



Report of Test LLI-19275-4

LED Roadway Lighting - Roadway luminaire. Product ID: QB 00 616S X 5 20 X 3G2S XXXX XXXX
Grey cast aluminum top housing and white plastic bottom housing with clear flat glass lens.
16 LEDs in 4 x 4 array with clear plastic sheet of individual lenses.
One Osram Optotronic LED driver. Model: QT50W/UNV/800C/2DIMLT2/P6 set to 400ma.
Operating at 120v AC and 60 Hz.



Performance Summary

Total Light Output	2897 lm	Min Power Factor	0.84 @ 277 V
Luminaire Power	22.4 W	Max THD(i)*	15.0 % @ 277 V
Luminous Efficacy	129.3 lm/W	0-90° Zonal Flux %	100.0 %
CCT	2980 K	80-90° Zonal Flux %	0.6 %
CIE(x,y) 1931	(0.439, 0.406)	BUG Rating*	B1-U0-G1
CRI	71	Street Classification*	Type II Short

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



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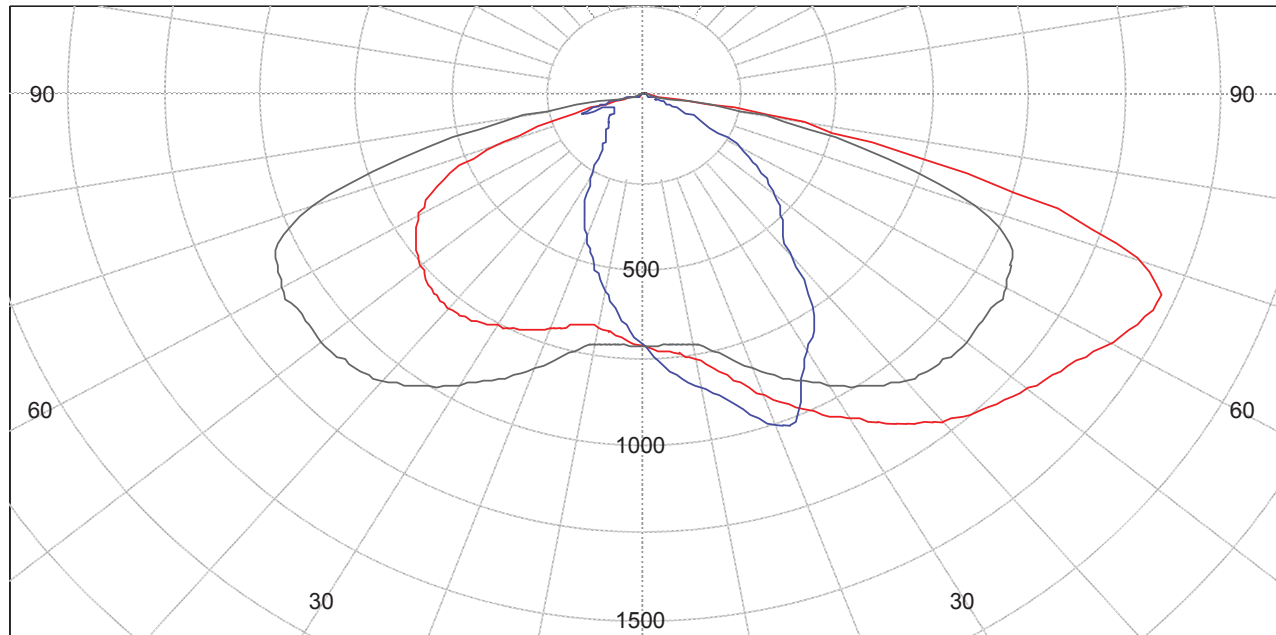
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Polar Light Distribution Curves



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 %	67.8 %	67.8 %
House Side	0.0 %	32.2 %	32.2 %
	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

15-Oct-2019
16-Oct-2019

RT



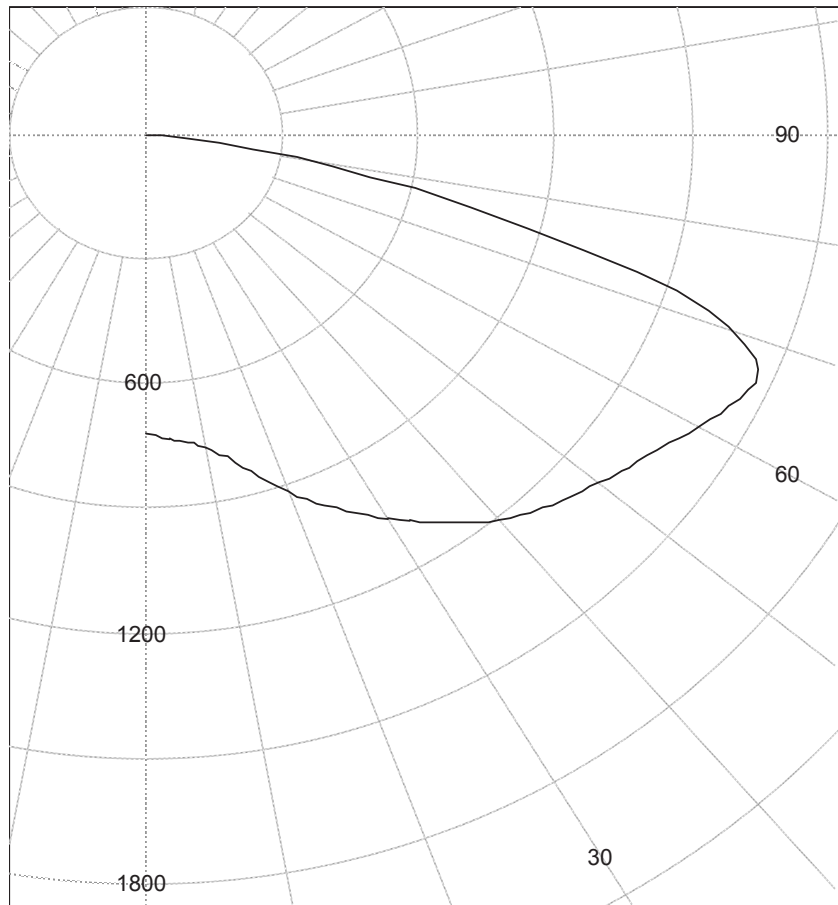
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Intensity in principal plane
(based on overall max intensity)

Vertical Angle (°)	Intensity (cd)
0.0	718.5
10.0	765.4
20.0	912.0
30.0	1065.8
35.0	1142.8
40.0	1211.7
45.0	1262.1
47.5	1281.7
50.0	1303.2
52.5	1322.9
55.0	1343.1
57.5	1374.3
60.0	1406.0
62.5	1434.8
65.0	1461.2
67.5	1455.2
70.0	1366.1
72.5	1181.3
75.0	869.1
77.5	554.7
80.0	333.8
82.5	130.3
85.0	5.7
87.5	2.4
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
1096.7 cd @ (90.0°, 50.0°)

Street side max intensity
1465.6 cd @ (72.5°, 66.5°)

Coordinates expressed in the C Type coordinate system
Data for the two symmetric halves of the luminaire has been averaged.



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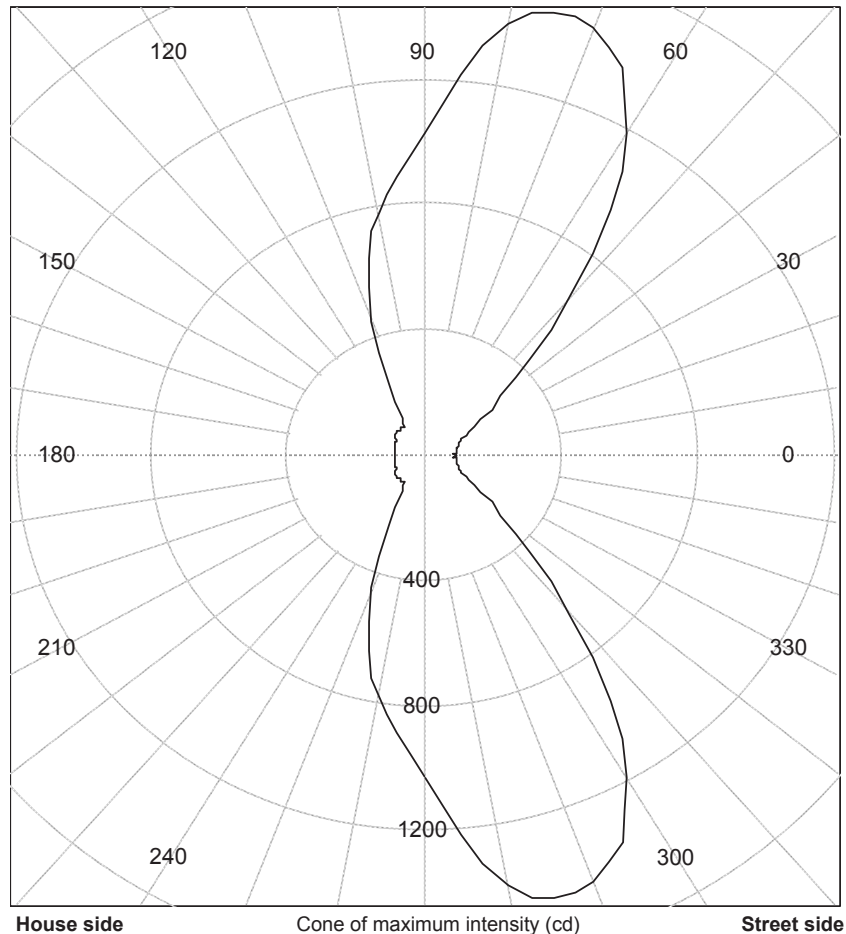
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Operating at 120v AC and 60 Hz.

Intensity in principal cone
(based on overall max intensity)

Lateral Plane (°)	(V66.5) (cd)
0	88.5
15	94.2
30	148.3
40	294.8
45	435.6
50	660.0
55	954.6
60	1187.9
65	1359.8
70	1444.3
75	1463.5
80	1393.5
85	1219.3
90	1030.2
95	889.8
100	785.1
105	646.8
110	451.0
115	249.9
120	132.1
125	103.0
130	107.8
135	111.5
140	107.8
150	95.7
165	91.3
180	89.4

Principal Conical Surface



House side max intensity
1096.7 cd @ (90.0°, 50.0°)

Street side max intensity
1465.6 cd @ (72.5°, 66.5°)

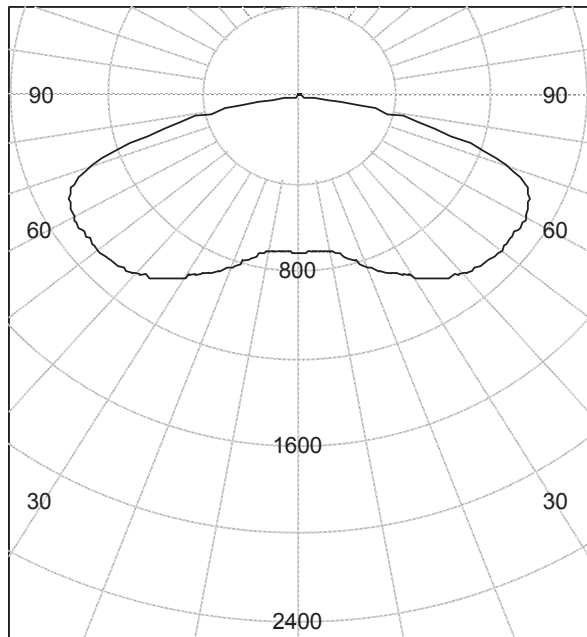
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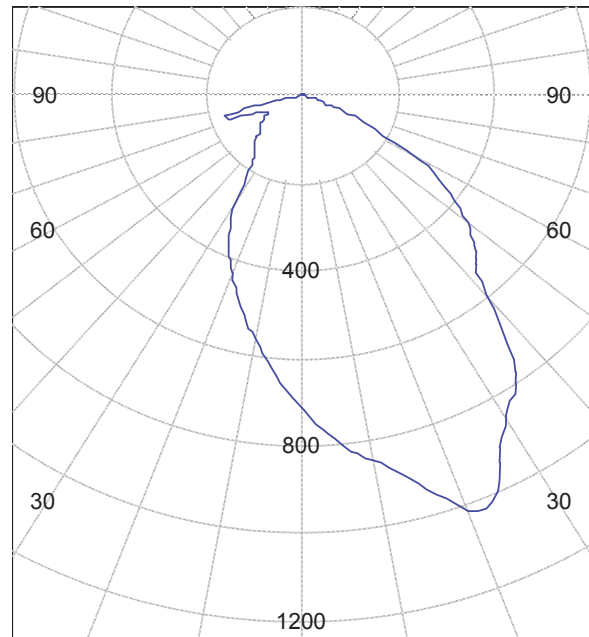
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Polar curve through L90 / L270



(L90) (cd) (L270)

Polar curve through L0 / L180



House side (L180) (cd) Street side (L0)



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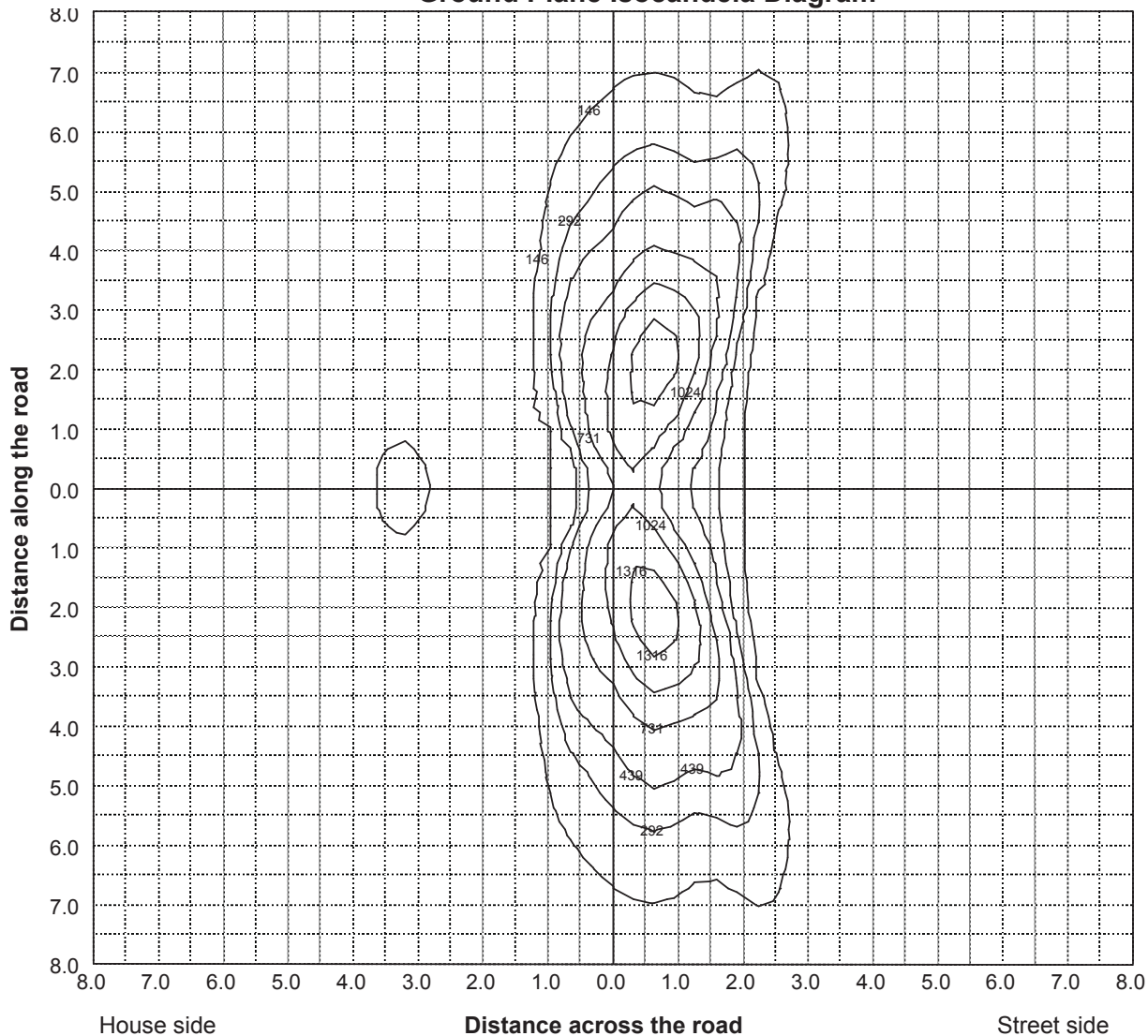
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Ground Plane Isocandela Diagram



The isocandela contour units are expressed as cd

Upstream and downstream sides have been averaged.



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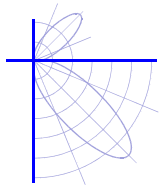
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Intensity data (cd)

Vertical	L-Plane								
	L0	L15	L30	L40	L45	L50	L55	L60	L65
0.0	718	718	718	718	718	718	718	718	718
10.0	848	840	831	821	814	808	798	789	778
20.0	1007	993	971	960	948	943	940	938	931
30.0	844	864	975	1084	1114	1121	1108	1097	1082
35.0	771	796	883	1015	1090	1149	1177	1177	1166
40.0	590	659	809	945	1027	1119	1197	1236	1239
45.0	505	543	708	884	978	1078	1175	1247	1278
47.5	479	516	665	848	957	1064	1160	1240	1289
50.0	446	484	627	812	933	1050	1145	1234	1294
52.5	405	439	593	773	910	1036	1141	1234	1306
55.0	359	387	543	728	885	1021	1137	1235	1310
57.5	318	335	477	672	844	1006	1144	1252	1332
60.0	248	272	406	602	777	977	1146	1269	1355
62.5	180	197	313	512	670	899	1108	1265	1373
65.0	116	126	206	386	532	766	1022	1224	1378
67.5	74	80	113	236	369	581	891	1156	1332
70.0	52	61	70	111	206	371	686	1017	1227
72.5	39	49	55	58	87	176	420	790	1025
75.0	31	38	43	43	44	64	165	493	787
77.5	25	31	30	33	31	33	43	215	493
80.0	20	24	18	21	21	20	22	69	245
82.5	9	12	9	10	10	11	11	18	69
85.0	4	4	4	4	4	4	5	5	6
87.5	2	2	2	2	2	2	2	2	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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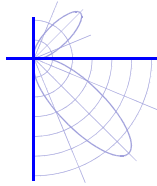
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Operating at 120v AC and 60 Hz.

Vertical	Intensity data (cd)								
	L-Plane								
	L70	L75	L80	L85	L90	L95	L100	L105	L110
0.0	718	718	718	718	718	718	718	718	718
10.0	771	759	747	735	722	710	695	682	668
20.0	920	901	880	858	832	803	770	733	692
30.0	1073	1058	1030	994	954	911	856	797	738
35.0	1150	1132	1106	1062	1015	960	894	824	754
40.0	1224	1199	1167	1117	1062	997	918	838	760
45.0	1274	1246	1208	1151	1086	1008	919	833	750
47.5	1292	1264	1221	1161	1091	1006	911	823	739
50.0	1312	1286	1238	1173	1097	1003	901	809	722
52.5	1330	1307	1255	1180	1093	993	889	797	706
55.0	1345	1330	1276	1189	1089	983	874	782	685
57.5	1373	1364	1305	1207	1094	978	866	770	660
60.0	1403	1394	1332	1218	1087	959	847	747	619
62.5	1430	1426	1358	1224	1074	940	829	717	562
65.0	1448	1457	1389	1229	1054	916	809	681	496
67.5	1428	1456	1388	1204	1008	865	762	617	415
70.0	1331	1380	1329	1131	919	782	679	517	308
72.5	1143	1198	1176	981	772	657	560	378	196
75.0	854	894	921	776	584	499	408	228	101
77.5	586	544	585	534	408	331	247	109	48
80.0	365	289	304	312	253	191	116	39	24
82.5	128	103	84	103	91	61	28	11	11
85.0	6	5	5	5	5	5	5	5	5
87.5	2	2	2	3	2	2	2	2	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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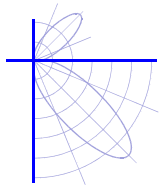
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Operating at 120v AC and 60 Hz.

Intensity data (cd)

Vertical	L-Plane								
	L115	L120	L125	L130	L135	L140	L150	L165	L180
0.0	718	718	718	718	718	718	718	718	718
10.0	654	640	626	614	605	595	580	569	566
20.0	652	613	577	544	515	492	463	439	433
30.0	679	621	563	506	452	406	342	294	276
35.0	683	615	546	476	405	339	254	204	191
40.0	683	603	513	422	326	246	179	163	159
45.0	664	568	456	326	218	166	153	144	138
47.5	645	542	410	267	178	151	147	135	128
50.0	622	505	354	216	154	145	141	130	121
52.5	596	454	294	178	145	142	135	125	115
55.0	557	389	233	151	139	139	129	121	106
57.5	504	323	186	136	136	135	123	108	95
60.0	438	261	152	127	131	130	115	100	89
62.5	366	205	128	120	126	122	107	95	85
65.0	294	158	111	112	118	114	99	93	86
67.5	219	118	98	104	106	103	93	93	97
70.0	152	89	86	96	94	94	87	109	135
72.5	93	68	73	82	79	80	73	143	170
75.0	57	52	60	62	63	64	77	125	138
77.5	37	38	43	42	43	47	60	94	110
80.0	22	23	24	24	26	28	33	47	61
82.5	10	10	9	9	10	9	6	12	21
85.0	4	3	3	2	2	2	1	1	1
87.5	2	1	1	1	1	0	0	0	0
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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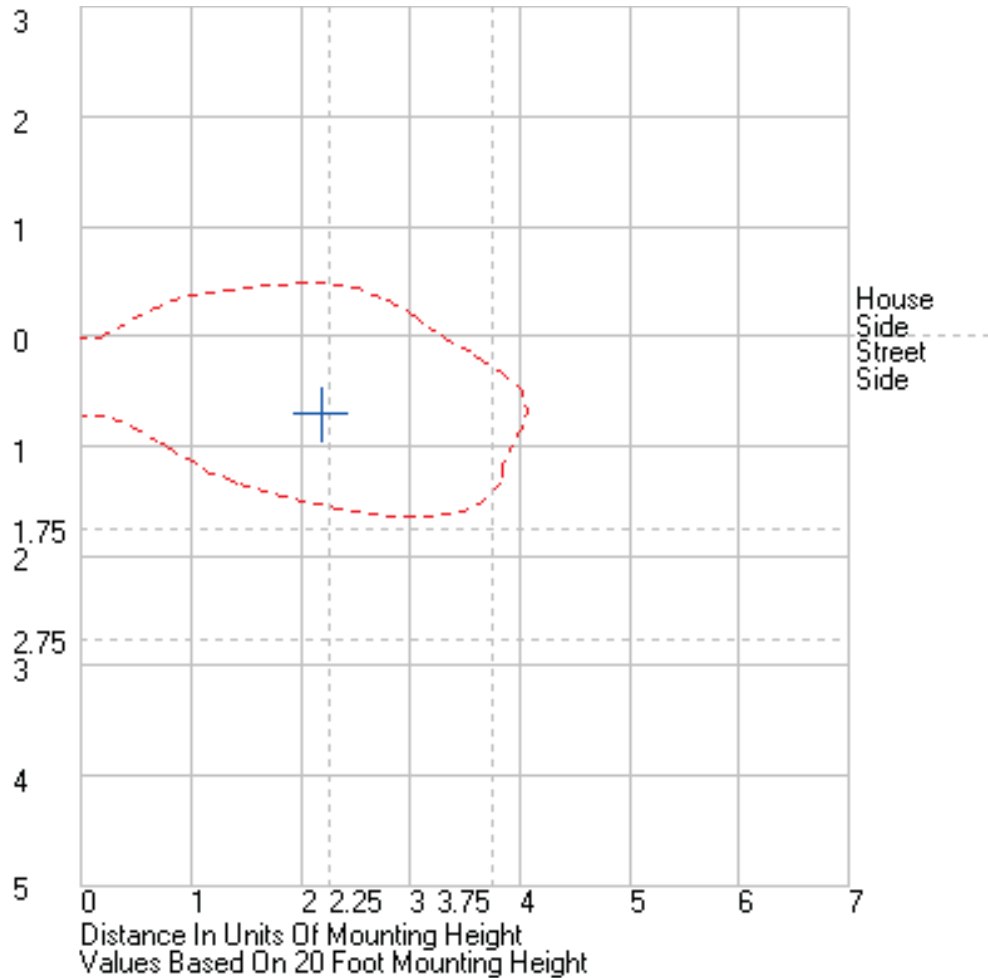
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LM-79 Performance Data

Spectral	CIE 1931 (x, y) ⁽¹⁾	(0.439, 0.406)
	CIE 1976 (u', v') ⁽¹⁾	(0.251, 0.522)
	Correlated Color Temperature (CCT) ⁽¹⁾	2980 K
	Spatial Δ (u', v') Uniformity ⁽²⁾	2.49E-03
	Color Rendering Index (Ra) ⁽¹⁾	71.3
	Special CRI 9 (R ₉) ^{(1),(3)}	-41.4
	Distance from Planckian Locus (Duv) ^{(1),(3)}	4.50E-04
	Scotopic/Photopic Ratio ^{(1),(3)}	1.22

Electrical	Voltage	120.0 V	(Setpoint 1)
	Frequency	60.0 Hz	
	Current	0.191 A	
	Power	22.4 W	
	Power Factor	0.98	
	Current THD	6.1 %	
	Voltage	277.0 V	(Setpoint 2)
	Frequency	60.0 Hz	
	Current	0.097 A	
	Power	22.6 W	
	Power Factor	0.84	
	Current THD	15 %	

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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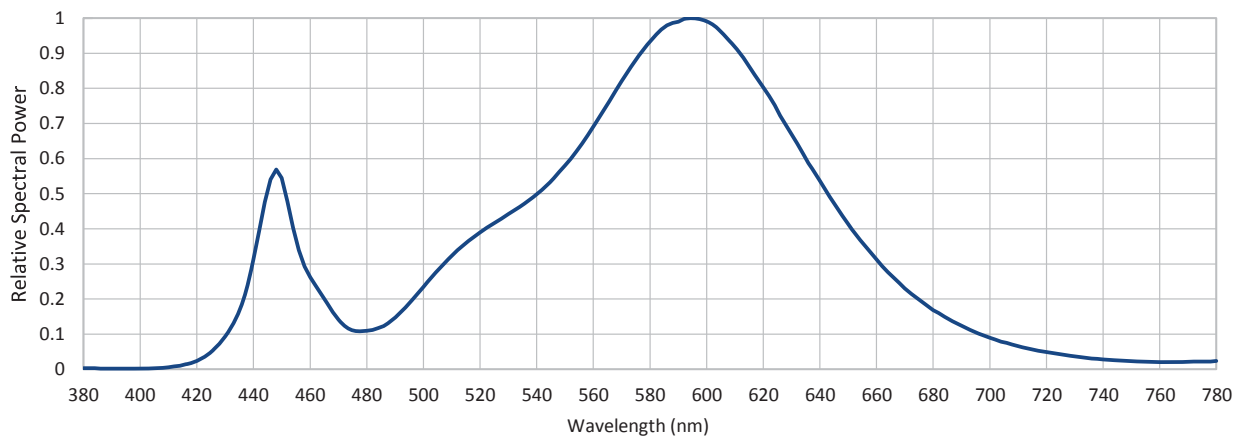
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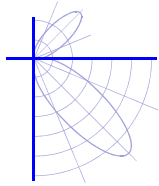
LM-79 Performance Data

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	0.262	540	0.498	620	0.803	700	0.090
385	0.003	465	0.200	545	0.536	625	0.737	705	0.077
390	0.002	470	0.141	550	0.580	630	0.669	710	0.066
395	0.002	475	0.112	555	0.632	635	0.600	715	0.057
400	0.002	480	0.110	560	0.691	640	0.537	720	0.049
405	0.003	485	0.120	565	0.755	645	0.472	725	0.042
410	0.006	490	0.147	570	0.820	650	0.414	730	0.037
415	0.012	495	0.188	575	0.881	655	0.360	735	0.032
420	0.024	500	0.235	580	0.933	660	0.313	740	0.028
425	0.050	505	0.281	585	0.973	665	0.269	745	0.025
430	0.093	510	0.323	590	0.990	670	0.230	750	0.023
435	0.168	515	0.360	595	1.000	675	0.199	755	0.021
440	0.313	520	0.390	600	0.991	680	0.169	760	0.021
445	0.508	525	0.417	605	0.962	685	0.145	765	0.020
450	0.545	530	0.442	610	0.917	690	0.124	770	0.021
455	0.371	535	0.469	615	0.863	695	0.105	775	0.022
								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, 0.520)	(0.250, 0.521)
10.0	(0.250, 0.521)	(0.251, 0.522)
20.0	(0.251, 0.522)	(0.250, 0.520)
30.0	(0.251, 0.522)	(0.252, 0.523)
40.0	(0.251, 0.522)	(0.250, 0.522)
50.0	(0.251, 0.522)	(0.250, 0.522)
60.0	(0.251, 0.523)	(0.251, 0.524)
70.0	(0.252, 0.523)	I <= 10% peak
80.0	(0.250, 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 / 2.75 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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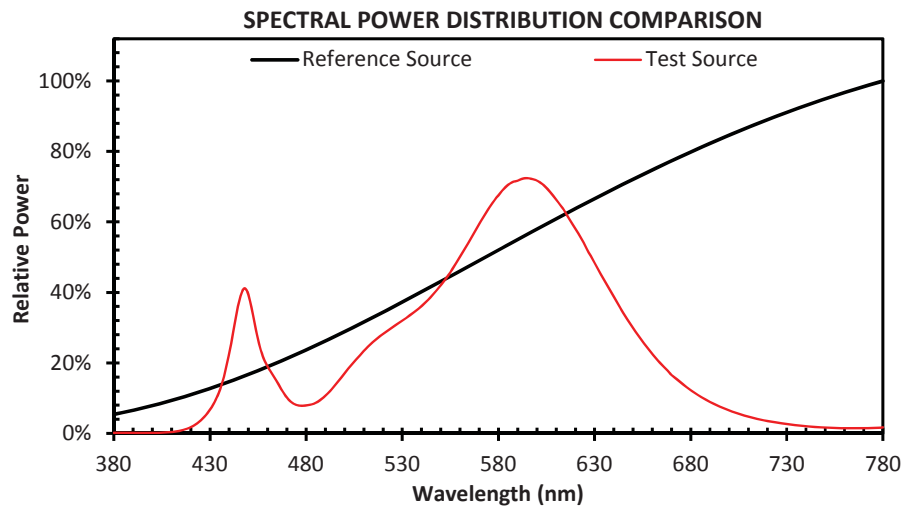
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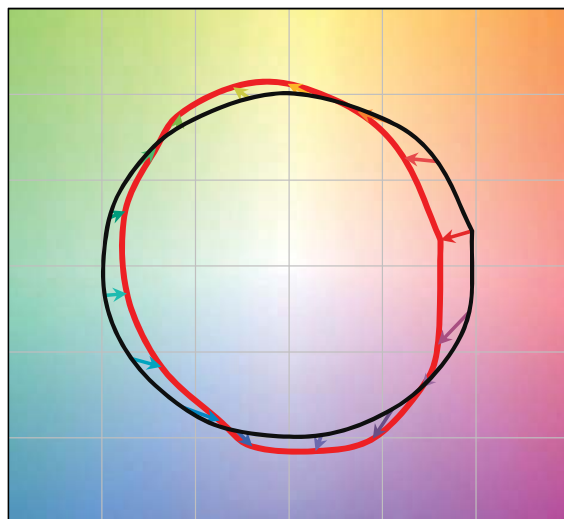
Test Report No. LLI-19275-4

LED Roadway Lighting - Roadway luminaire. Product ID: QB 00 616S X 5 20 X 3G2S XXXX XXXX
Grey cast aluminum top housing and white plastic bottom housing with clear flat glass lens.
16 LEDs in 4 x 4 array with clear plastic sheet of individual lenses.
One Osram Optotronic LED driver. Model: QT50W/UNV/800C/2DIMLT2/P6 set to 400ma.
Operating at 120v AC and 60 Hz.

R_f	73
R_g	93



COLOR VECTOR GRAPHIC

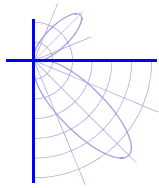


— Test Source

→ Series1

COLOR DISTORTION GRAPHIC





Test Report No. LLI-19275-4

LED Roadway Lighting - Roadway luminaire. Product ID: QB 00 616S X 5 20 X 3G2S XXXX XXXX
Grey cast aluminum top housing and white plastic bottom housing with clear flat glass lens.
16 LEDs in 4 x 4 array with clear plastic sheet of individual lenses.
One Osram Optotronic LED driver. Model: QT50W/UNV/800C/2DIMLT2/P6 set to 400ma.
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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