

25.6.2020 / 12.57

Test report: TR 2638

Luminaire: ActivePAQ-L-2F40-MSA2-2R-4K-840-4-20

Goniophotometric Test Report**TEST ARTEFACT**

The measurement device (DUT) was LED.

The DUT worked fine during the calibration and no defects were observed.

The DUT was mounted on the goniometer i.e. the AC input cable of the LUT was located in the direction of the C270 plane. The effect of the burning position was measured and the correction was less than <0.2%

Company: Tepcomp Oy

MEASUREMENT METHOD

The test method is with accordance of LM-79-08 / CIE S025 test standards. The measurements were made by a goniospectrophotometer SSL LUMI 160. The spectral radiant intensities of a light source at different directions were measured with a calibrated spectrometer located at a known distance from the light source.

MEASUREMENT UNCERTAINTY

The photometer (SSL L-200, sn L200-004) is traceable to national standard at NIST (Certificate of calibration CR 0134 signed on 13 February 2020).

The photometer measuring head (SSL LH-1010, sn LH200-003) is traceable to national standard of illuminance responsivity at PTB (Certificate of calibration CR 0112 signed on 10 March 2020). The power meter and supply of type Chroma66201 662012000823 is traceable national standard of electrical parameters at NIST (Calibration certificate RMA 7962, calibration date 13 December 2019). The expanded uncertainties of the luminous flux and efficacy are $\pm 3.8\%$ and $\pm 4.0\%$ ($k = 2$), respectively.

MEASUREMENTS

Table below describes the measurement conditions. The luminaire under test and photometer/spectrometer were mounted onto the same optical axis and perpendicular by an alignment laser. The measurement distance from the rotation axis to the photometer optical receiving surface was measured by laser distance meter. Temperature was measured with Delta OHM HD 2108.2 thermocouple thermometer from type K thermocouple cable. The temperature of the LED was 45.0°C

Table - Measurement information

Ambient temperature of the laboratory	25.0 degC
Power supply	230.0 Vac
Measurement distance	8890 mm
Location of the rotation axis (behind the outermost surface of the optics)	0 mm
Angular step, C plane	15.0 deg
Angular step, gamma angle	2.5 deg
Maximum gamma angle	90.0 deg
Stabilization time	22 min

Table. Luminous intensity data (cd) at measured C planes (rows) and gamma angles (columns)

	0	15	30	45	60	75	90	105	120	135	150	165	180	195	210	225	240	255	270	285	300	315	330	345
0.0	864	864	864	864	864	864	864	864	864	864	864	864	864	864	864	864	864	864	864	864	864	864	864	864
2.5	865	865	865	863	863	863	862	863	862	860	861	861	865	864	863	864	863	864	863	864	866	865	866	866
5.0	865	864	864	863	862	860	859	859	858	855	856	854	860	860	861	860	862	862	861	864	865	865	866	867
7.5	864	863	860	861	858	857	853	854	852	851	849	850	857	856	855	858	858	860	861	861	864	864	865	865
10.0	860	858	857	855	853	850	849	846	844	842	840	841	851	850	851	851	854	855	856	860	861	863	863	864
12.5	853	852	849	849	847	843	840	837	836	834	832	831	843	842	843	845	845	850	850	854	856	858	859	861
15.0	846	846	843	842	838	836	830	828	826	823	820	820	833	833	834	836	838	840	844	847	852	852	854	855
17.5	838	837	835	833	828	825	819	817	813	810	807	807	823	822	824	826	829	832	834	840	844	846	848	849
20.0	828	826	824	822	816	813	808	803	800	795	792	793	810	810	812	815	818	823	825	831	834	836	840	841
22.5	817	815	812	808	804	798	795	789	785	780	778	775	795	795	798	800	806	810	815	818	825	828	830	831
25.0	803	800	797	795	790	785	779	773	769	763	761	758	780	781	782	786	789	796	800	805	812	814	818	820
27.5	788	786	784	779	774	768	762	755	751	745	741	739	762	764	765	771	774	781	786	793	798	801	805	806
30.0	772	769	767	762	757	749	743	736	731	724	721	718	744	745	747	753	757	765	768	776	782	786	790	793
32.5	754	751	749	743	737	730	723	716	710	703	698	693	722	725	727	733	738	746	750	759	765	771	773	777
35.0	734	731	728	723	717	709	701	694	687	678	670	666	701	702	706	712	717	726	732	740	747	753	756	759
37.5	713	710	707	701	694	686	677	668	662	653	635	633	676	675	681	689	694	704	710	719	726	733	736	740
40.0	690	687	683	678	670	661	652	643	636	623	597	599	645	644	649	664	672	680	689	697	705	712	715	719
42.5	664	659	657	652	644	634	626	617	608	587	562	565	615	610	612	638	645	656	663	673	682	689	693	696
45.0	634	628	625	626	617	607	597	588	579	551	532	532	583	577	576	606	619	629	638	648	656	664	667	669
47.5	602	593	588	597	589	578	567	557	548	519	502	499	551	545	544	570	590	601	609	621	630	638	636	637
50.0	570	559	552	564	559	547	536	525	515	487	470	466	518	512	513	535	559	571	580	592	602	610	600	604
52.5	537	525	519	530	527	516	504	493	479	449	437	431	485	479	483	503	529	540	550	562	573	579	565	572
55.0	505	494	487	495	493	482	469	457	438	413	402	396	450	444	451	469	495	507	518	531	541	545	532	539
57.5	471	460	454	459	458	445	433	420	391	373	365	358	413	409	416	431	457	473	485	497	509	511	501	506
60.0	437	425	420	420	419	410	396	383	350	332	327	320	376	372	380	390	411	437	449	463	473	475	468	473
62.5	400	390	385	376	372	370	357	344	313	293	288	281	338	335	343	348	367	400	411	426	433	435	433	439
65.0	362	353	348	333	328	331	318	304	273	254	247	242	299	296	303	307	329	362	374	389	389	392	395	404
67.5	322	313	309	294	289	291	277	259	231	212	208	204	260	255	261	268	291	321	335	349	345	351	360	366
70.0	282	273	267	256	245	250	235	210	188	173	170	166	221	215	219	229	247	281	295	309	306	313	324	327
72.5	243	234	227	218	201	207	194	167	149	137	133	129	181	176	181	189	203	234	254	268	265	272	284	287
75.0	202	195	187	178	164	163	153	125	112	102	98	94	143	140	144	151	163	191	212	223	219	235	241	244
77.5	162	156	148	140	125	118	113	85	78	70	65	61	107	105	110	115	124	144	171	179	176	192	202	205
80.0	124	119	111	103	91	77	76	54	48	41	37	34	73	72	76	82	88	102	131	133	141	155	164	168
82.5	89	83	77	71	59	46	45	30	25	20	18	16	44	44	45	51	57	65	92	90	105	117	127	131
85.0	56	52	48	41	32	23	19	12	9	6	5	5	21	21	23	26	32	37	57	59	73	82	90	94
87.5	30	27	25	19	14	8	3	3	3	4	4	4	6	7	8	10	13	17	29	34	42	50	57	63
90.0	12	11	9	6	4	3	1	2	3	3	3	3	3	3	4	3	4	5	7	14	20	26	32	36

Table. Measurement results of the main luminous parameters

Luminous flux	Input power	Luminous efficacy	LOR	DWFF	Luminous intensity (g=0)
2583.3 lm	19.26 W	134.1 lm/W	100.0 %	100.0 %	864 cd

Table. Electrical parameters during the light measurements.

	Pin	PF	Vin	If
Value	19.26 W	0.9970	230.0 V	0.0839 A
St.dev.	0.09 %	0.00 %	0.00 %	0.09 %

Table. Maximum luminous intensity and its direction

Iv	g	C plane
865 cd	2.5 deg	0.0 deg

Table. Beam widths at two perpendicular planes

	Beam angle, FWHM, 50% (deg)	Beam angle, 10% (deg)	Effective beam direction from g=0
C0-180	116.6	161.7	-0.0
C90-270	118.7	162.2	-0.0

Figure. Polar curve of the angular luminous intensity distribution at two perpendicular C planes and at C plane with maximum luminous intensity.

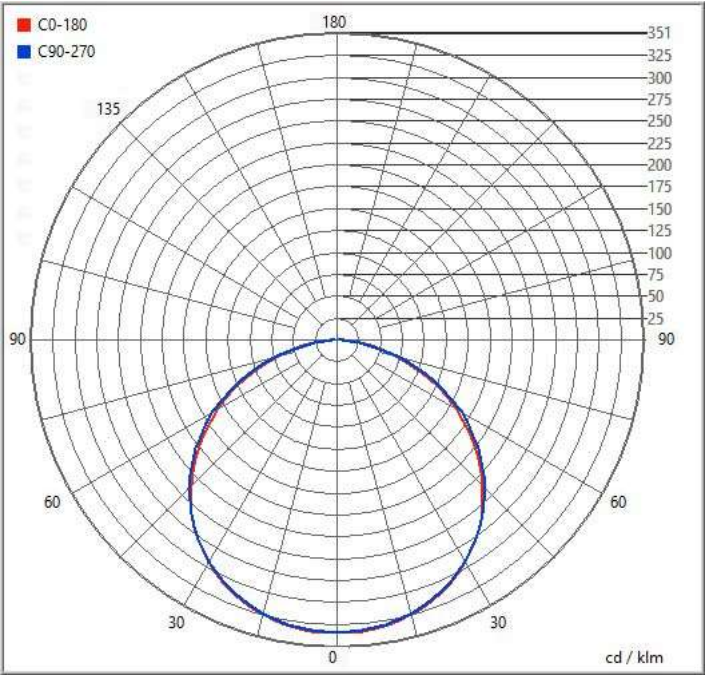


Figure. Luminous intensity distribution in cartesian diagram at all measured C planes

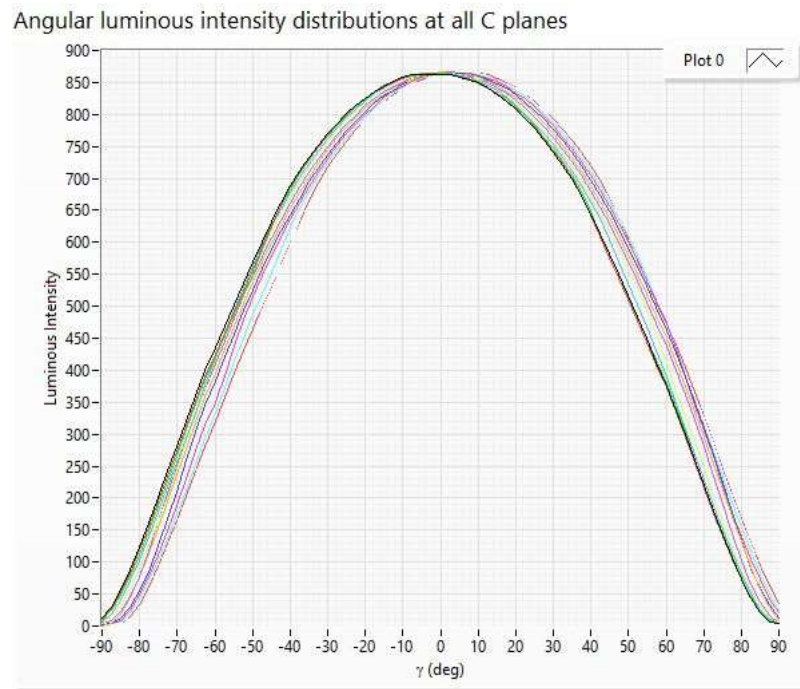


Figure. Isocandela as a function of C plane at gamma angle with maximum luminous intensity

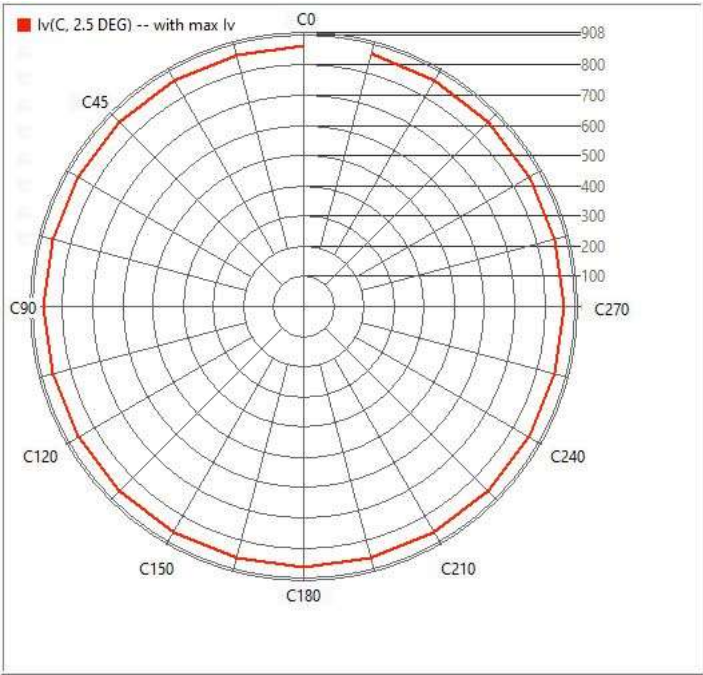


Table. Zonal lumen summary

	Lumens	Relative lumens (%)
0-20	318.50	12.33
0-30	682.60	26.43
0-40	1129.90	43.75
0-60	2029.30	78.57
0-80	2535.70	98.18
0-90	2582.70	100.00
10-90	2500.80	96.83
20-40	811.40	31.42
20-50	1281.60	49.62
40-70	1225.70	47.46
40-90	1452.80	56.25
60-80	506.40	19.61
60-90	553.40	21.43
70-80	180.10	6.97
80-90	47.00	1.82
90-110	0.00	0.00
90-120	0.00	0.00
90-130	0.00	0.00
90-150	0.00	0.00
90-180	0.00	0.00
110-180	0.00	0.00
0-180	2582.70	100.00

Figure. Cumulative luminous flux

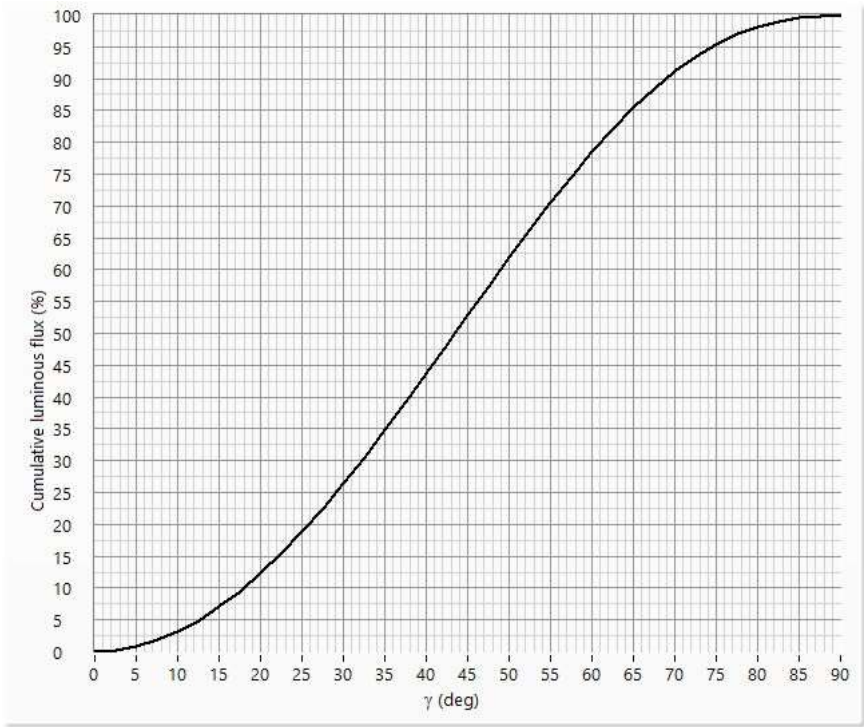


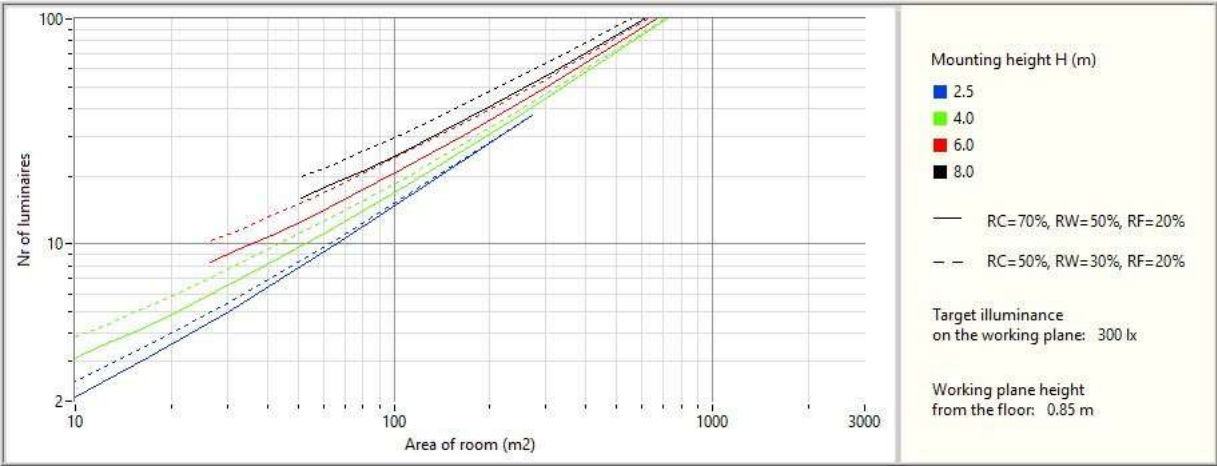
Table. Luminance at different angles based on the defined luminous areas and measured luminous intensities.

	C 0	C 45	C 90
g 0	56527	56527	56527
g 45	13357	16695	49037
g 55	9739	12423	45542
g 65	6484	8133	39537
g 75	3351	4244	28545
g 85	767	1027	9934

Ceiling		70	70	50	50	30		70	70	50	50	30
Walls		50	30	50	30	30		50	30	50	30	30
Floor		20	20	20	20	20		20	20	20	20	20
Room size		Viewing direction at right angles to lamp axis						Viewing direction parallel to lamp axis				
X	Y											
2H	2H	26.0	27.6	26.3	27.9	28.3		26.4	28.0	26.7	28.3	28.6
	3H	27.8	29.3	28.2	29.6	30.0		28.2	29.7	28.6	30.0	30.4
	4H	28.5	29.9	28.9	30.2	30.6		28.9	30.3	29.3	30.6	31.0
	6H	28.9	30.2	29.3	30.6	31.0		29.3	30.6	29.7	31.0	31.4
	8H	29.1	30.3	29.5	30.7	31.1		29.4	30.7	29.8	31.1	31.5
	12H	29.2	30.4	29.6	30.7	31.2		29.5	30.7	29.9	31.1	31.5
4H	2H	26.6	28.0	27.0	28.4	28.8		26.9	28.3	27.3	28.7	29.1
	3H	28.6	29.8	29.1	30.2	30.6		29.0	30.1	29.4	30.5	30.9
	4H	29.4	30.5	29.9	30.9	31.3		29.7	30.8	30.2	31.2	31.6
	6H	30.0	30.9	30.5	31.4	31.8		30.3	31.2	30.7	31.6	32.1
	8H	30.2	31.1	30.7	31.5	32.0		30.4	31.3	30.9	31.7	32.2
	12H	30.3	31.1	30.8	31.6	32.1		30.5	31.3	31.0	31.8	32.3
8H	4H	29.7	30.6	30.2	31.0	31.5		30.0	30.9	30.4	31.3	31.8
	6H	30.4	31.1	30.9	31.6	32.1		30.6	31.3	31.1	31.8	32.3
	8H	30.7	31.3	31.2	31.8	32.3		30.8	31.5	31.3	32.0	32.5
	12H	30.9	31.5	31.4	31.9	32.5		31.0	31.6	31.5	32.0	32.6
12H	4H	29.7	30.5	30.2	31.0	31.5		30.0	30.8	30.5	31.3	31.7
	6H	30.5	31.1	31.0	31.6	32.1		30.7	31.3	31.2	31.8	32.3
	8H	30.8	31.4	31.3	31.8	32.4		30.9	31.5	31.4	32.0	32.5

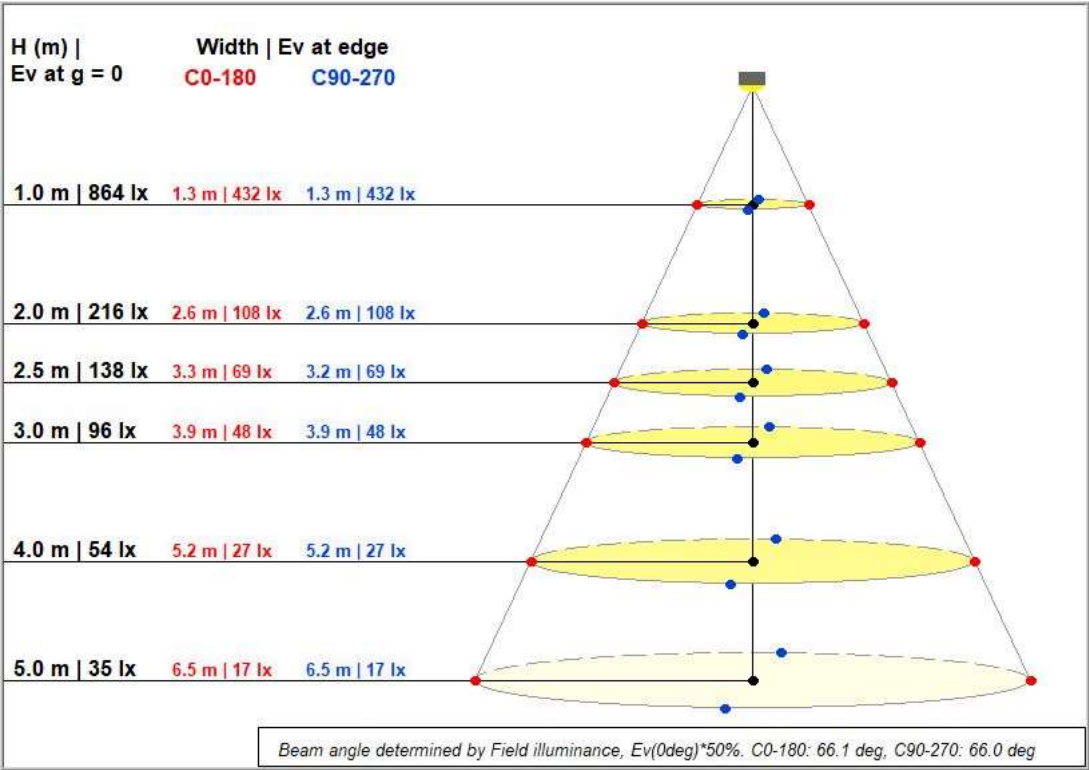
CU table

RC	80				70				50			30			10		
RW	70	50	30	10	70	50	30	10	50	30	10	50	30	10	50	30	10
RF / RCR	20				20				20			20			20		
0	119	119	119	119	116	116	116	116	111	111	111	106	106	106	102	102	102
1	87	84	80	77	89	85	82	79	88	85	82	90	88	86	93	91	89
2	83	76	71	66	84	77	72	67	78	73	69	80	75	71	81	77	73
3	79	69	62	56	78	70	63	57	70	64	59	70	65	60	71	66	62
4	74	63	55	49	73	63	55	49	63	56	51	63	57	52	63	57	53
5	69	57	49	43	68	57	49	43	57	49	44	56	50	45	56	50	45
6	65	52	44	38	64	52	44	38	51	44	39	51	44	39	51	44	40
7	61	48	39	34	60	48	40	34	47	40	34	46	40	35	46	40	35
8	57	44	36	30	56	44	36	30	43	36	31	43	36	31	42	36	31
9	53	41	33	27	53	40	33	27	40	33	28	39	33	28	39	33	28
10	50	38	30	25	49	37	30	25	37	30	25	36	30	25	36	30	26

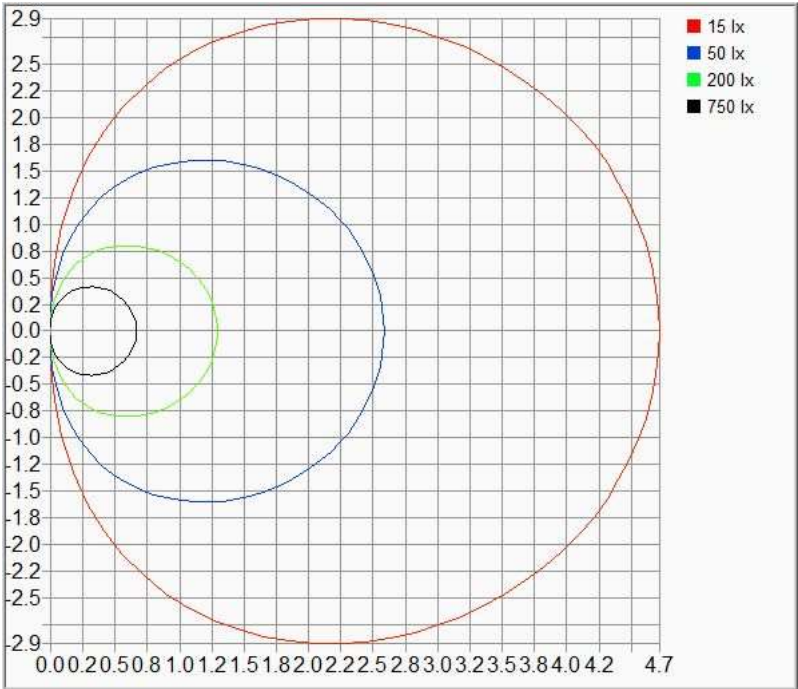


CONE DIAGRAM

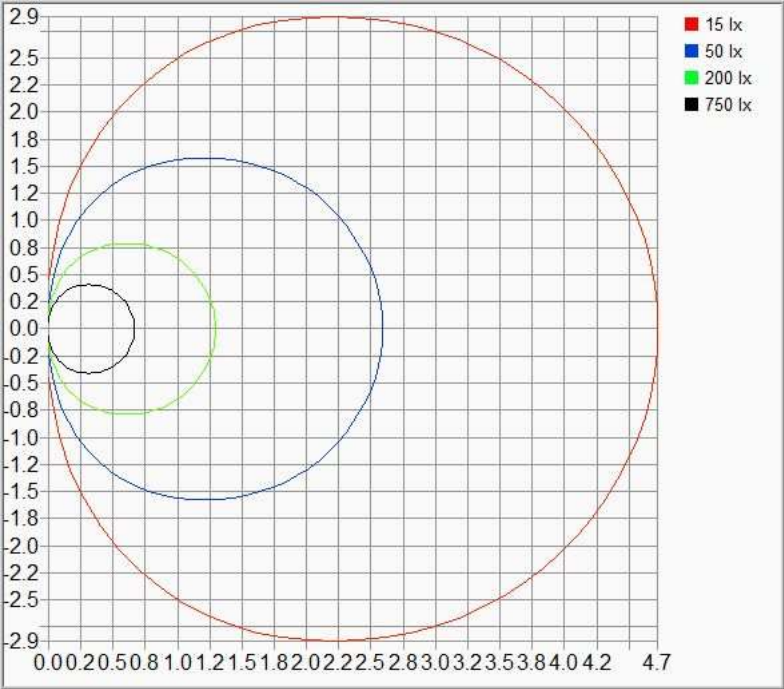
- Cone is limited by the beam angle at the planes of C0 and C90
- H = Mounting Height
- D = Cone diameter
- Ev Edge = illuminance at the edge of the cone of the C0/90 plane
- Ev Center = illuminance at the center of the cone



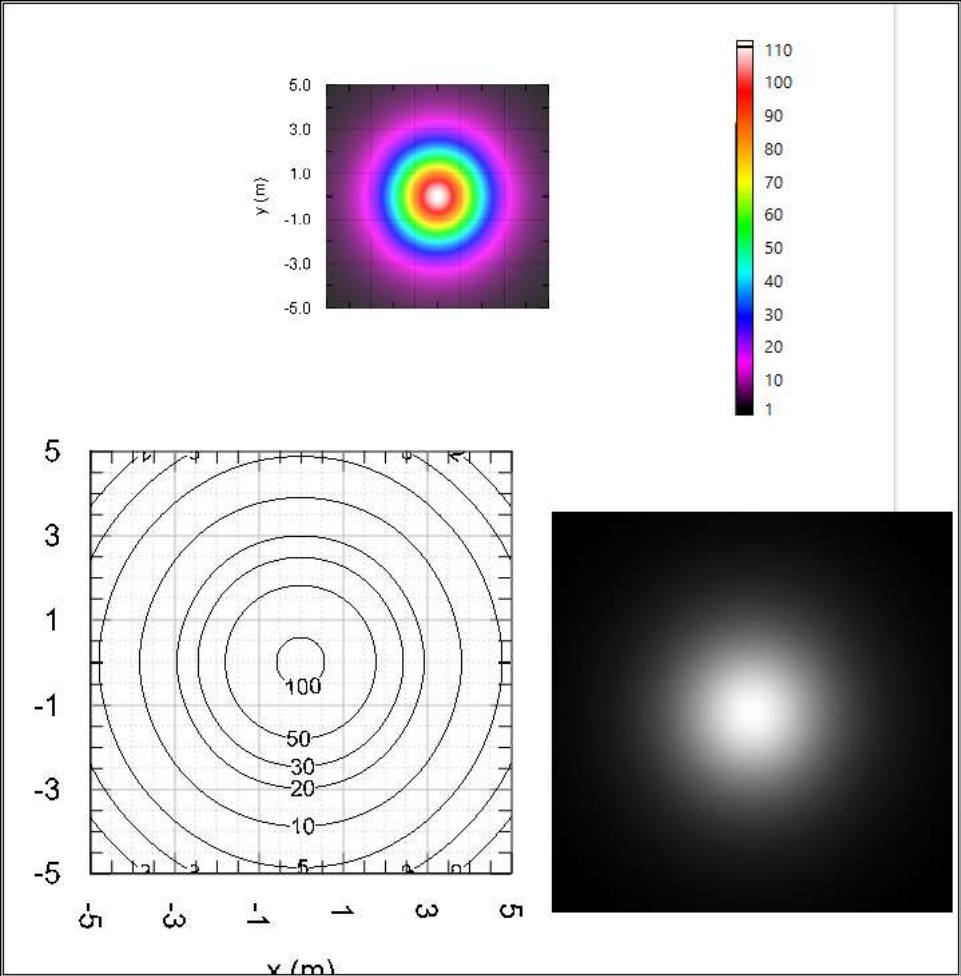
Vertical isolux



Horizontal isolux

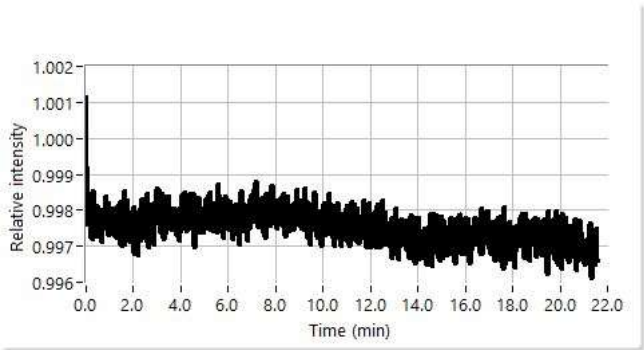


Floor illuminance figures at mounting height of 2.5 meters
with C rotation of 0.0 degrees and with gamma rotation of 0.0 degrees.
Degradation factor of installation was 0.80.



Stabilization curve

Lumen drift: -0.3 %
Stabilization time: 22 min



Goniocolorimetric Test Report



MEASUREMENT METHOD

The measurements were made by a goniospectrophotometer at the dark room of SSL Resource Ltd. The spectral radiant intensities of a light source at different directions were measured with a calibrated spectrometer located at a known distance from the light source.

MEASUREMENT UNCERTAINTY

The measurement uncertainty of the u'v', CCT, and Ra are ±0.002, ±100 K, and ±1 (k = 2), respectively (SM240, Calibration certificate 105105-2F005624-K01).

MEASUREMENTS

Table below describes the measurement conditions. The luminaire under test and photometer/spectrometer were mounted onto the same optical axis and perpendicular by an alignment laser and auxiliary mirror. The measurement distance from the rotation axis to the photometer optical receiving surface was measured by laser distance meter and a caliper.

The Luminaire under test (LUT) was mounted on the goniometer i.e. the AC input cable of the LUT was located in the direction of the C270 plane.

Table - Measurement information

Ambient temperature of the laboratory	25.0 degC
Power supply	0.0 Vac
Measurement distance	3400 mm
Location of the rotation axis	5 mm
Angular step, C plane	45.0 deg
Angular step, gamma angle	10.0 deg
Maximum gamma angle	80.0 deg
Stabilization time	0 min

Table - Measurement results of the total colorimetric parameters

Color coordinates in CIE 1931 diagram	x,y	(0.3808, 0.3795)
Color coordinates in CIE 1976 diagram	u',v'	(0.2242, 0.5028)
Correlated color temperature	CCT	4012 K
General color rendering index	CRI, Ra	85.0
Spatial color uniformity	SDCM	7.9
Distance from Planckian locus	Du'v'	0.001

Weighted average of the angular color measurements. --SDCM = Maximum deviation of the angular u', v' measurements from the weighted average. --SDCM corresponds 1-step MacAdam Ellipse, 1 SDCM corresponds to u'v' = 0.001

Table - Total special color rendering indeces















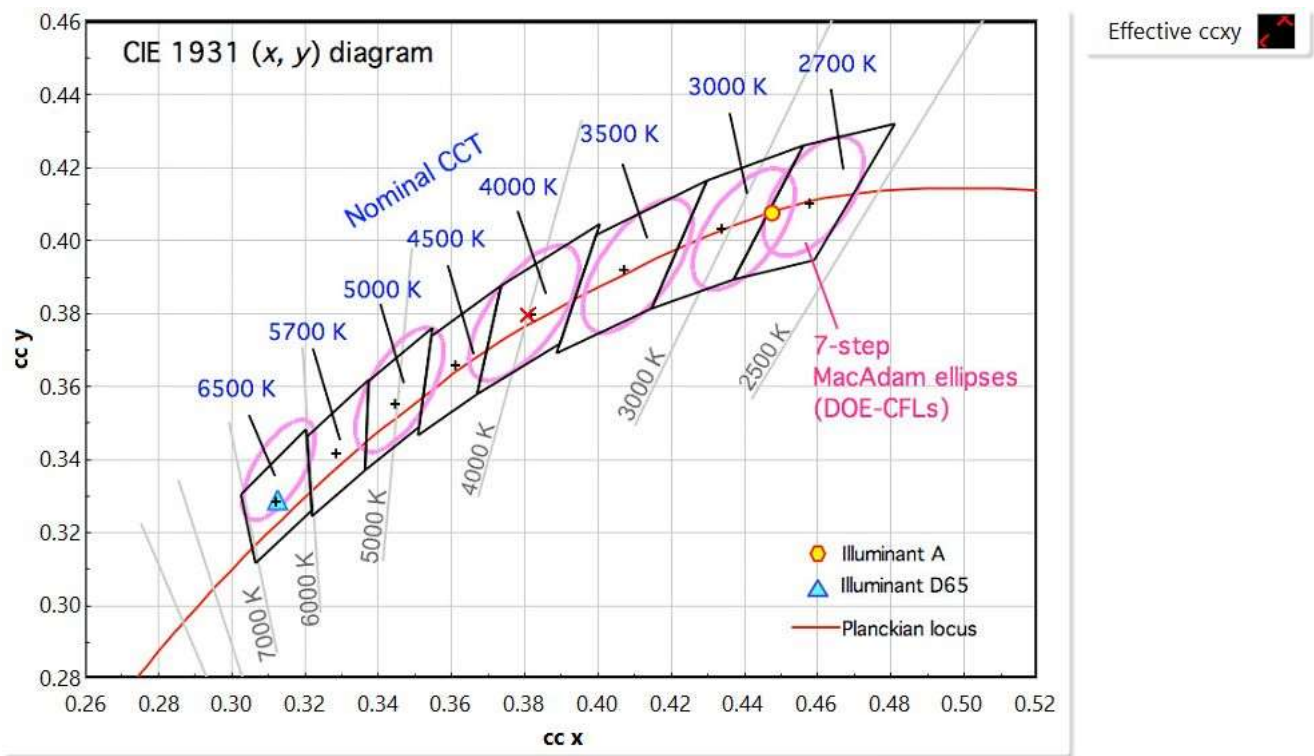
R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14
83.5	91.4	96.3	83.6	83.6	87.8	86.7	66.7	14.7	79.4	83.3	64.3	85.7	98.4
													

Figure - Weighted average color coordinates (x,y) in CIE 1931 color diagram



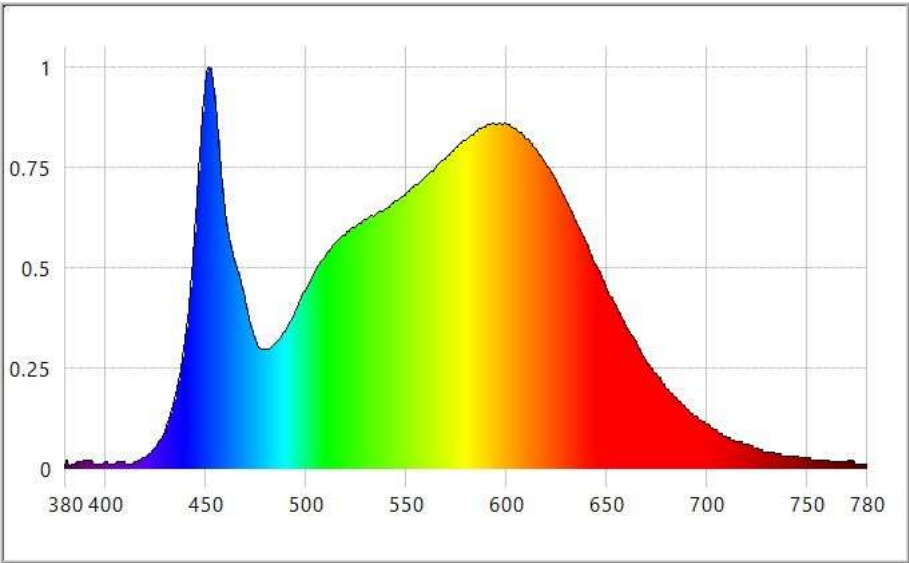


Figure - Total spectral radiant flux

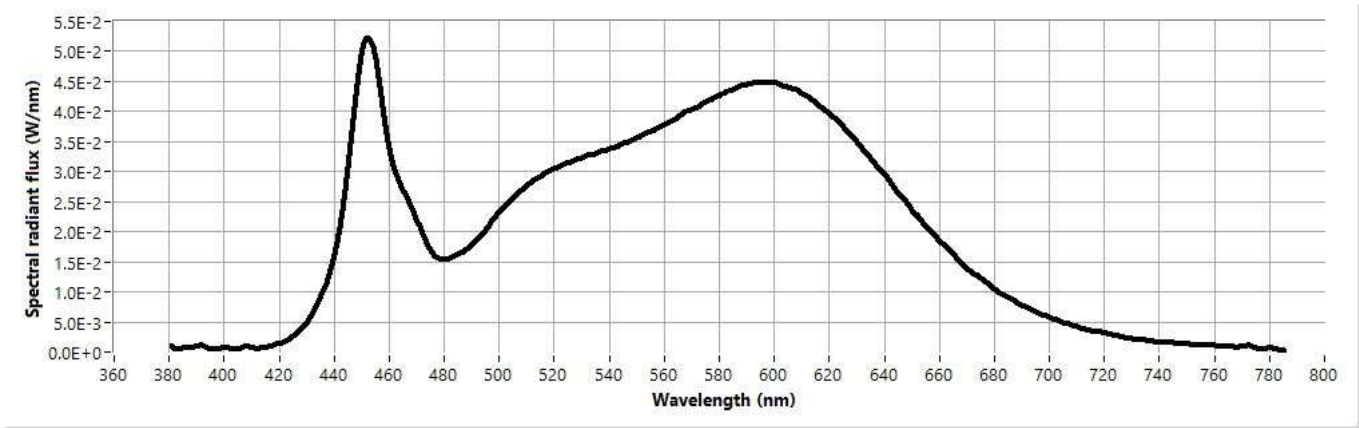
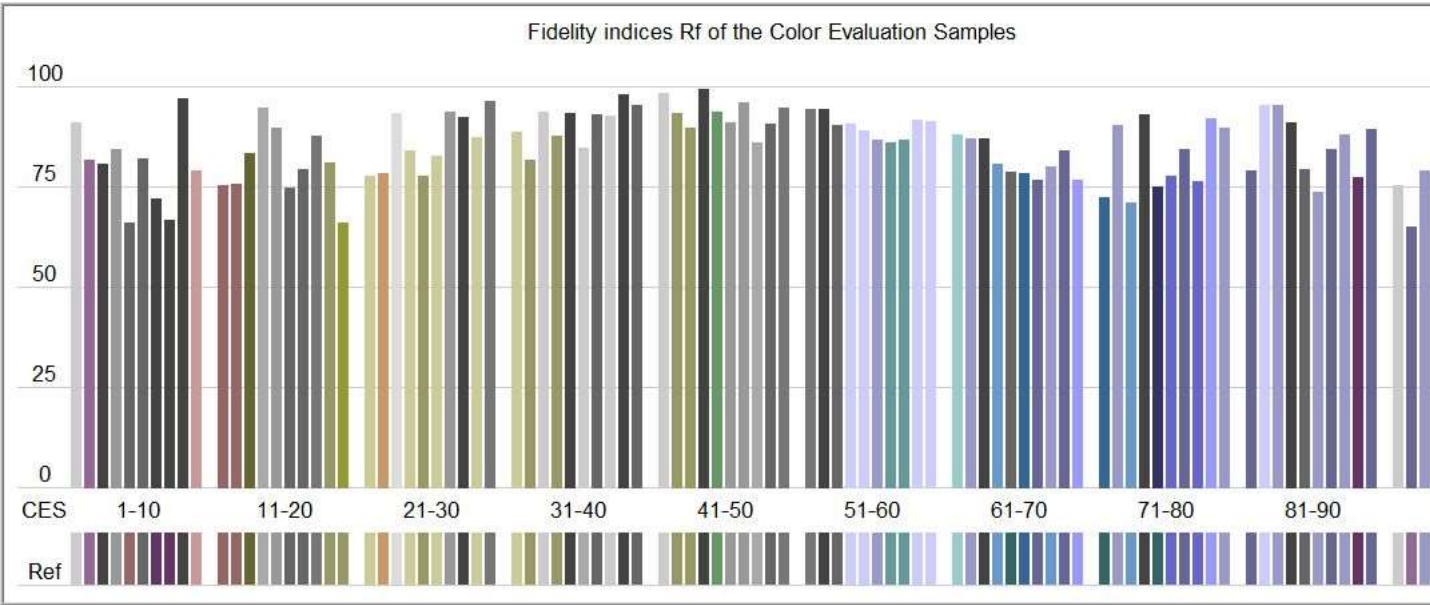


Table - Color rendition values according to TM30-18



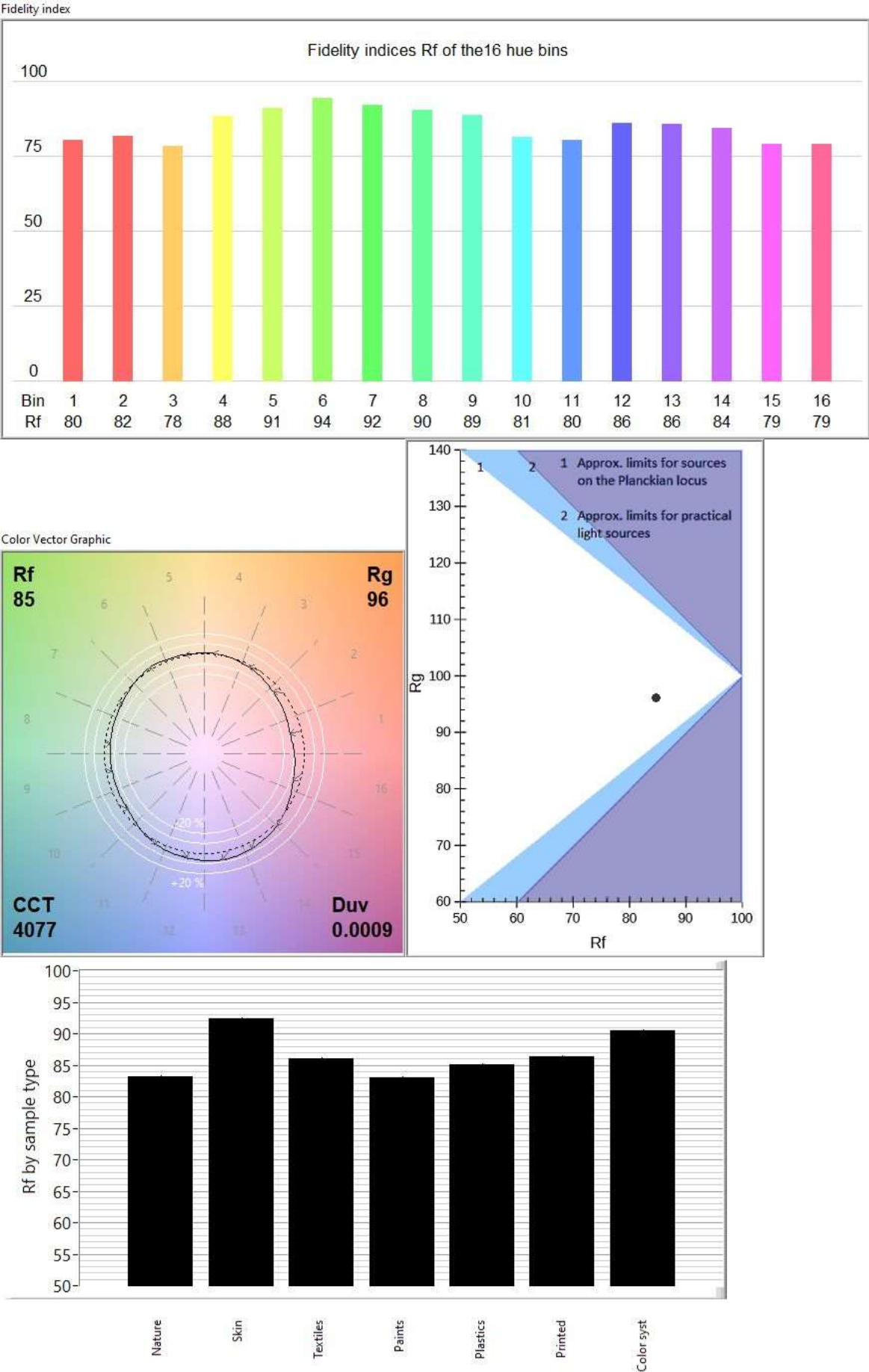


Table - Color coordinates u'v' at different angles in CIE1976 color diagram

C-plane	gamma	u'	v'
0	80	0.2258	0.5106
0	70	0.2251	0.5093
0	60	0.2247	0.5070
0	50	0.2244	0.5045
0	40	0.2242	0.5025
0	30	0.2240	0.5010
0	20	0.2239	0.5000
0	10	0.2237	0.4993
0	0	0.2237	0.4990
180	80	Iv < 10%	Iv < 10%
180	70	0.2252	0.5093
180	60	0.2247	0.5069
180	50	0.2244	0.5045
180	40	0.2241	0.5023
180	30	0.2239	0.5007
180	20	0.2238	0.4997
180	10	0.2237	0.4990
180	0	0.2237	0.4985
45	80	0.2260	0.5075
45	70	0.2250	0.5066
45	60	0.2245	0.5048
45	50	0.2243	0.5029
45	40	0.2239	0.5013
45	30	0.2239	0.5003
45	20	0.2237	0.4994
45	10	0.2237	0.4988
45	0	0.2237	0.4985
225	80	Iv < 10%	Iv < 10%
225	70	0.2250	0.5069
225	60	0.2245	0.5050
225	50	0.2243	0.5031
225	40	0.2240	0.5016
225	30	0.2239	0.5003
225	20	0.2237	0.4995
225	10	0.2237	0.4987
225	0	0.2237	0.4983
90	80	0.2256	0.5072
90	70	0.2248	0.5066
90	60	0.2245	0.5051
90	50	0.2242	0.5035
90	40	0.2240	0.5019
90	30	0.2238	0.5005
90	20	0.2237	0.4994
90	10	0.2236	0.4986
90	0	0.2237	0.4984
270	80	0.2254	0.5078
270	70	0.2247	0.5068
270	60	0.2243	0.5052
270	50	0.2242	0.5036
270	40	0.2240	0.5021
270	30	0.2238	0.5007
270	20	0.2238	0.4995
270	10	0.2236	0.4987
270	0	0.2236	0.4983
135	80	Iv < 10%	Iv < 10%

135	70	0.2251	0.5071
135	60	0.2245	0.5048
135	50	0.2242	0.5031
135	40	0.2241	0.5015
135	30	0.2238	0.5004
135	20	0.2237	0.4993
135	10	0.2237	0.4986
135	0	0.2236	0.4983
315	80	0.2256	0.5078
315	70	0.2247	0.5066
315	60	0.2245	0.5052
315	50	0.2241	0.5029
315	40	0.2240	0.5014
315	30	0.2238	0.5002
315	20	0.2236	0.4993
315	10	0.2236	0.4986
315	0	0.2236	0.4982

Figure - Spatial color uniformity in CIE1976 diagram

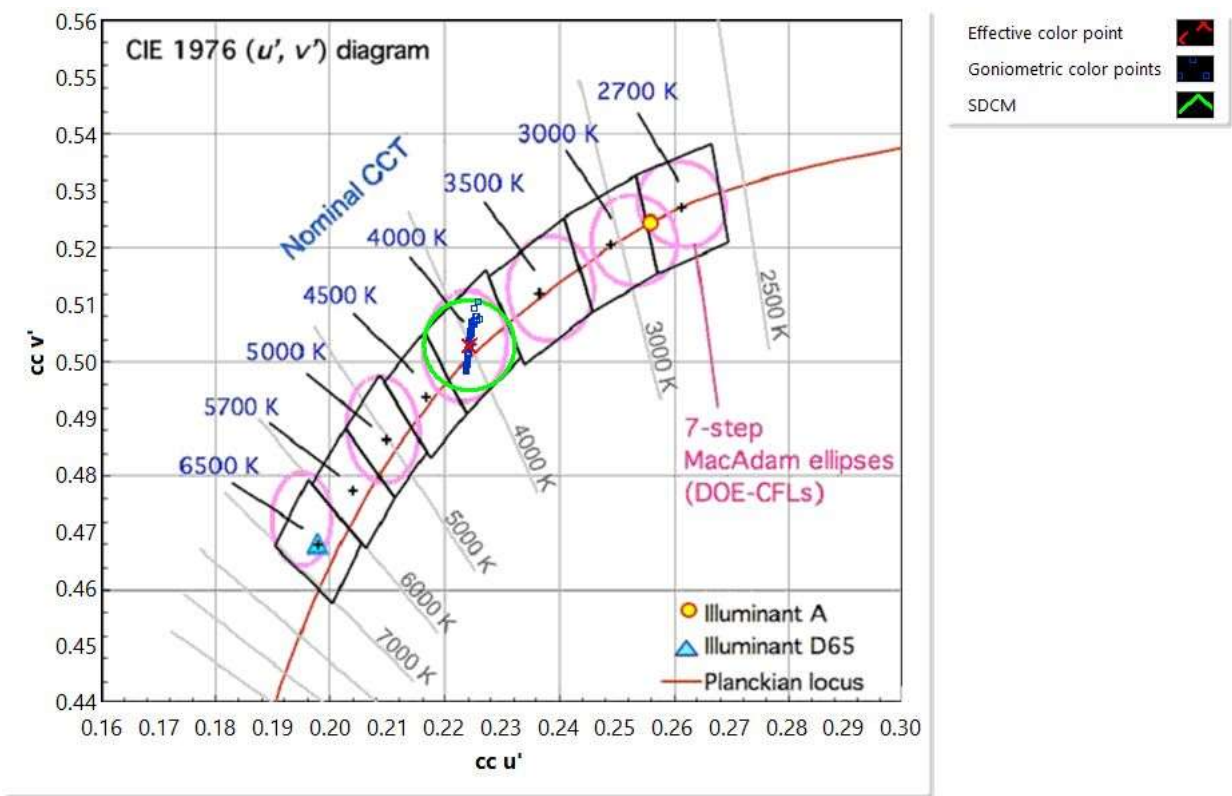


Figure - CCT as a function of angle

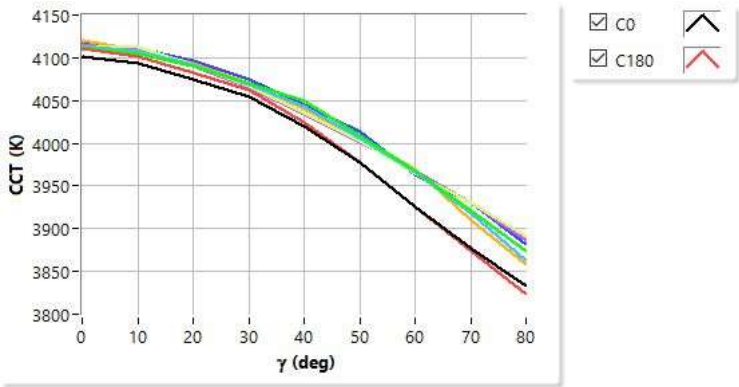
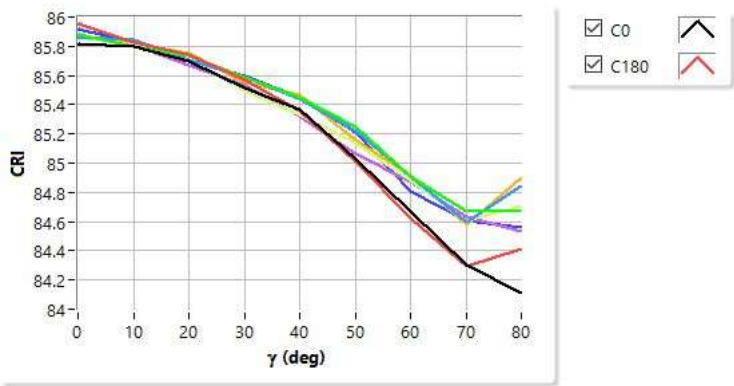


Figure - CRI, Ra as a function of angle



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