



## Test Report

for

### MaxLite Inc

10 York Ave West Caldwell, NJ 07006 United States

## Outdoor Pole/Arm-Mounted Area and Roadway Luminaires

**Model: AR-MAL100UT3-40X, AR-MAL100UT3-50X**

(X = Finish; BR=BRONZE; BL=BLACK; WH=WHITE)

### Laboratory: Leading Testing Laboratories

**NVLAP CODE: 200960-0**

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Report No.: HZ17060034e

The laboratory that conducted the testing detailed in this report has been accredited for SSL by NVLAP.

Review by:

Engineer: April Zou  
Jul. 18, 2017

Approved by



Manager: Jim Zhang  
Jul. 18, 2017

Note: This report does not imply product certification, approval, or endorsement by NVLAP, NIST, or any agency of the Federal Government.

## Sample Photos



### Equipment Under Test (EUT)

<b>Name</b>	: Outdoor Pole/Arm-Mounted Area and Roadway Luminaires
<b>Model</b>	: AR-MAL100UT3-40X, AR-MAL100UT3-50X
<b>Electrical Ratings</b>	: 100~277V, 60Hz
<b>Product Description</b>	: 4000K, 5000K Manufacturer of the LED light source: Nichia Corporation Model of the LED light source: NF2L757GRT-V1

### Test specifications:

<b>Date of Receipt</b>	: Jun. 19, 2017
<b>Date of Test</b>	: Jun. 21, 2017
<b>Test item</b>	: Total Luminous Flux, Luminous Distribution Intensity, Luminous Efficacy, Correlated Color Temperature, Color Rendering Index, Chromaticity Coordinate, Electrical parameters, In-Situ Maximum Temperature
<b>Reference Standard</b>	: IESNA LM-79-2008 Approved Method for the Electrical and Photometric Measurements of Solid-State Lighting Products

### LM – 79 TEST RESULTS For Model AR-MAL100UT3-40X

Test ambient temperature: 25.2°C, Orientation: base up, The stabilization time: 60 mins.

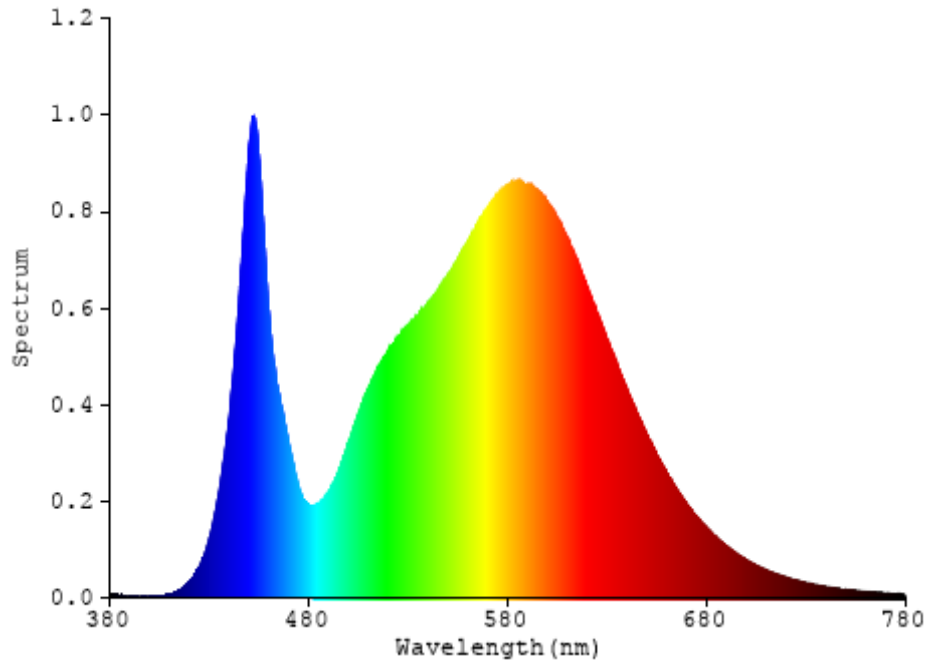
Parameter	Result		
Test Voltage (V)	120.0	100.0	277.0
Voltage frequency (Hz)	60	60	60
Test Current (A)	0.850	1.033	0.384
Power Factor	0.9972	0.9987	0.9484
Test Power (W)	101.68	103.18	100.81
THD A%	3.92	3.37	10.86
Luminous Efficacy (lm/W)	131.2	129.4	132.4
Total Luminous Flux (lm)	13343.0	13352.0	13348.0
Color Rendering Index (CRI)	76.3		
R9	-23		
Correlated Color Temperature (CCT) (K)	4044		
Chromaticity (Chroma x, Chroma y)	(0.3788, 0.3764)		
Chromaticity (Chroma u, Chroma v)	(0.2242, 0.3341)		
Chromaticity (Chroma u', Chroma v')	(0.2242, 0.5012)		
Duv	0.0003		
Average Beam Angle (°)	110.6		
Center Beam Candle Power (cd)	2873		
Spacing Criteria	0.95 (0°-180°)/ 1.92 (90°-270°)		
Zonal Lumens in the 0°-60°Zone	68.62%		
Zonal Lumens in the 60°-90°Zone	31.38%		
Zonal Lumens in the 90°-120°Zone	0.00%		
Zonal Lumens in the 120°-180°Zone	0.00%		

Special Color Rendering Indices	
R1	73
R2	85
R3	93
R4	73
R5	73
R6	78
R7	82
R8	53
R9	-23
R10	64
R11	70
R12	51
R13	76
R14	96

Test data per Goniophotometer Method

Note: According to CIE 1976 (u', v') diagram,  $u' = u = 4x/(-2x+12y+3)$ ,  $v' = 3v/2 = 9y/(-2x+12y+3)$ .

### Spectral Power Distribution For Model AR-MAL100UT3-40X



Spectral Power Distribution

**Zonal Lumen Tabulation For Model AR-MAL100UT3-40X**

$\gamma(^{\circ})$	Lumens	% Total
0- 10	272.382	2.04%
10- 20	792.767	5.94%
20- 30	1268.69	9.51%
30- 40	1732.873	12.99%
40- 50	2260.791	16.94%
50- 60	2828.593	21.20%
60- 70	2724.854	20.42%
70- 80	1284.987	9.63%
80- 90	176.651	1.32%

$\gamma(^{\circ})$	Lumens	% Total
0- 90	13342.59	100.00%
80- 90	176.651	1.32%

Zonal Lumen Data

Note: The Flux in this table might be a little different from the total flux in Table 2 due to rounding.

**Luminous Intensity Data For Model AR-MAL100UT3-40X**

Table--1 UNIT: cd

C (DBG) \ y (DBG)	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90
0	2873	2873	2873	2873	2873	2873	2873	2873	2873	2873	2873	2873	2873	2873	2873	2873	2873	2873	2873
5	2988	2987	2984	2982	2979	2975	2970	2965	2959	2952	2944	2936	2927	2918	2908	2897	2886	2875	2864
10	3064	3062	3059	3054	3049	3043	3036	3028	3019	3008	2997	2984	2970	2954	2937	2918	2898	2876	2853
15	3107	3104	3101	3095	3089	3083	3076	3068	3059	3049	3037	3023	3007	2988	2967	2943	2916	2884	2851
20	3127	3123	3119	3115	3110	3104	3099	3094	3087	3080	3072	3061	3047	3030	3007	2979	2947	2907	2863
25	3132	3128	3125	3121	3117	3115	3113	3112	3112	3111	3110	3107	3099	3086	3065	3035	2997	2949	2893
30	3147	3142	3138	3135	3132	3130	3132	3137	3145	3154	3164	3171	3174	3169	3152	3122	3077	3018	2947
35	3190	3185	3178	3172	3166	3165	3170	3182	3200	3222	3247	3272	3291	3299	3291	3260	3207	3133	3041
40	3276	3268	3258	3247	3237	3233	3240	3259	3290	3331	3380	3430	3475	3506	3511	3482	3416	3319	3199
45	3384	3374	3360	3345	3333	3329	3341	3372	3422	3490	3574	3668	3757	3827	3858	3836	3754	3622	3457
50	3478	3467	3451	3434	3422	3423	3446	3496	3576	3687	3828	3991	4165	4322	4422	4426	4326	4134	3886
55	3551	3538	3518	3496	3480	3482	3516	3592	3715	3890	4119	4407	4740	5080	5337	5393	5219	4880	4450
60	3486	3482	3474	3463	3458	3473	3523	3626	3799	4058	4422	4888	5435	5996	6386	6369	5934	5266	4541
65	2996	2998	3013	3047	3103	3189	3314	3491	3745	4109	4582	5107	5650	6139	6369	6072	5330	4456	3623
70	1908	1932	2014	2142	2296	2463	2674	2952	3292	3683	4105	4508	4822	5061	5081	4593	3792	2993	2314
75	819	836	889	980	1113	1295	1542	1844	2202	2576	2833	3007	2991	2755	2370	1938	1575	1295	1071
80	241	247	273	339	435	511	618	756	924	1074	1186	1200	1119	878	652	513	405	380	378
85	50.0	51.2	57.6	69.0	89.8	106	112	98.8	103	134	203	273	238	180	121	84.0	67.4	67.3	90.8
90	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Luminous Intensity Data

Table--2 UNIT: cd

C (DBG) \ y (DBG)	95	100	105	110	115	120	125	130	135	140	145	150	155	160	165	170	175	180	185
0	2873	2873	2873	2873	2873	2873	2873	2873	2873	2873	2873	2873	2873	2873	2873	2873	2873	2873	2873
5	2852	2840	2828	2816	2804	2793	2782	2771	2762	2753	2745	2738	2732	2727	2723	2721	2719	2720	2721
10	2830	2805	2780	2754	2728	2703	2678	2655	2633	2613	2595	2579	2565	2554	2546	2540	2538	2538	2541
15	2815	2776	2736	2695	2654	2613	2573	2535	2500	2466	2437	2411	2388	2370	2356	2347	2342	2342	2349
20	2814	2761	2705	2647	2588	2530	2473	2418	2367	2320	2278	2241	2209	2183	2164	2151	2145	2146	2154
25	2830	2760	2686	2609	2531	2454	2380	2308	2242	2181	2128	2081	2042	2011	1987	1973	1966	1967	1977
30	2866	2776	2681	2583	2485	2389	2296	2208	2128	2055	1993	1939	1895	1860	1835	1819	1812	1814	1826
35	2937	2822	2700	2577	2456	2337	2224	2119	2025	1943	1872	1813	1766	1729	1703	1687	1680	1683	1694
40	3062	2913	2758	2602	2446	2298	2161	2037	1929	1836	1760	1699	1652	1616	1591	1576	1569	1571	1581
45	3271	3071	2862	2652	2448	2260	2091	1946	1823	1722	1643	1580	1534	1501	1478	1465	1458	1459	1467
50	3609	3310	3000	2697	2422	2182	1981	1814	1678	1570	1488	1425	1380	1350	1331	1319	1313	1315	1320
55	3987	3511	3050	2633	2279	1995	1769	1589	1446	1336	1255	1196	1156	1132	1117	1109	1105	1109	1113
60	3850	3221	2676	2229	1879	1605	1392	1229	1106	1015	951	908	881	865	857	854	858	864	865
65	2919	2348	1896	1550	1288	1089	943	838	763	711	676	659	642	634	634	637	650	658	651
70	1792	1405	1125	923	777	676	600	549	516	494	480	472	470	471	476	483	492	498	494
75	880	722	609	515	454	413	385	367	354	346	342	341	342	345	349	345	341	350	358
80	367	338	304	276	257	244	237	233	229	229	229	231	225	211	207	210	214	220	218
85	121	139	132	104	91.5	75.1	68.1	66.4	68.2	79.1	96.3	92.7	90.2	90.6	91.4	90.8	90.0	98.9	101
90	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Luminous Intensity Data



Table--3

UNIT: cd

C (DBG) y (DBG)	190	195	200	205	210	215	220	225	230	235	240	245	250	255	260	265	270	275	280
0	2873	2873	2873	2873	2873	2873	2873	2873	2873	2873	2873	2873	2873	2873	2873	2873	2873	2873	2873
5	2724	2728	2733	2739	2747	2755	2764	2773	2784	2796	2807	2820	2832	2844	2855	2868	2880	2891	2903
10	2549	2557	2569	2583	2600	2618	2639	2662	2685	2710	2736	2762	2789	2814	2840	2865	2889	2912	2933
15	2359	2374	2393	2417	2445	2476	2511	2548	2587	2628	2670	2712	2754	2795	2835	2874	2910	2943	2974
20	2168	2190	2218	2251	2291	2337	2386	2440	2497	2556	2616	2676	2736	2794	2850	2904	2952	2996	3035
25	1995	2021	2056	2098	2149	2207	2272	2342	2417	2494	2574	2655	2735	2813	2889	2959	3023	3080	3128
30	1846	1875	1915	1963	2022	2090	2168	2254	2347	2445	2547	2651	2756	2859	2959	3053	3136	3208	3266
35	1715	1746	1787	1841	1906	1983	2073	2174	2288	2410	2539	2672	2808	2943	3074	3199	3308	3400	3471
40	1600	1628	1669	1723	1791	1876	1976	2095	2230	2381	2545	2720	2898	3075	3249	3414	3560	3681	3770
45	1481	1508	1544	1594	1663	1751	1860	1993	2151	2333	2541	2772	3017	3264	3503	3729	3931	4102	4223
50	1331	1350	1380	1426	1490	1578	1691	1834	2008	2220	2474	2774	3110	3465	3815	4149	4458	4724	4911
55	1120	1133	1156	1194	1249	1328	1432	1570	1746	1970	2250	2598	3015	3487	3988	4498	4998	5457	5799
60	869	877	893	920	960	1018	1100	1211	1359	1551	1801	2123	2536	3041	3634	4296	5015	5739	6360
65	650	653	661	675	698	732	781	851	947	1081	1262	1504	1818	2238	2783	3452	4249	5122	5902
70	490	489	490	495	505	521	544	578	626	697	796	936	1127	1393	1750	2234	2853	3591	4304
75	362	361	359	361	364	370	380	395	416	447	489	551	636	752	906	1105	1338	1604	1898
80	216	221	240	249	251	252	256	262	270	277	288	308	338	377	418	445	451	460	505
85	105	107	109	118	122	112	95.7	92.0	93.5	101	127	156	164	179	177	155	123	109	118
90	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Luminous Intensity Data

Table--4

UNIT: cd

C (DBG) y (DBG)	285	290	295	300	305	310	315	320	325	330	335	340	345	350	355				
0	2873	2873	2873	2873	2873	2873	2873	2873	2873	2873	2873	2873	2873	2873	2873				
5	2913	2923	2932	2941	2950	2957	2964	2970	2975	2978	2982	2985	2986	2987	2988				
10	2953	2971	2987	3002	3015	3026	3036	3045	3051	3057	3061	3064	3066	3066	3065				
15	3001	3025	3045	3062	3076	3087	3096	3103	3107	3111	3113	3114	3114	3114	3110				
20	3069	3095	3115	3129	3139	3144	3147	3148	3147	3146	3143	3141	3138	3136	3131				
25	3166	3192	3208	3214	3212	3206	3197	3187	3177	3167	3159	3152	3147	3143	3137				
30	3308	3330	3336	3327	3309	3284	3256	3230	3208	3190	3177	3167	3161	3156	3151				
35	3517	3532	3520	3489	3444	3393	3343	3299	3262	3235	3218	3206	3200	3197	3194				
40	3821	3826	3791	3726	3643	3557	3478	3411	3359	3322	3300	3288	3282	3281	3280				
45	4277	4262	4188	4071	3932	3796	3676	3578	3504	3451	3418	3400	3392	3389	3388				
50	4982	4929	4773	4556	4323	4111	3929	3784	3672	3591	3537	3505	3490	3485	3482				
55	5949	5856	5563	5179	4796	4461	4187	3971	3808	3689	3614	3573	3556	3553	3554				
60	6714	6667	6278	5749	5227	4758	4367	4069	3851	3698	3601	3545	3516	3502	3494				
65	6347	6347	6063	5673	5234	4767	4330	3978	3699	3485	3322	3201	3119	3066	3028				
70	4767	4862	4762	4611	4396	4095	3750	3399	3065	2782	2556	2374	2213	2073	1978				
75	2220	2601	2874	2991	2936	2777	2556	2253	1895	1604	1356	1160	1027	933	872				
80	611	802	1060	1282	1311	1267	1172	970	787	637	523	437	346	287	261				
85	158	218	292	362	350	270	197	172	170	167	145	111	83.8	67.2	57.9				
90	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00				

Luminous Intensity Data

**LM – 79 TEST RESULTS For Model AR-MAL100UT3-50X**

Test ambient temperature: 25.1°C, Orientation: base up, The stabilization time: 60 mins.

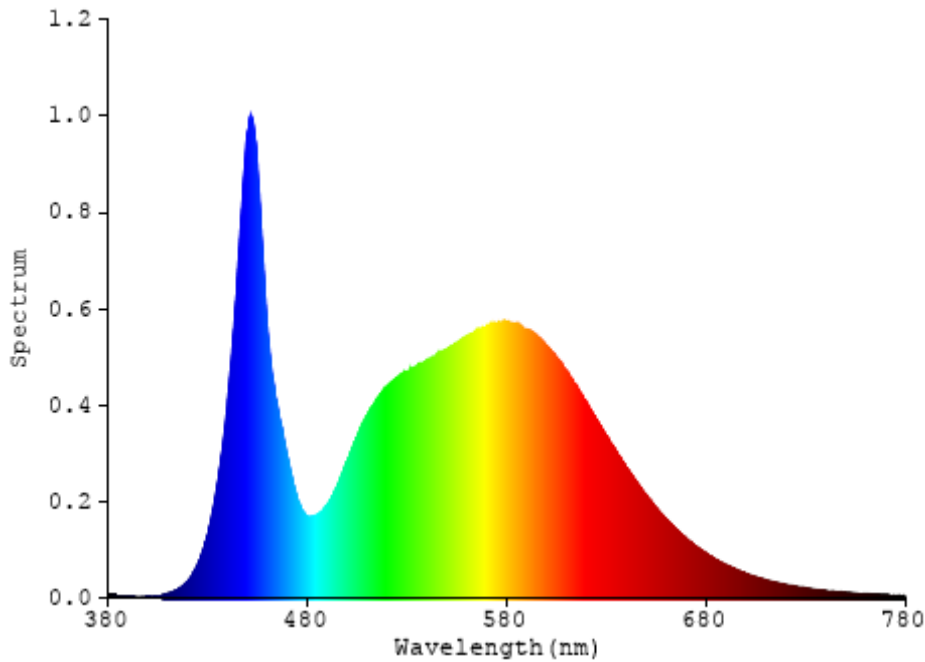
Parameter	Result		
Test Voltage (V)	120.0	100.0	277.0
Voltage frequency (Hz)	60	60	60
Test Current (A)	0.851	1.034	0.385
Power Factor	0.9972	0.9987	0.9490
Test Power (W)	101.82	103.34	101.11
THD A%	3.97	3.45	10.64
Luminous Efficacy (lm/W)	131.4	129.6	132.4
Total Luminous Flux (lm)	13381.0	13389.0	13390.0
Color Rendering Index (CRI)	78.3		
Correlated Color Temperature (CCT) (K)	5117		
Chromaticity (Chroma x, Chroma y)	(0.3421, 0.3524)		
Chromaticity (Chroma u, Chroma v)	(0.2091, 0.3231)		
Chromaticity (Chroma u', Chroma v')	(0.2091, 0.4846)		
Duv	0.0016		

Special Color Rendering Indices	
R1	76
R2	84
R3	90
R4	78
R5	77
R6	78
R7	84
R8	60
R9	-15
R10	62
R11	76
R12	53
R13	78
R14	95

Test data per Goniophotometer Method

Note: According to CIE 1976 (u',v') diagram,  $u' = u = 4x/(-2x+12y+3)$ ,  $v' = 3v/2 = 9y/(-2x+12y+3)$ .

**Spectral Power Distribution**



Spectral Power Distribution



## EQUIPMENT LIST

Test Equipment	Model	Equipment No.	Calibration Date	Calibration Due date
Goniophotometer system	GO-R5000	HZTE011-01	Jul. 26, 2016	Jul. 25, 2017
Digital Power Meter	PF2010A	HZTE028-01	Jul. 26, 2016	Jul. 25, 2017
AC Power Supply	DPS1060	HZTE001-06	Dec. 25, 2016	Dec. 24, 2017
DC Power Supply	WY12010	HZTE004-03	Dec. 25, 2016	Dec. 24, 2017
Temperature Meter	TES1310	HZTE017-01	Aug. 08, 2016	Aug. 07, 2017
Standard Source	D908	HZTE012-01	Jul. 28, 2016	Jul. 27, 2017
Standard source	SCL-1400	HZTE012-02	Jul. 28, 2016	Jul. 27, 2017

Test Equipment List

## TEST METHODS

### Seasoning of SSL Product

For the purpose of rating new SSL products, SSL products shall be tested with no seasoning. Therefore, no seasoning was performed.

### Goniophotometer Method

#### Photometric and Electrical Measurements

An EVERFINE Type C Model GO-R5000 Goniophotometer was used to measure the intensity at each angle of distribution for each sample. The photometric distance is 2.475m for near-field measurement or 30m for far-field measurement. Bandwidth of spectroradiometer is 380nm-780nm.

Ambient temperature was measured at the same height of the sample mounted on the Goniophotometer equipment. Each SSL unit was operated on the client provided driver at the rated input voltage in its designated orientation.

The stabilization time typically ranges from 30 min (small integrated LED lamps) to 2 or more hours for large SSL luminaires). It can be judged that stability is reached when the variation (maximum – minimum) of at least 3 readings of the light output and electrical power over a period of 30 min, taken 15 minutes apart, is less than 0.5 %.

Electrical measurements including voltage, current, and power were measured using the Everfine Digital Power Meter.

Some graphics were created with Photometric Plus software.

The standard reference of the Goniophotometer system is halogen incandescent lamp, the intensity distribution type is omni-directional, and is traceable to the National Institute of Metrology P.R. China.

The uncertainty of goniophotometer system reported in this document is expanded uncertainty is 2.3% with a coverage factor  $k=2$ .

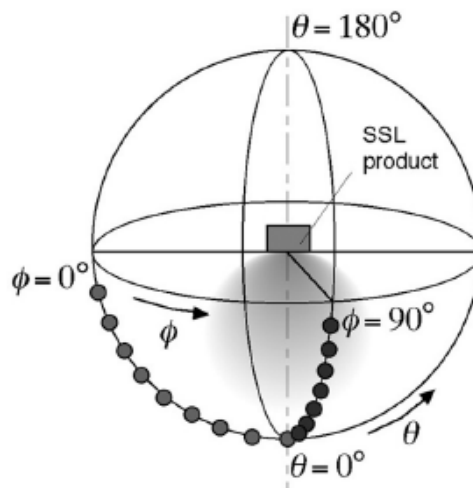
## Color Characteristics Measurements

The color characteristics of SSL products include chromaticity coordinates, correlated color temperature, and color rendering index. These characteristics of SSL products may be spatially non-uniform, and thus, in order that they can be specified accurately, the color quantities shall be measured as values that are spatially average, weighted to intensity, over the angular range where light is intentionally emitted from the SSL product. The color characteristics measurements are using gonio-spectroradiometer.

## Color Spatial Uniformity

The characteristics of SSL products may be spatially non-uniform, the chromaticity coordinate shall be measured at two vertical planes ( $C=0^\circ/180^\circ$  and  $C=90^\circ/270^\circ$ ) and at  $10^\circ$  or less intervals for vertical angle until the light output dropped to below 10% of the peak intensity. The averaged weighted chromaticity coordinate was calculated from these points. The data was then analyzed to check for delta color differences of the  $u'$ ,  $v'$  chromaticity coordinates. The spatial non-uniformity of chromaticity,  $\Delta u'v'$ , is determined as the maximum deviation (distance on the CIE ( $u'$ ,  $v'$ ) diagram) among all measured points from the spatially averaged chromaticity coordinate.

The geometry for the chromaticity measurement using gonio-spectroradiometer is shown as following.



\*\*\* End of Report \*\*\*

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