



Report of Test LLI-19244-4

LED Roadway Lighting - Roadway luminaire. Product ID: QB 00 616S X 5 25 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 500ma.
Operating at 120v AC and 60 Hz.



Performance Summary

Total Light Output	3581 lm	Min Power Factor	0.88 @ 277 V
Luminaire Power	27.6 W	Max THD(i)*	13.0 % @ 277 V
Luminous Efficacy	129.7 lm/W	0-90° Zonal Flux %	100.0 %
CCT	3040 K	80-90° Zonal Flux %	0.6 %
CIE(x,y) 1931	(0.434, 0.404)	BUG Rating*	B1-U0-G1
CRI	72	Street Classification*	Type II Short

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



LightLab
INTERNATIONAL

LightLab International, LLC
Phoenix AZ 85085



This document is issued in accordance with the accreditation requirements of NVLAP. The laboratory is accredited for compliance with ISO/IEC 17025. The results of the tests, calibrations and/or measurements included in this document are traceable to the SI system of units.

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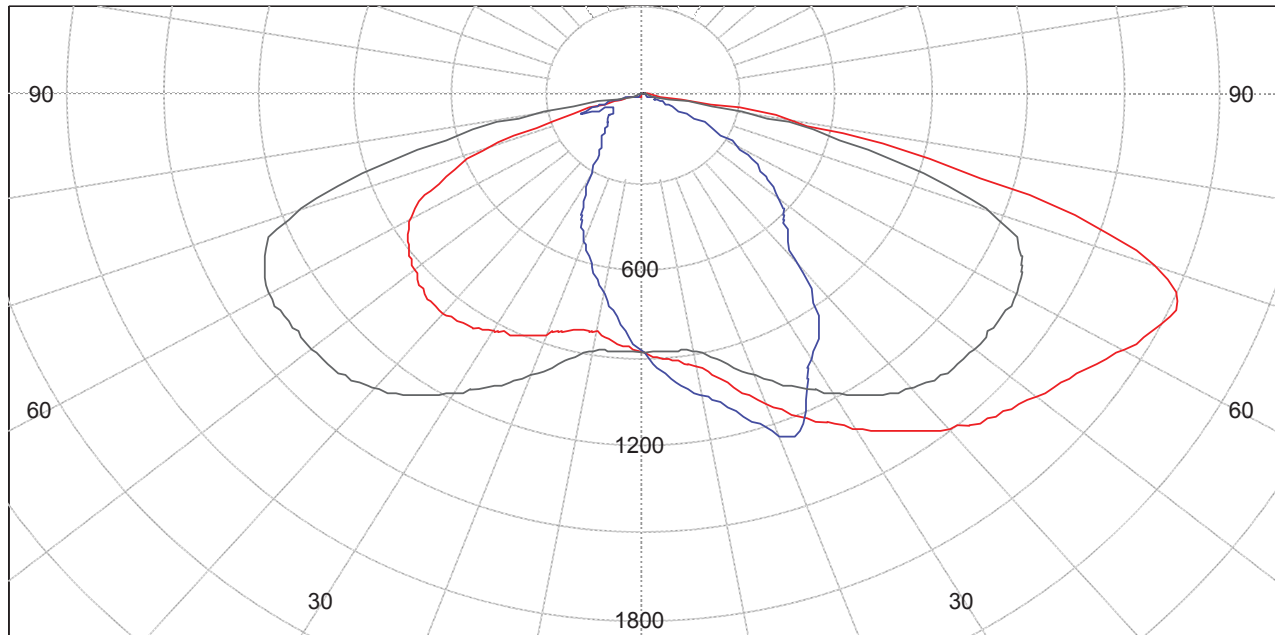




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Polar Light Distribution Curves



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 %	68.0 %	68.0 %
House Side	0.0 %	32.0 %	32.0 %
	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

19-Sep-2019
23-Sep-2019



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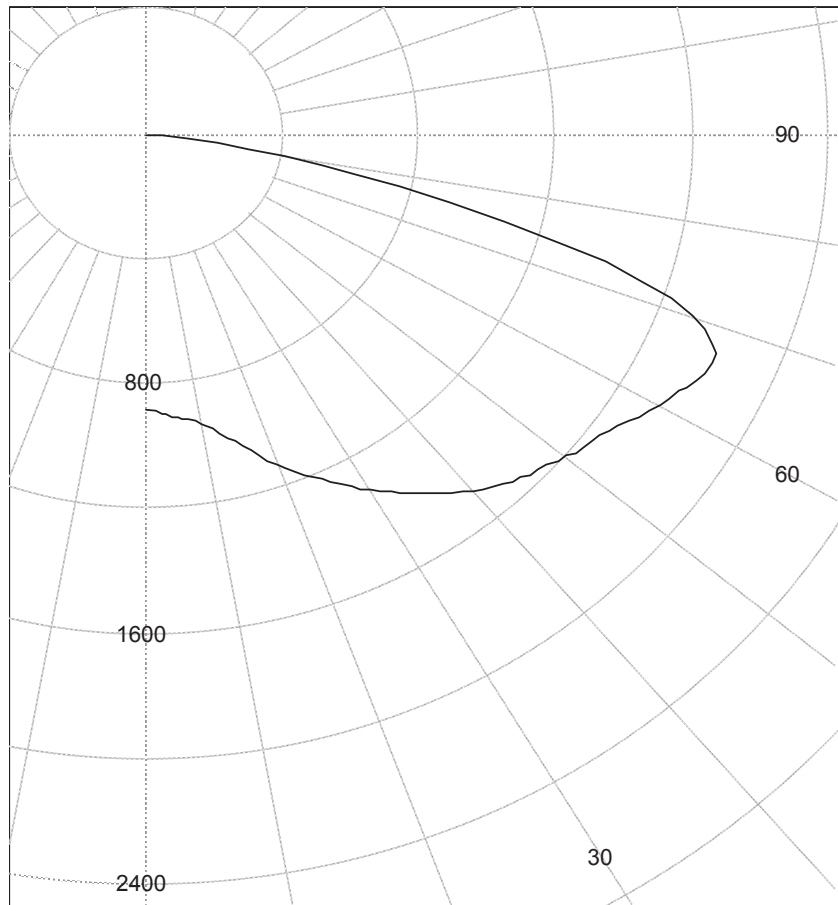
One Osram Optotronic LED driver. Model: QT50W/UNV/800C/2DIMLT2/P6 set to 500ma.

Operating at 120v AC and 60 Hz.

Intensity in principal plane
(based on overall max intensity)

Vertical Angle (°)	Intensity (cd)
0.0	884.1
10.0	942.0
20.0	1124.2
30.0	1314.8
35.0	1409.0
40.0	1493.4
45.0	1556.6
47.5	1580.0
50.0	1606.1
52.5	1632.9
55.0	1657.9
57.5	1697.6
60.0	1737.5
62.5	1774.5
65.0	1810.0
67.5	1804.5
70.0	1699.7
72.5	1473.4
75.0	1088.5
77.5	694.7
80.0	419.1
82.5	167.2
85.0	8.4
87.5	3.0
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
1356.3 cd @ (90.0°, 58.0°)

Street side max intensity
1815.5 cd @ (72.5°, 66.0°)

Coordinates expressed in the C Type coordinate system

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



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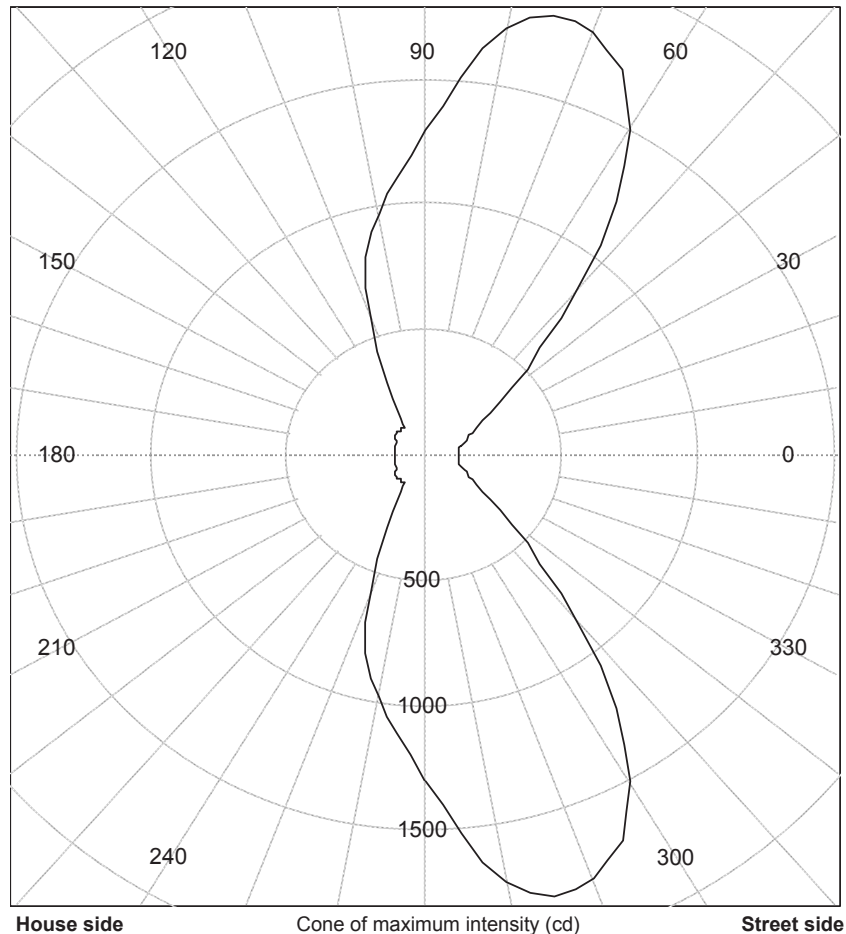
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Operating at 120v AC and 60 Hz.

Intensity in principal cone
(based on overall max intensity)

Lateral Plane (°)	(V66.0) (cd)
0	123.7
15	133.0
30	216.5
40	416.8
45	596.1
50	879.7
55	1222.7
60	1493.1
65	1697.9
70	1795.4
75	1814.0
80	1728.1
85	1515.4
90	1289.7
95	1116.9
100	983.9
105	815.0
110	573.1
115	322.7
120	169.9
125	129.2
130	134.0
135	139.4
140	134.5
150	118.4
165	111.9
180	107.8

Principal Conical Surface



House side max intensity
1356.3 cd @ (90.0°, 58.0°)

Street side max intensity
1815.5 cd @ (72.5°, 66.0°)

Coordinates expressed in the C Type coordinate system

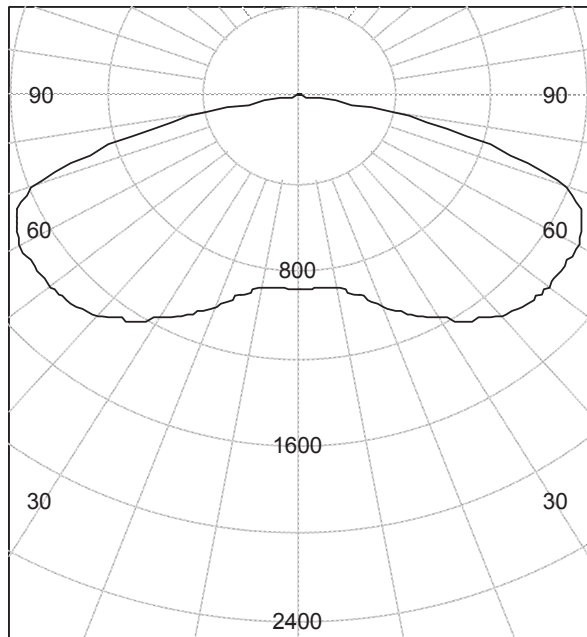
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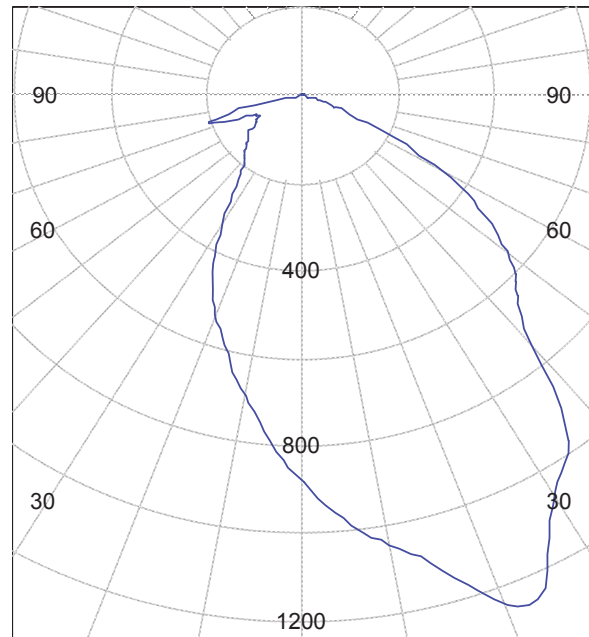
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Polar curve through L90 / L270



(L90) (cd) (L270)

Polar curve through L0 / L180



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

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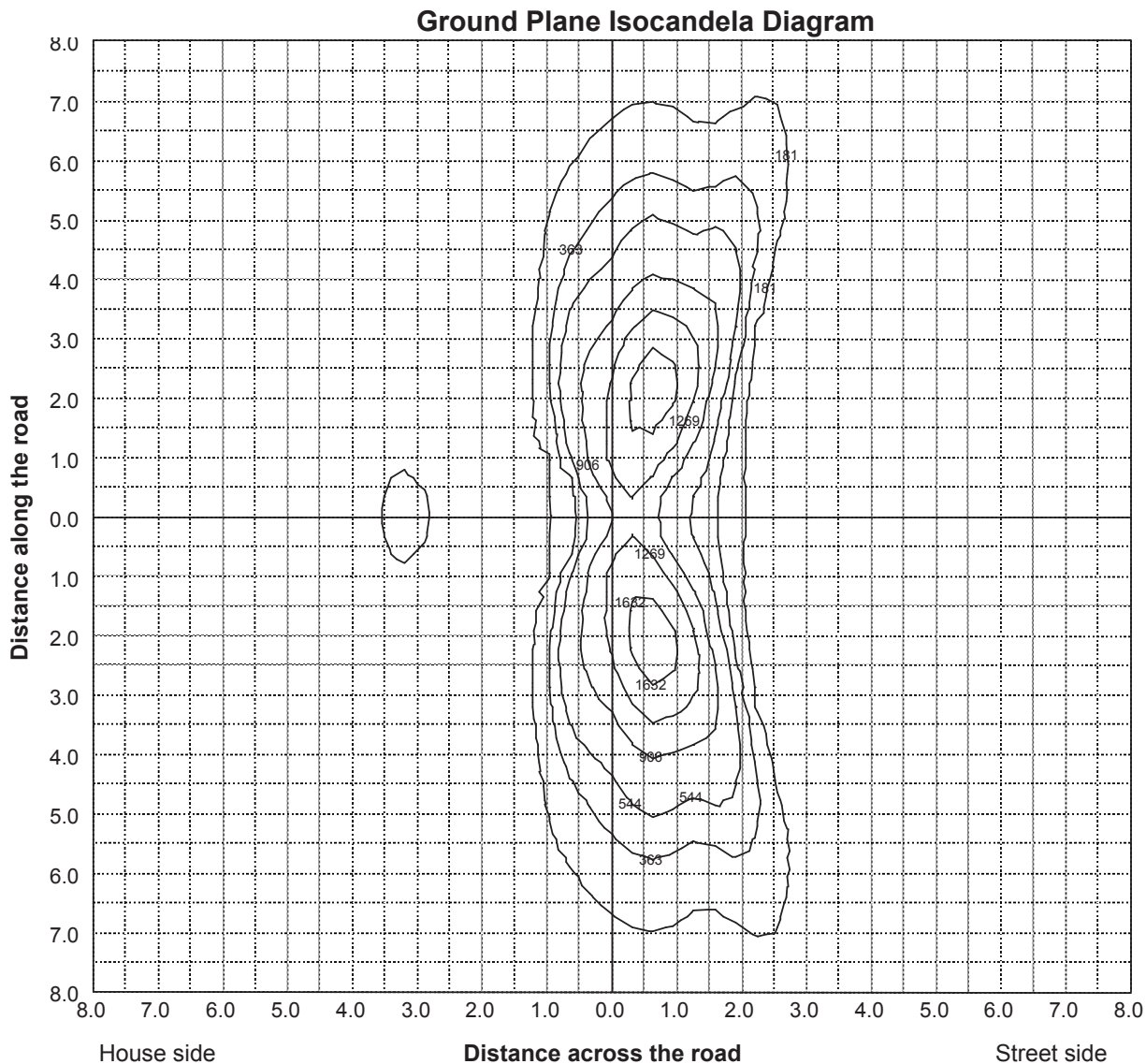
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The isocandela contour units are expressed as cd

Upstream and downstream sides have been averaged.



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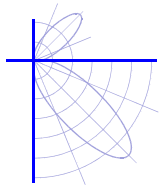
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Intensity data (cd)

Vertical	L-Plane								
	L0	L15	L30	L40	L45	L50	L55	L60	L65
0.0	884	884	884	884	884	884	884	884	884
10.0	1043	1034	1022	1010	1003	994	983	970	959
20.0	1238	1222	1192	1178	1164	1159	1157	1155	1146
30.0	1047	1076	1213	1346	1377	1381	1364	1348	1333
35.0	960	989	1097	1263	1354	1422	1453	1448	1436
40.0	741	828	1006	1174	1276	1388	1482	1526	1527
45.0	628	678	884	1098	1215	1335	1456	1542	1579
47.5	596	643	828	1054	1186	1317	1438	1536	1592
50.0	556	604	780	1010	1155	1298	1418	1529	1600
52.5	505	549	737	962	1129	1282	1412	1528	1615
55.0	448	485	677	907	1099	1264	1405	1527	1622
57.5	398	420	598	839	1050	1244	1413	1547	1648
60.0	315	345	510	754	970	1212	1418	1569	1674
62.5	229	251	397	644	842	1122	1377	1567	1699
65.0	149	163	264	492	674	960	1273	1518	1706
67.5	94	102	147	305	472	737	1118	1438	1656
70.0	66	77	88	145	268	476	866	1271	1526
72.5	49	61	69	74	114	230	538	995	1279
75.0	39	48	54	54	56	85	217	628	986
77.5	32	39	38	41	39	42	56	276	622
80.0	26	31	24	27	27	25	28	88	310
82.5	12	16	12	13	14	14	15	23	88
85.0	4	5	5	5	5	6	6	6	9
87.5	2	2	2	2	3	3	3	3	3
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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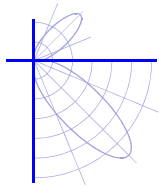
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Operating at 120v AC and 60 Hz.

Intensity data (cd)

Vertical	L-Plane								
	L70	L75	L80	L85	L90	L95	L100	L105	L110
0.0	884	884	884	884	884	884	884	884	884
10.0	948	934	919	903	890	871	855	839	822
20.0	1135	1111	1084	1056	1025	987	947	901	851
30.0	1323	1304	1270	1224	1177	1120	1052	979	906
35.0	1418	1397	1363	1306	1251	1180	1100	1014	927
40.0	1509	1478	1438	1375	1311	1227	1131	1034	935
45.0	1571	1536	1490	1419	1342	1243	1131	1027	923
47.5	1594	1560	1506	1430	1348	1241	1123	1014	910
50.0	1620	1586	1529	1444	1355	1237	1113	997	888
52.5	1644	1615	1551	1454	1351	1227	1097	984	867
55.0	1661	1640	1574	1467	1349	1214	1079	966	841
57.5	1697	1684	1611	1490	1353	1210	1069	951	810
60.0	1737	1726	1646	1507	1347	1187	1048	924	760
62.5	1769	1764	1680	1514	1331	1165	1026	886	691
65.0	1795	1805	1719	1520	1307	1135	1002	842	610
67.5	1775	1806	1719	1490	1248	1073	942	762	507
70.0	1658	1718	1649	1400	1140	969	840	637	376
72.5	1430	1493	1463	1218	960	813	692	464	237
75.0	1069	1115	1145	964	726	617	500	277	122
77.5	736	678	727	664	507	409	301	132	57
80.0	463	360	378	386	311	232	138	47	29
82.5	165	130	104	127	111	74	32	13	13
85.0	9	7	7	7	7	6	6	6	6
87.5	3	3	3	3	3	3	3	3	3
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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Operating at 120v AC and 60 Hz.

Intensity data (cd)

Vertical	L-Plane								
	L115	L120	L125	L130	L135	L140	L150	L165	L180
0.0	884	884	884	884	884	884	884	884	884
10.0	804	787	770	756	744	732	715	700	695
20.0	800	754	709	668	633	604	569	540	532
30.0	833	763	691	620	554	495	419	358	334
35.0	839	756	670	582	495	412	310	248	232
40.0	839	740	627	512	394	297	219	199	195
45.0	816	696	554	392	262	202	187	176	168
47.5	792	663	498	321	215	185	181	165	155
50.0	763	617	428	259	188	178	172	159	147
52.5	730	553	355	214	178	175	165	153	142
55.0	681	472	281	183	171	171	158	147	129
57.5	615	392	225	166	166	166	150	132	116
60.0	536	317	185	155	161	159	141	122	109
62.5	447	249	155	147	154	150	131	116	104
65.0	358	191	135	138	145	139	121	114	105
67.5	266	142	120	128	130	127	114	114	121
70.0	183	108	105	118	114	115	106	136	170
72.5	112	82	89	100	96	98	90	177	208
75.0	68	63	72	76	76	78	95	148	165
77.5	44	46	53	53	54	58	72	112	132
80.0	26	29	31	30	33	37	41	50	68
82.5	13	13	13	13	13	12	7	11	20
85.0	5	5	4	3	2	2	2	1	1
87.5	2	2	2	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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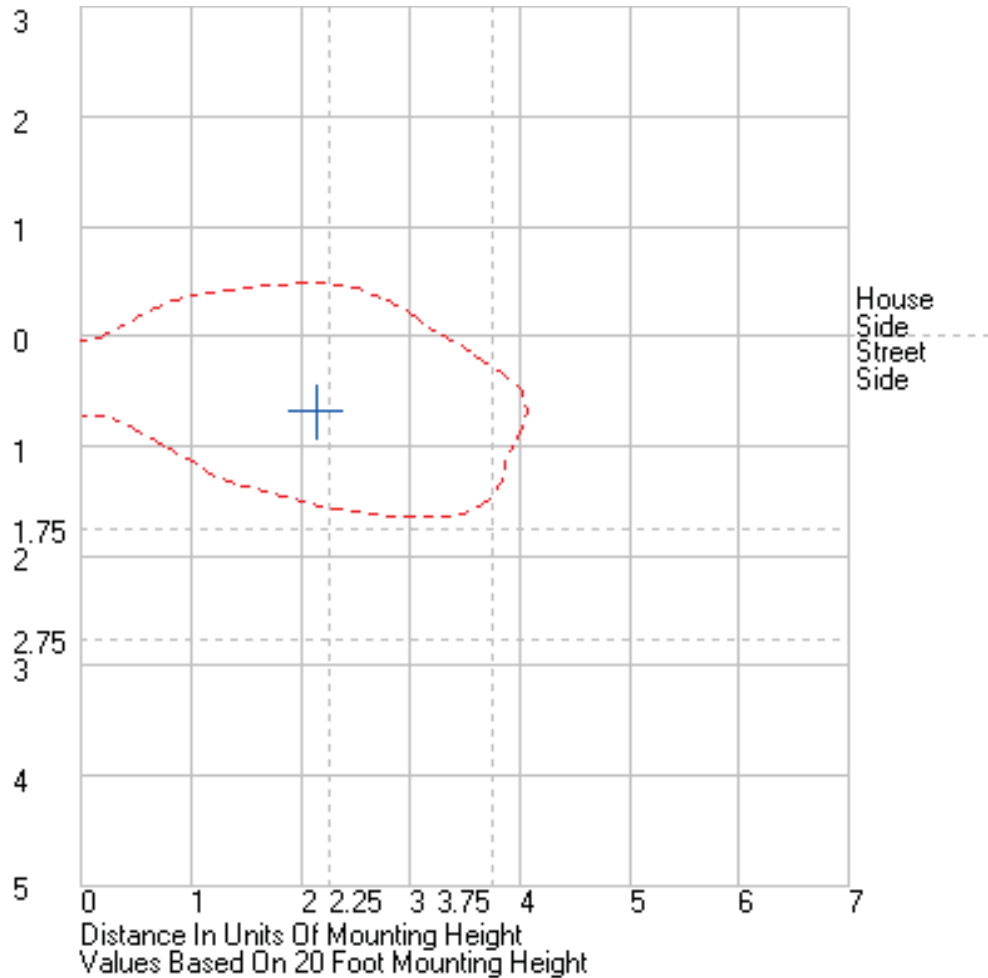
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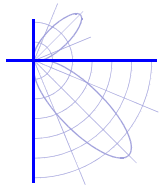
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LM-79 Performance Data

Spectral	CIE 1931 (x, y) ⁽¹⁾	(0.434, 0.404)
	CIE 1976 (u', v') ⁽¹⁾	(0.249, 0.521)
	Correlated Color Temperature (CCT) ⁽¹⁾	3040 K
	Spatial Δ (u', v') Uniformity ⁽²⁾	2.91E-03
	Color Rendering Index (Ra) ⁽¹⁾	71.5
	Special CRI 9 (R ₉) ^{(1),(3)}	-41.0
	Distance from Planckian Locus (Duv) ^{(1),(3)}	1.68E-04
	Scotopic/Photopic Ratio ^{(1),(3)}	1.24

Electrical	Voltage	120.0 V	(Setpoint 1)
	Frequency	60.0 Hz	
	Current	0.234 A	
	Power	27.6 W	
	Power Factor	0.98	
	Current THD	5.1 %	
	Voltage	277.0 V	(Setpoint 2)
	Frequency	60.0 Hz	
	Current	0.113 A	
	Power	27.7 W	
	Power Factor	0.88	
	Current THD	13 %	

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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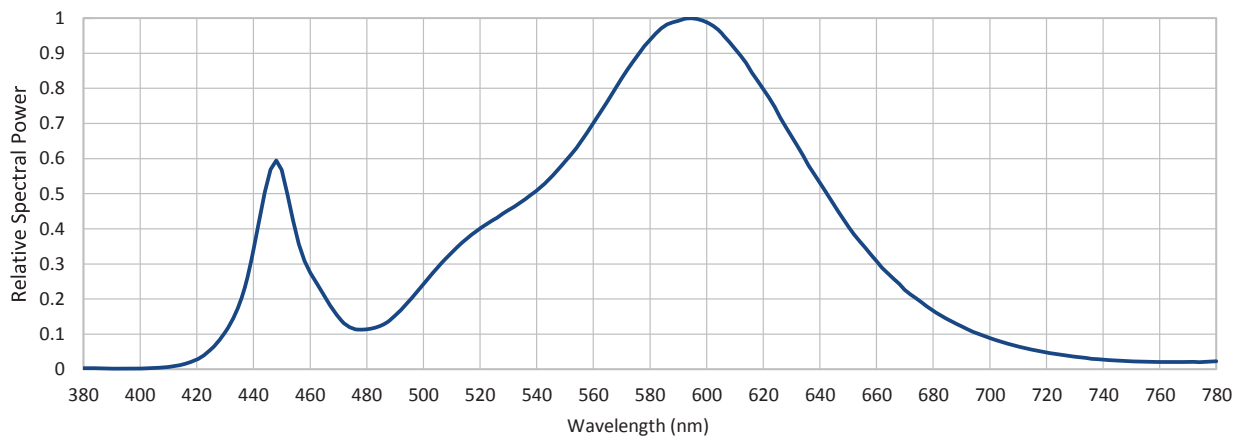
Operating at 120v AC and 60 Hz.

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	0.275	540	0.509	620	0.798	700	0.089
385	0.003	465	0.209	545	0.547	625	0.732	705	0.076
390	0.002	470	0.148	550	0.591	630	0.663	710	0.065
395	0.002	475	0.117	555	0.642	635	0.595	715	0.056
400	0.002	480	0.114	560	0.701	640	0.532	720	0.048
405	0.004	485	0.125	565	0.764	645	0.467	725	0.041
410	0.007	490	0.153	570	0.828	650	0.408	730	0.036
415	0.014	495	0.195	575	0.887	655	0.355	735	0.031
420	0.028	500	0.243	580	0.938	660	0.308	740	0.027
425	0.058	505	0.290	585	0.976	665	0.265	745	0.025
430	0.105	510	0.332	590	0.992	670	0.226	750	0.023
435	0.187	515	0.370	595	0.999	675	0.196	755	0.022
440	0.339	520	0.401	600	0.989	680	0.167	760	0.021
445	0.537	525	0.427	605	0.959	685	0.143	765	0.020
450	0.568	530	0.453	610	0.913	690	0.122	770	0.021
455	0.390	535	0.480	615	0.859	695	0.104	775	0.021
								780	0.023





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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	(0.248, 0.519)	(0.248, 0.519)
10.0	(0.248, 0.519)	(0.249, 0.521)
20.0	(0.249, 0.521)	(0.248, 0.519)
30.0	(0.249, 0.521)	(0.250, 0.522)
40.0	(0.249, 0.521)	(0.248, 0.521)
50.0	(0.249, 0.521)	(0.249, 0.521)
60.0	(0.250, 0.521)	(0.249, 0.522)
70.0	(0.250, 0.522)	I <= 10% peak
80.0	(0.247, 0.519)	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 / 18.25 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)

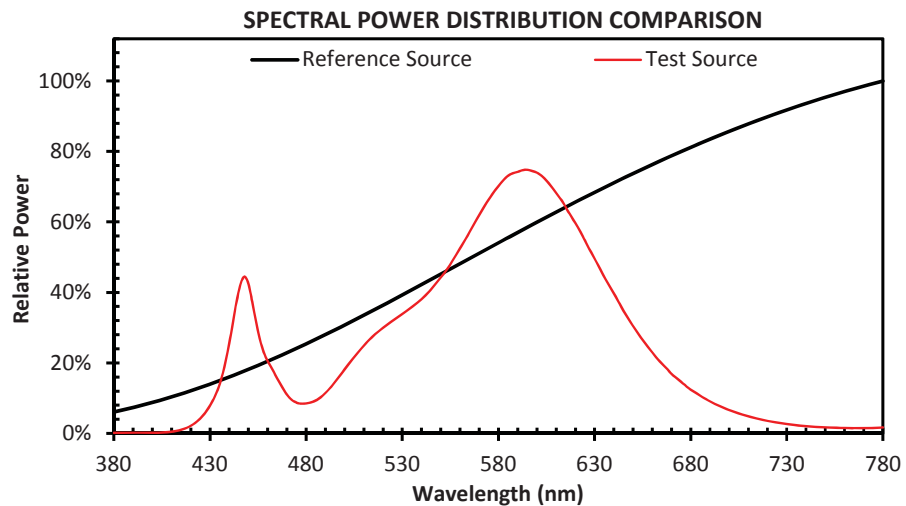
Page 14 of 16 *RT*



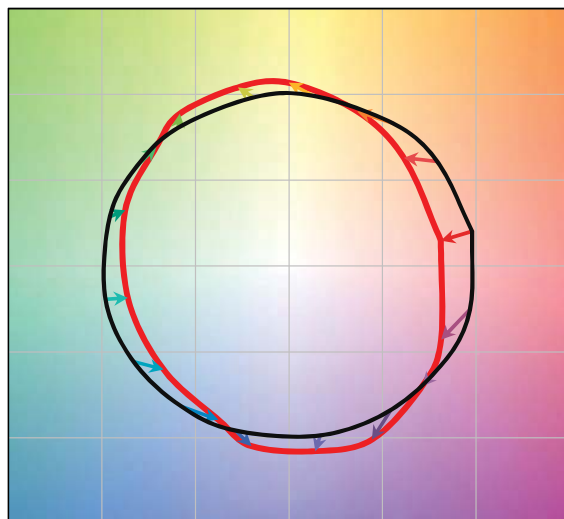
Test Report No. LLI-19244-4

LED Roadway Lighting - Roadway luminaire. Product ID: QB 00 616S X 5 25 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 500ma.
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-19244-4

LED Roadway Lighting - Roadway luminaire. Product ID: QB 00 616S X 5 25 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 500ma.
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.