10% peak
80.0	(0.226, 0.504)	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 2.5 / 15.0 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-20010-6

LED Roadway Lighting - Roadway luminaire. Product ID: QB 00 660M X 5 30 X 4G2S XXXX

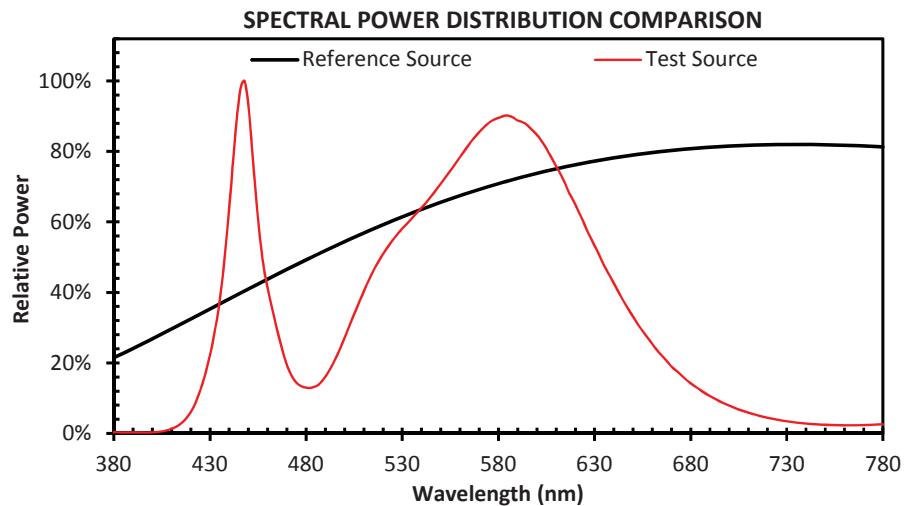
Grey cast aluminum top housing and white plastic bottom housing with clear flat glass lens.

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

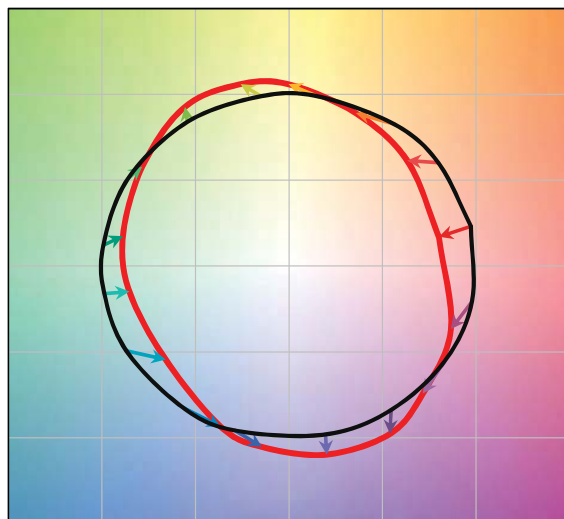
One Osram Optotronic LED driver. Model: QT180W/UNV/1250C/2DIM/P6 set to 900 ma.

Operating at 120v AC and 60 Hz.

R_f	71
R_g	94



COLOR VECTOR GRAPHIC



— Test Source

→ Series1

COLOR DISTORTION GRAPHIC





Test Report No. LLI-20010-6

LED Roadway Lighting - Roadway luminaire. Product ID: QB 00 660M X 5 30 X 4G2S 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 25.3 °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.