

# Goniophotometric Test Report



## TEST ARTEFACT

The measurement device (DUT) was LED linear light of type ActivePAQ Linear Performer 2Ft 3.000lm. The DUT was mounted onto the goniometer i.e. the cable was located in the direction of the C270. Tc temperature was 46.1 degC measured by K type thermocouple. The effect of the burning position was measured and the correction was less than <0.3%.

Customer: 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 (SN: C-1R.1600-001) 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 and photometer located at a known distance from the light source.

## MEASUREMENT UNCERTAINTY

The photometer (SSL L-200, sn L200-009 & LH200-010 18f3-003) used in goniophotometer is traceable to national standard of illuminance responsivity at PTB (Certificate of calibration TR 0066, calibrated 14 May 2019). The power meter was of type The expanded uncertainties of the luminous flux and efficacy are  $\pm 3.8\%$  and  $4.0\%$  ( $k = 2$ ), respectively.

The measurement uncertainty of the  $u'v'$ , CCT, and Ra are  $\pm 0.002$ ,  $\pm 80$  K, and  $\pm 1$  ( $k = 2$ ), respectively (SM240-SVOP5221, Calibration certificate CR 0055).

## 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.

**Table - Measurement information**

Ambient temperature of the laboratory	25.0 degC
Power supply	230.0 Vac
Measurement distance	8847 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	35 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	1047	1047	1047	1047	1047	1047	1047	1047	1047	1047	1047	1047	1047	1047	1047	1047	1047	1047	1047	1047	1047	1047	1047	1047
2.5	1047	1043	1043	1044	1043	1043	1042	1042	1042	1042	1041	1043	1044	1048	1048	1048	1049	1049	1049	1049	1049	1050	1051	1049
5.0	1045	1038	1038	1038	1038	1037	1036	1036	1035	1035	1034	1038	1040	1048	1048	1048	1049	1049	1050	1050	1051	1051	1052	1049
7.5	1042	1032	1032	1031	1030	1029	1027	1027	1026	1025	1024	1030	1035	1046	1046	1046	1047	1047	1048	1049	1051	1051	1052	1048
10.0	1037	1022	1023	1021	1020	1019	1017	1017	1015	1014	1013	1021	1034	1042	1043	1043	1044	1044	1045	1047	1049	1049	1050	1045
12.5	1031	1011	1012	1010	1009	1007	1005	1004	1003	1001	1000	1009	1027	1036	1037	1037	1039	1039	1041	1043	1045	1045	1046	1040
15.0	1022	998	999	997	995	993	992	990	988	985	984	996	1017	1028	1030	1030	1032	1033	1034	1037	1039	1040	1041	1032
17.5	1010	983	983	982	980	978	976	973	971	968	965	980	1006	1019	1020	1021	1023	1024	1026	1029	1031	1033	1034	1023
20.0	998	964	965	965	963	961	958	955	953	948	939	960	992	1007	1009	1010	1012	1014	1016	1019	1021	1023	1025	1012
22.5	982	941	943	946	944	941	939	936	932	921	905	934	976	993	995	997	999	1001	1004	1007	1009	1012	1014	999
25.0	965	914	913	925	923	920	917	914	910	890	872	903	957	978	979	981	984	987	990	993	996	998	1001	984
27.5	942	879	878	899	900	897	893	890	885	857	843	870	935	959	961	964	967	970	974	977	980	983	986	967
30.0	918	849	848	867	875	872	868	864	857	826	816	840	908	937	937	944	949	952	956	960	963	966	968	947
32.5	892	821	820	834	848	845	841	836	828	797	787	811	876	906	907	919	929	932	937	940	944	947	948	920
35.0	861	794	793	801	819	816	811	807	797	766	756	782	840	872	875	890	907	911	915	919	923	925	921	887
37.5	825	763	763	768	788	785	780	775	765	731	722	750	803	842	845	856	882	887	891	897	901	900	888	853
40.0	788	730	728	731	755	752	748	742	725	692	688	716	769	812	815	822	856	862	867	872	877	868	853	823
42.5	755	696	693	695	716	718	713	707	677	652	653	682	737	780	785	791	826	835	841	846	850	833	824	792
45.0	722	662	657	651	668	681	676	668	632	605	615	646	704	748	753	763	795	806	812	817	820	799	796	762
47.5	689	625	619	606	623	642	637	625	594	563	575	609	671	714	720	731	763	776	782	787	789	769	765	729
50.0	654	584	581	567	584	601	595	581	554	523	534	569	635	679	687	696	729	743	749	756	756	737	731	695
52.5	617	535	538	527	542	558	552	537	509	481	491	528	596	644	653	656	686	708	715	722	721	702	697	660
55.0	575	487	490	483	494	513	507	489	460	436	448	486	558	606	617	609	640	672	678	686	678	659	663	624
57.5	528	440	442	438	441	463	460	431	408	392	401	441	518	567	579	568	598	633	640	648	632	613	627	585
60.0	478	393	393	389	391	406	413	383	359	346	350	389	476	527	539	527	557	591	600	608	588	572	589	540
62.5	432	347	343	337	346	356	363	332	314	298	299	341	431	485	497	485	516	548	559	566	547	531	548	490
65.0	387	302	295	288	296	299	313	275	264	247	248	292	382	441	453	441	470	504	515	522	505	490	502	439
67.5	343	255	248	241	243	248	262	225	215	199	200	246	336	392	406	396	420	457	470	477	458	445	452	393
70.0	298	208	201	196	192	194	211	174	166	156	155	198	289	343	356	353	369	400	424	425	403	396	401	348
72.5	253	164	157	152	147	146	162	129	122	114	117	153	241	295	306	309	322	351	377	370	356	346	354	303
75.0	206	122	117	110	106	100	115	89	83	79	81	114	195	246	258	261	276	299	328	322	311	298	308	256
77.5	163	82	78	74	70	61	72	53	51	49	45	77	152	201	211	212	229	244	279	264	259	251	261	256
80.0	124	51	48	44	38	33	36	26	25	23	22	45	115	156	165	164	183	193	230	215	208	204	212	209
82.5	86	27	24	21	16	12	10	9	9	9	9	22	115	118	123	123	134	144	181	163	161	157	168	166
85.0	56	12	10	8	6	5	2	4	5	5	6	9	79	82	86	86	93	99	134	115	116	115	126	126
87.5	30	7	6	5	5	3	1	3	4	4	5	6	48	49	52	54	58	62	91	72	77	80	87	86
90.0	13	6	6	4	4	2	1	2	3	4	5	5	24	25	27	28	30	33	52	40	46	48	53	55

**Table. Measurement results of the main luminous parameters**

Luminous flux	Input power	Luminous efficacy	LOR	DWFF	Luminous intensity (g=0)
3063.7 lm	20.30 W	150.9 lm/W	100.0 %	100.0 %	1047 cd

**Table. Electrical parameters during the light measurements.**

	Pin	PF	Vin	If
Value	20.31 W	0.9740	230.0 V	0.0909 A
St.dev.	0.04 %	0.00 %	0.00 %	0.32 %

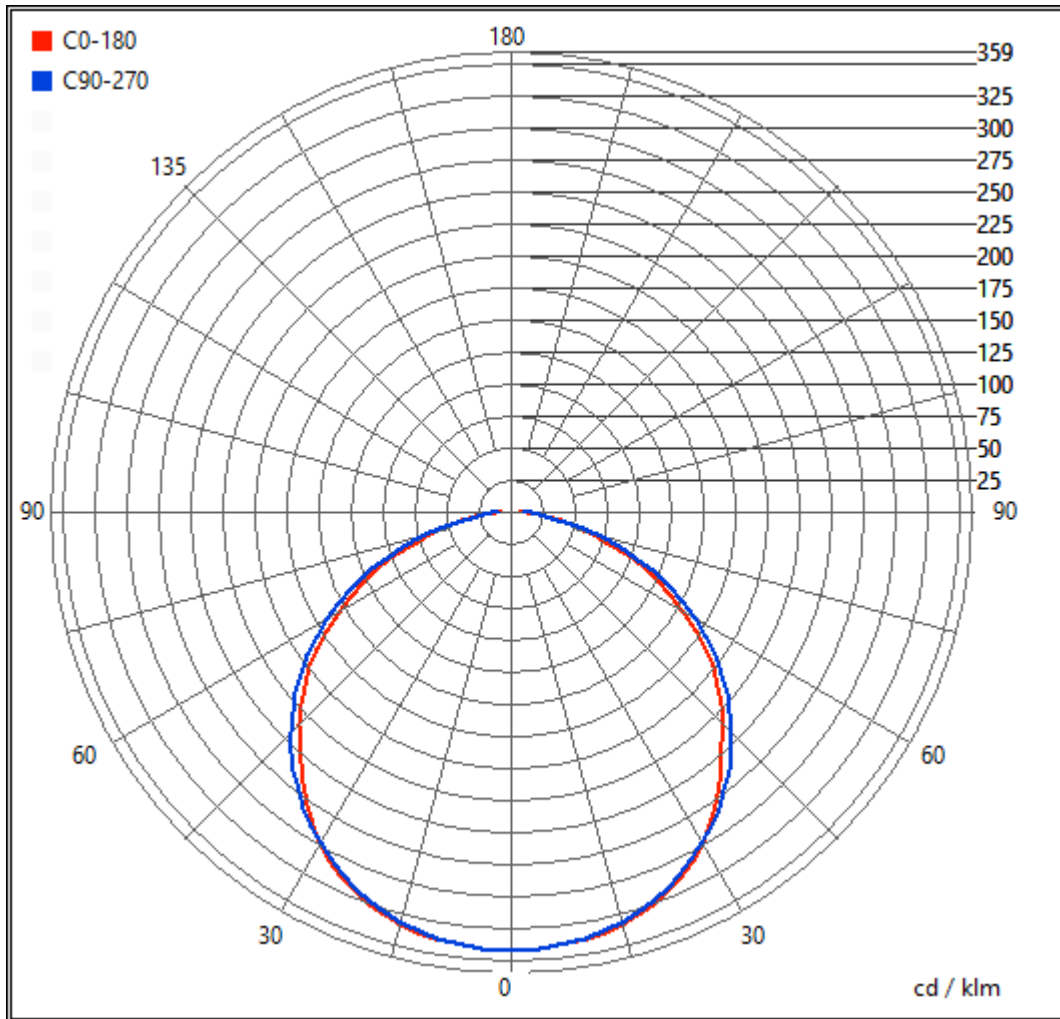
**Table. Maximum luminous intensity and its direction**

Iv	g	C plane
1052 cd	5.0 deg	150.0 deg

**Table. Beam widths at two perpendicular planes**

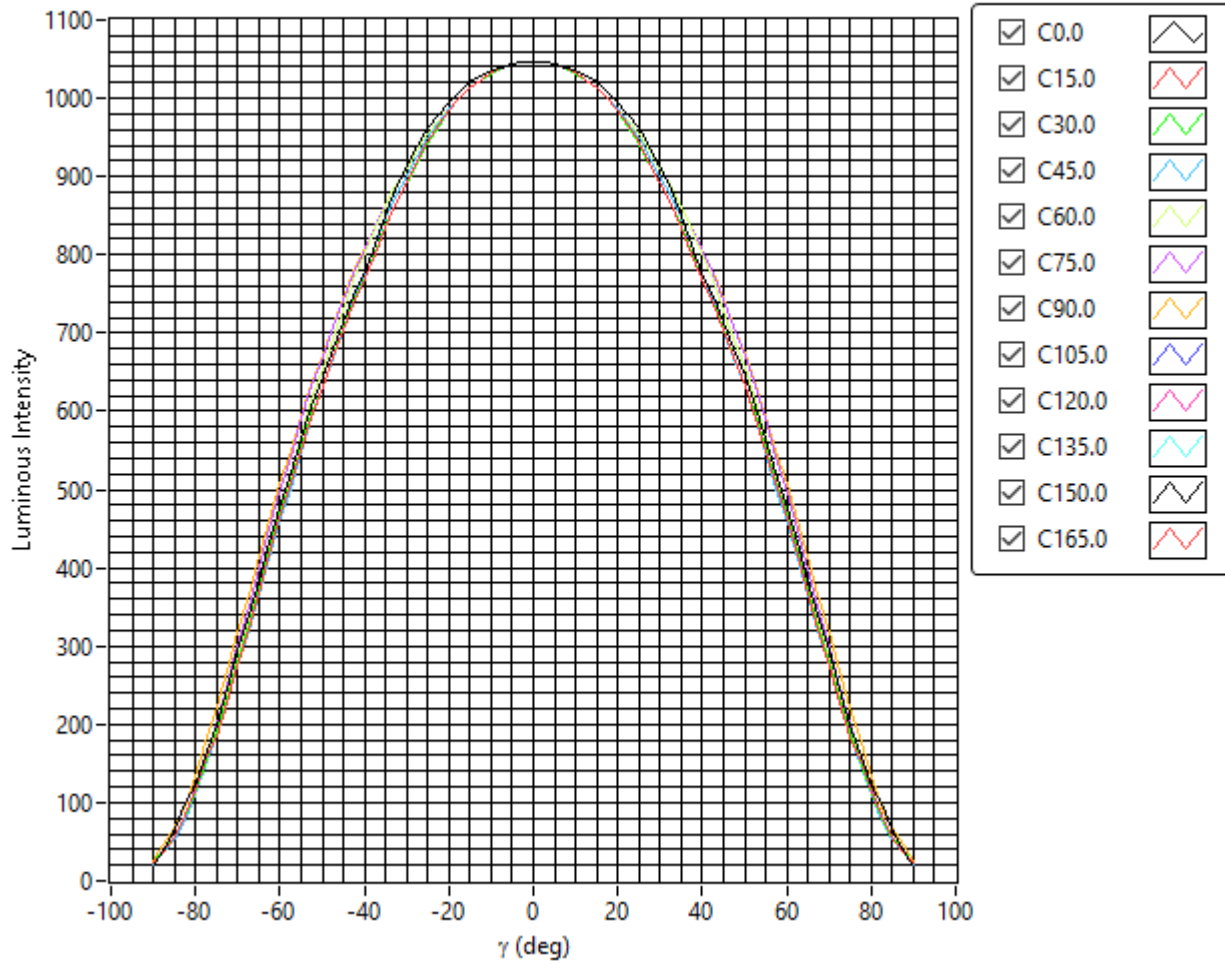
	Beam angle, FWHM, 50% (deg)	Beam angle, 10% (deg)	Effective beam direction from g=0
C0-180	114.8	164.5	0.2
C90-270	118.6	162.3	-5.3

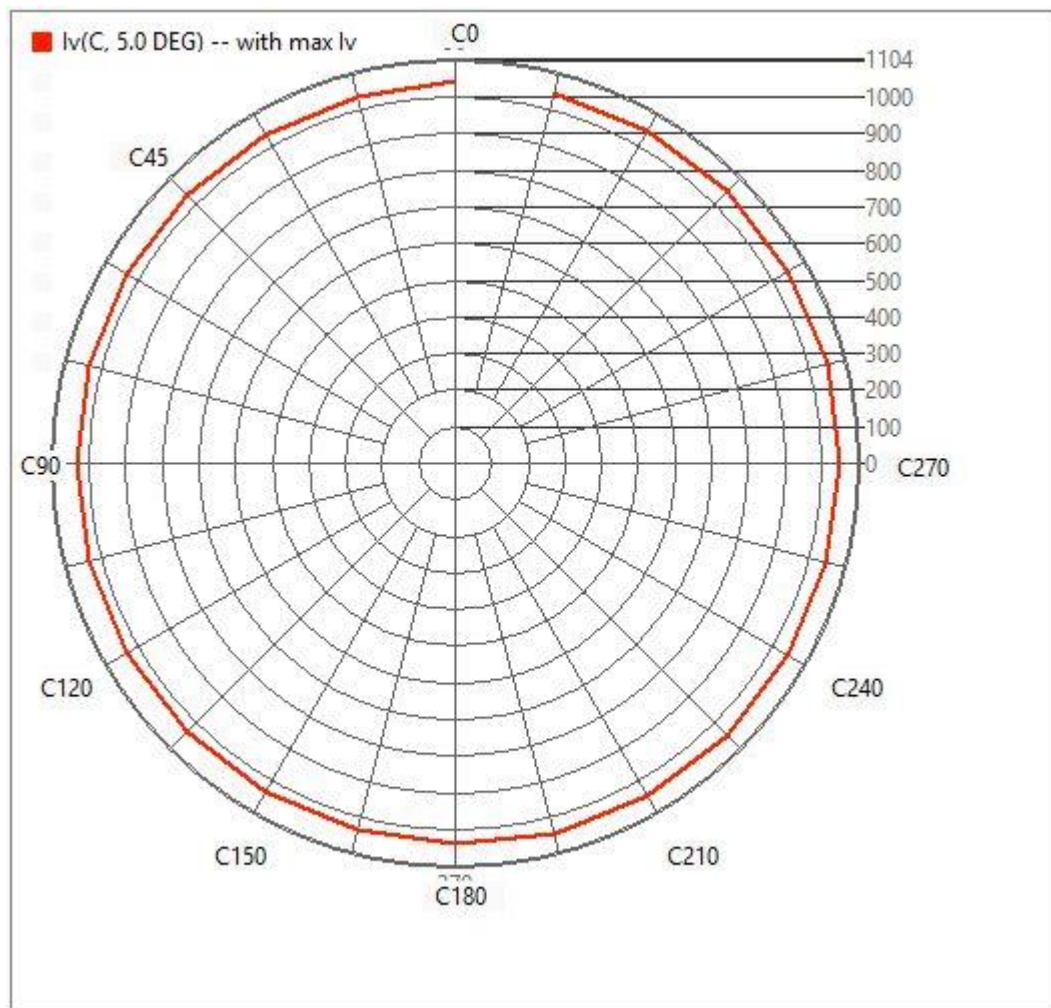
**Figure. Polar curve of the angular luminous intensity distribution at two perpendicular C planes and at C plane with maximum luminous intensity.**



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

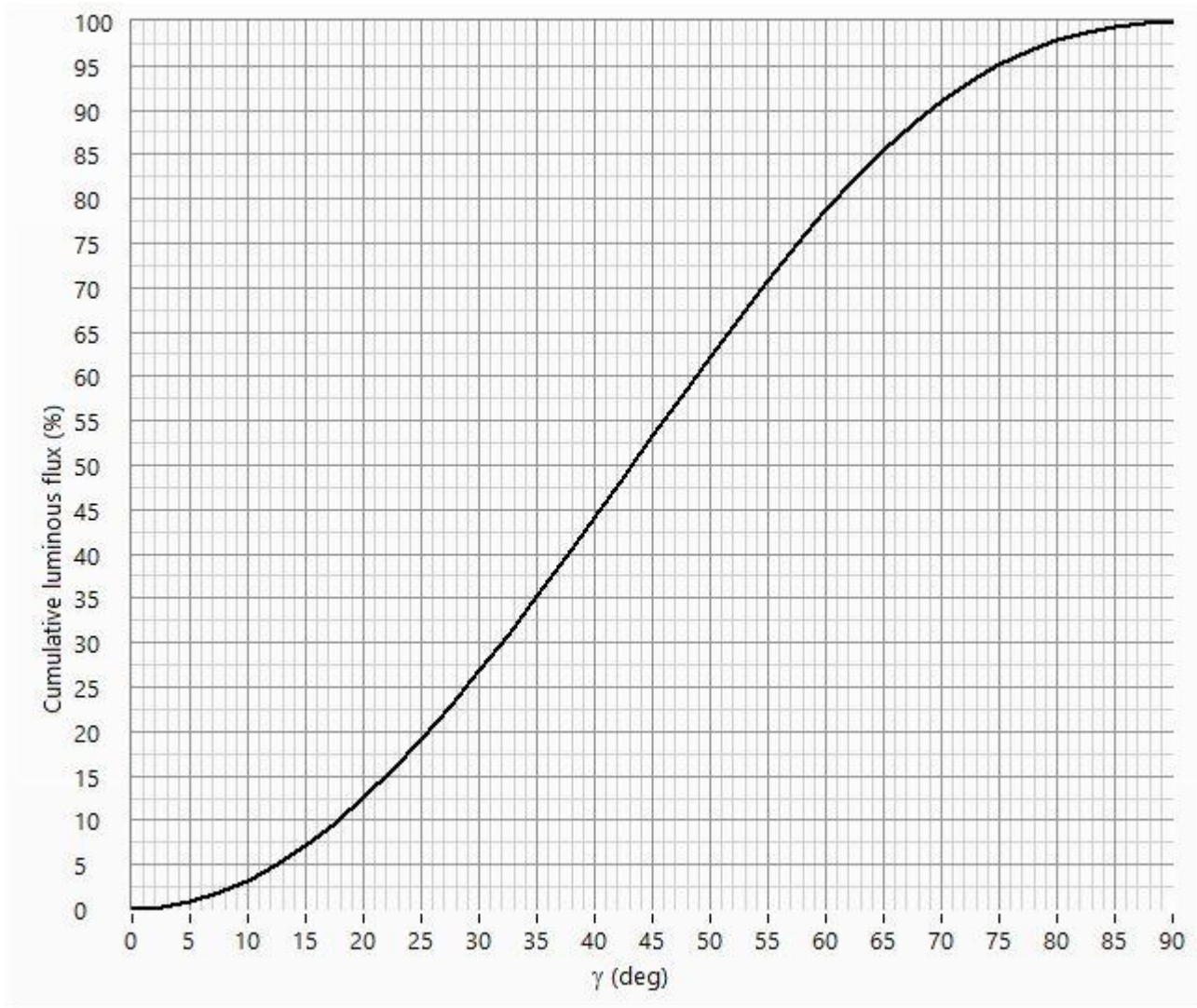
Angular luminous intensity distributions at all horizontal planes



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

**Table. Zonal lumen summary**

	Lumens	Relative lumens (%)
0-20	385.20	12.58
0-30	822.60	26.86
0-40	1353.40	44.20
0-60	2411.30	78.74
0-80	2996.40	97.85
0-90	3062.20	100.00
10-90	2963.10	96.76
20-40	968.20	31.62
20-50	1522.60	49.72
40-70	1435.20	46.87
40-90	1708.80	55.80
60-80	585.10	19.11
60-90	650.90	21.26
70-80	207.80	6.79
80-90	65.80	2.15
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	3062.20	100.00

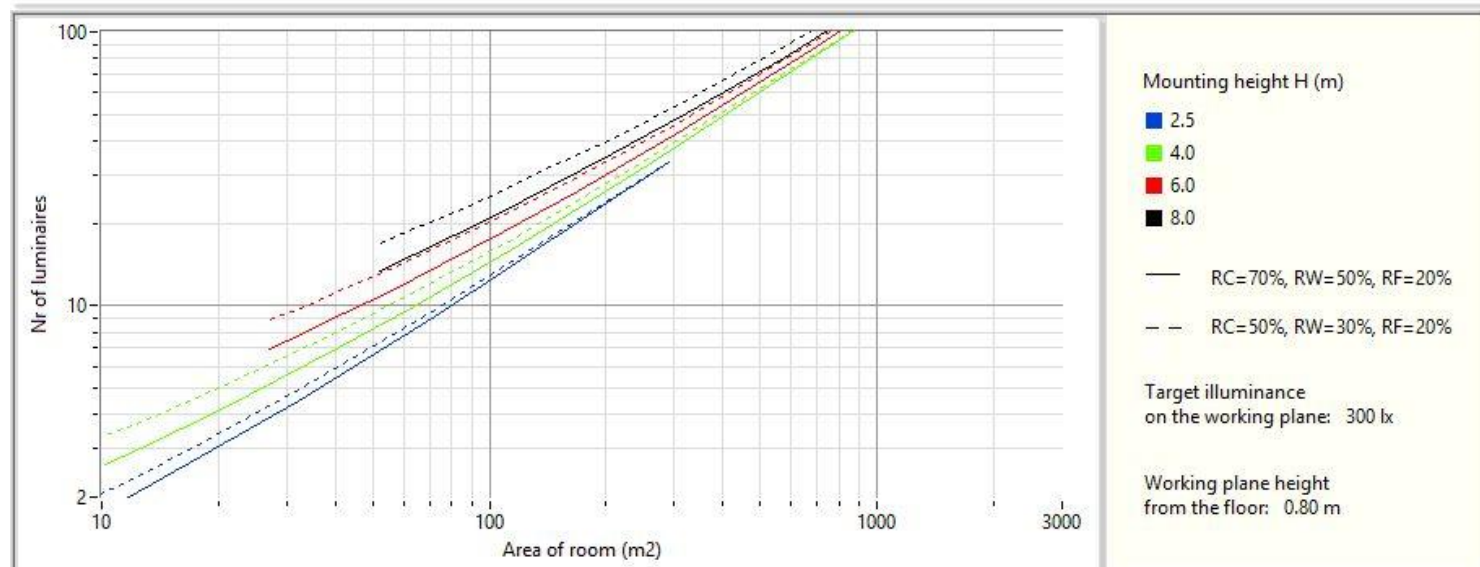
**Figure. Cumulative luminous flux**

**UGR table**

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	25.9	27.5	26.2	27.8	28.1	25.7	27.3	26.1	27.7	28.0
	3H	27.5	29.0	27.9	29.3	29.7	26.9	28.4	27.3	28.7	29.1
	4H	28.1	29.5	28.5	29.9	30.3	27.2	28.6	27.6	29.0	29.3
	6H	28.6	29.9	29.0	30.3	30.7	27.3	28.6	27.7	29.0	29.4
	8H	28.8	30.0	29.2	30.4	30.8	27.3	28.6	27.7	28.9	29.3
	12H	28.9	30.1	29.3	30.5	30.9	27.3	28.5	27.7	28.9	29.3
4H	2H	26.3	27.8	26.7	28.1	28.5	26.0	27.4	26.4	27.8	28.2
	3H	28.1	29.3	28.5	29.7	30.1	27.4	28.6	27.8	29.0	29.4
	4H	28.8	29.8	29.2	30.2	30.7	27.7	28.8	28.2	29.2	29.7
	6H	29.2	30.2	29.7	30.6	31.1	27.9	28.8	28.3	29.2	29.7
	8H	29.4	30.3	29.9	30.7	31.2	27.9	28.7	28.3	29.2	29.6
	12H	29.6	30.3	30.0	30.8	31.3	27.8	28.6	28.3	29.1	29.6
8H	4H	28.9	29.7	29.3	30.2	30.6	27.8	28.7	28.3	29.1	29.6
	6H	29.4	30.1	29.8	30.6	31.0	27.9	28.7	28.4	29.1	29.6
	8H	29.5	30.2	30.0	30.7	31.2	27.9	28.6	28.4	29.1	29.6
	12H	29.7	30.3	30.2	30.8	31.3	27.9	28.5	28.4	29.0	29.5
12H	4H	28.9	29.6	29.3	30.1	30.6	27.8	28.6	28.3	29.0	29.5
	6H	29.3	30.0	29.9	30.5	31.0	27.9	28.6	28.4	29.0	29.6
	8H	29.5	30.1	30.0	30.6	31.2	27.9	28.5	28.4	29.0	29.5

## CU table

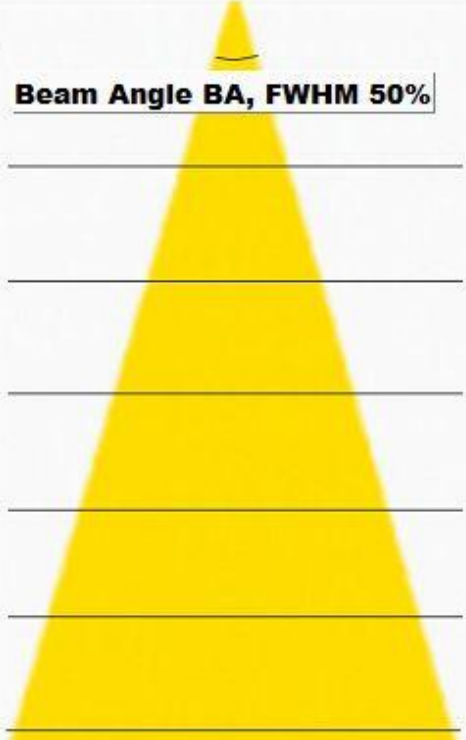
RC	80				70				50			30			10		
RW	70	50	30	10	70	50	30	10	50	30	10	50	30	10	50	30	10
RF / RCR	20				20				20			20			20		
0	119	119	119	119	116	116	116	116	111	111	111	106	106	106	102	102	102
1	87	84	80	77	89	85	82	79	88	85	82	90	88	85	93	90	88
2	83	76	71	66	84	77	72	67	78	73	69	80	75	71	81	77	73
3	79	70	62	57	78	70	63	57	70	64	59	70	65	60	71	66	62
4	74	63	55	49	73	63	55	50	63	56	51	63	57	52	63	57	53
5	69	57	49	43	68	57	49	43	57	50	44	57	50	45	56	50	46
6	65	52	44	38	64	52	44	38	52	44	39	51	45	39	51	45	40
7	61	48	40	34	60	48	40	34	47	40	35	47	40	35	46	40	35
8	57	44	36	30	56	44	36	31	43	36	31	43	36	31	42	36	32
9	54	41	33	28	53	41	33	28	40	33	28	40	33	28	39	33	28
10	51	38	30	25	50	38	30	25	37	30	25	37	30	26	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

H (m)	D (m) C0-180	D (m) C90-270	Ev (lx) Center	Ev (lx) Edge, C0-180	Ev (lx) Edge, C90-270
1.0	3.2	2.8	1047	82	70
2.0	6.3	5.5	262	20	17
2.5	7.9	6.9	167	13	11
3.0	9.5	8.3	116	9.1	7.7
4.0	13	11	65	5.1	4.3
5.0	16	14	42	3.3	2.8



**Table - Measurement information**















Ambient temperature of the laboratory	25.0 degC
Power supply	230.0 Vac
Measurement distance	3150 mm
Location of the rotation axis	0 mm
Angular step, C plane	90.0 deg
Angular step, gamma angle	10.0 deg
Maximum gamma angle	80.0 deg
Stabilization time	35 min

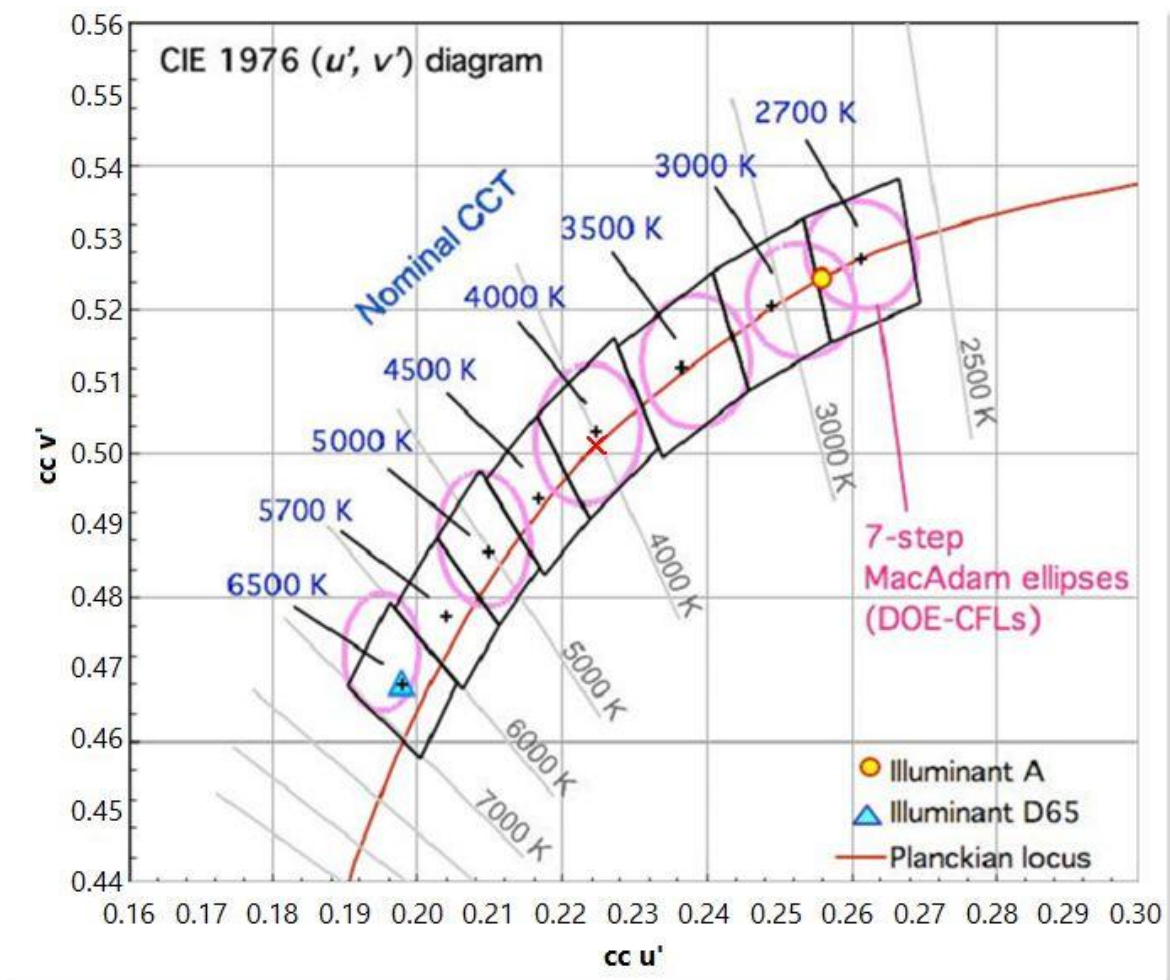
**Table - Measurement results of the total colorimetric parameters**

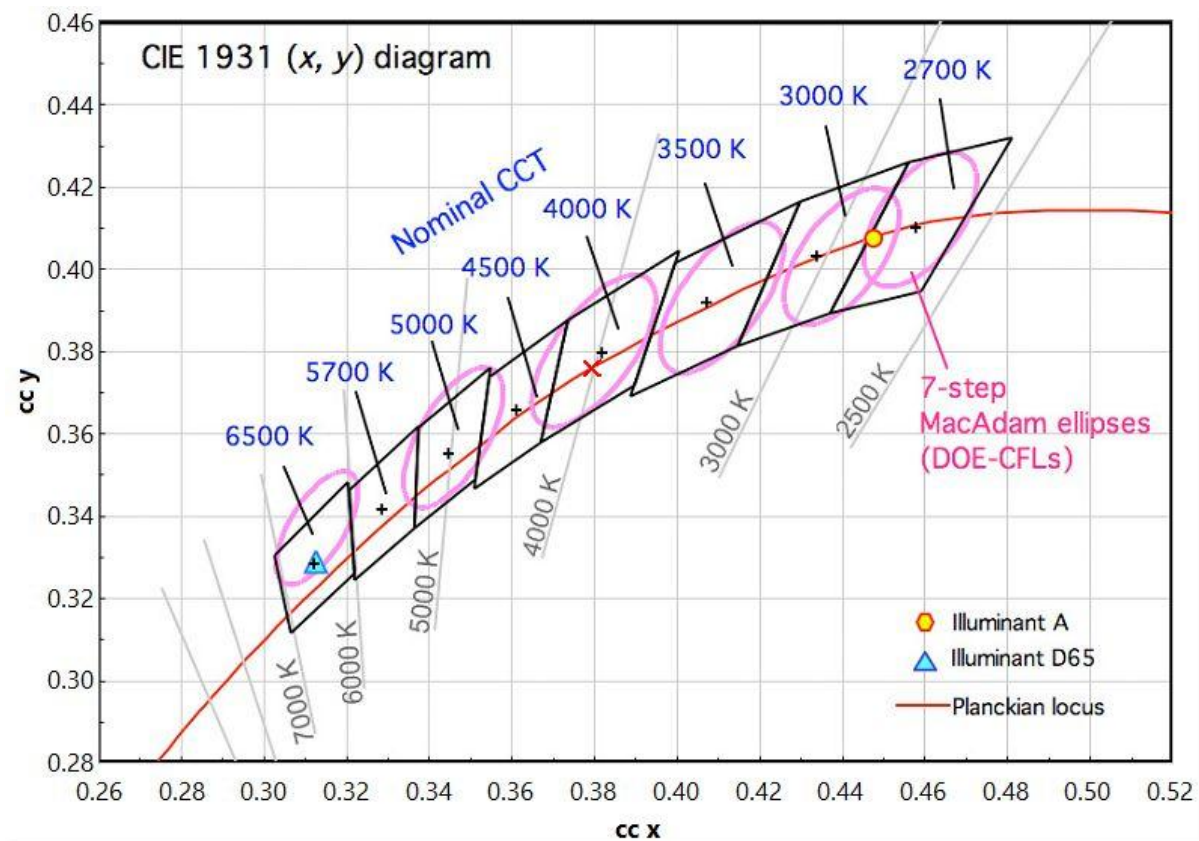
Color coordinates in CIE 1931 diagram	x,y	(0.3793, 0.3757)
Color coordinates in CIE 1976 diagram	u',v'	(0.2248, 0.5009)
Correlated color temperature	CCT	4023 K
General color rendering index	CRI, Ra	84.4
Spatial color uniformity	SDCM	2.8
Distance from Planckian locus	Du'v'	0.000

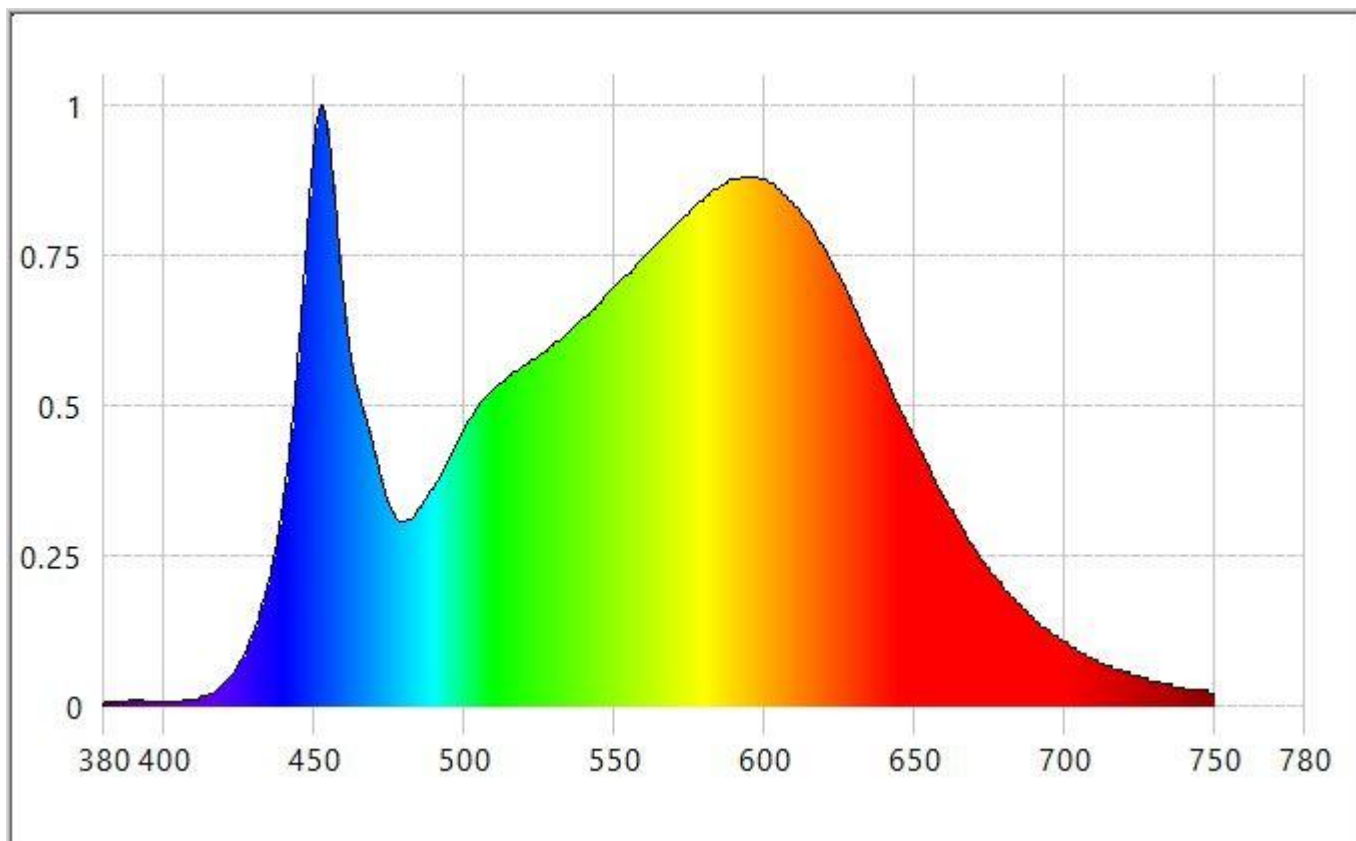
Weighted average of the angular color measurements. --SDCM = Maximum deviation of the angular  $u'$ ,  $v'$  measurements from the weighted average. -- SDCM corresponds 1-step MacAdam Ellipse, 1 SDCM corresponds to  $u'v' = 0.001$

**Table - Total special color rendering indices**

R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14
83.1	92.0	96.0	82.1	83.2	88.3	85.4	65.0	12.6	80.7	81.3	65.1	85.6	98.4
													

**Figure - Weighted average color coordinates ( $u', v'$ ) in CIE 1976 color diagram**

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



**Figure - Total spectral radiant flux**

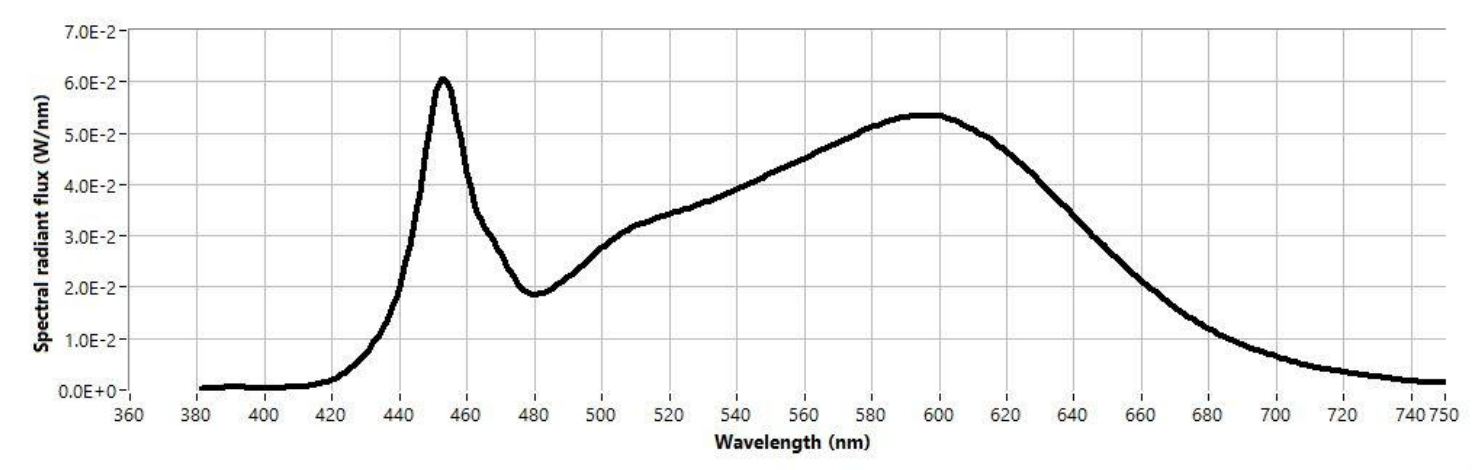
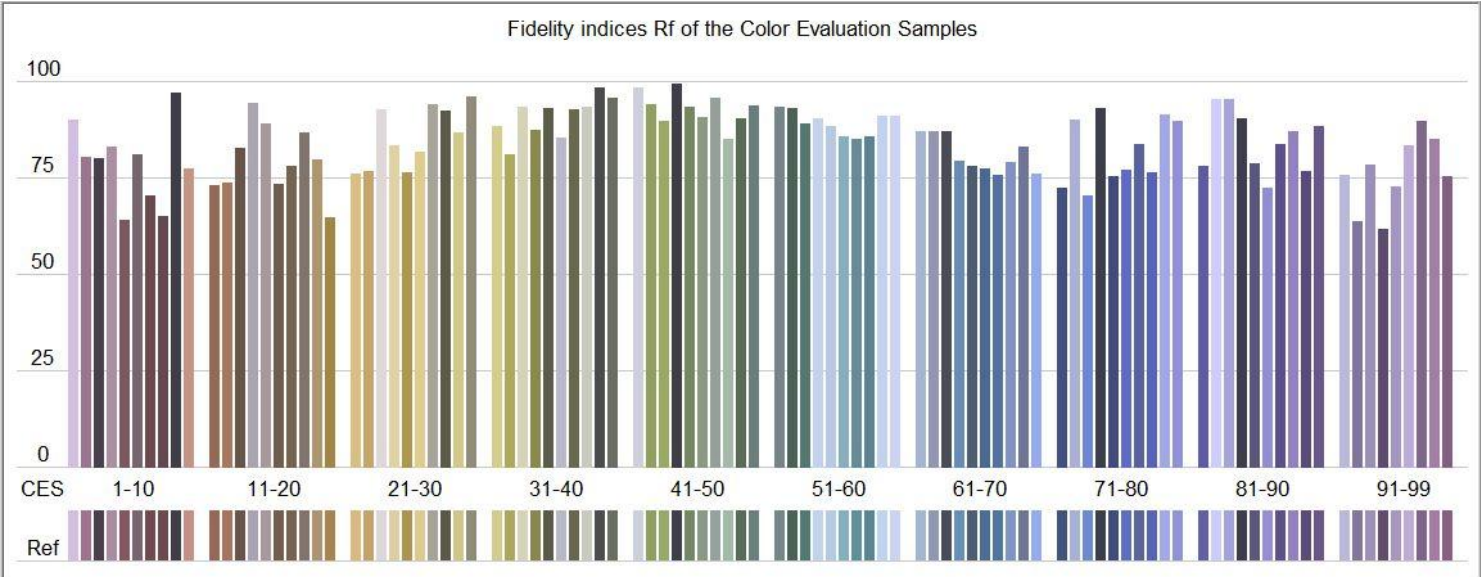
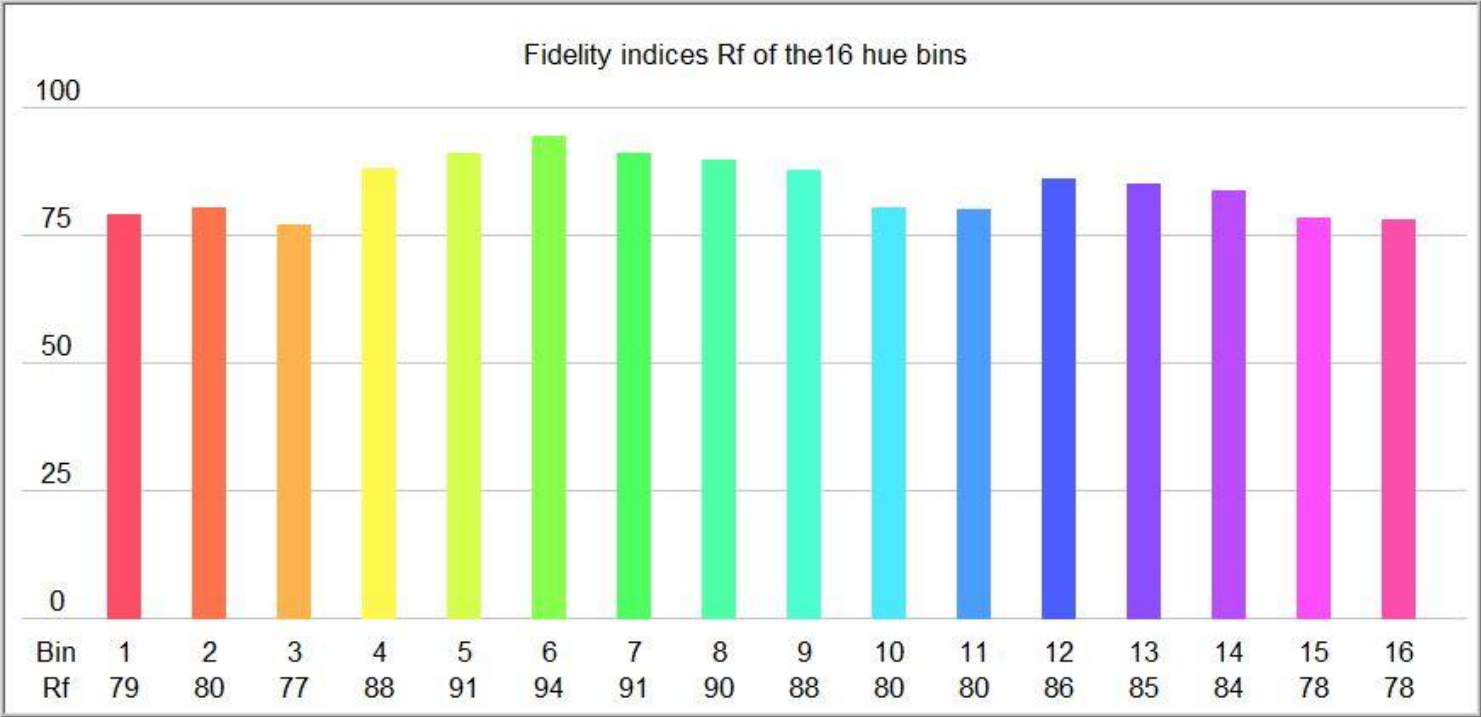


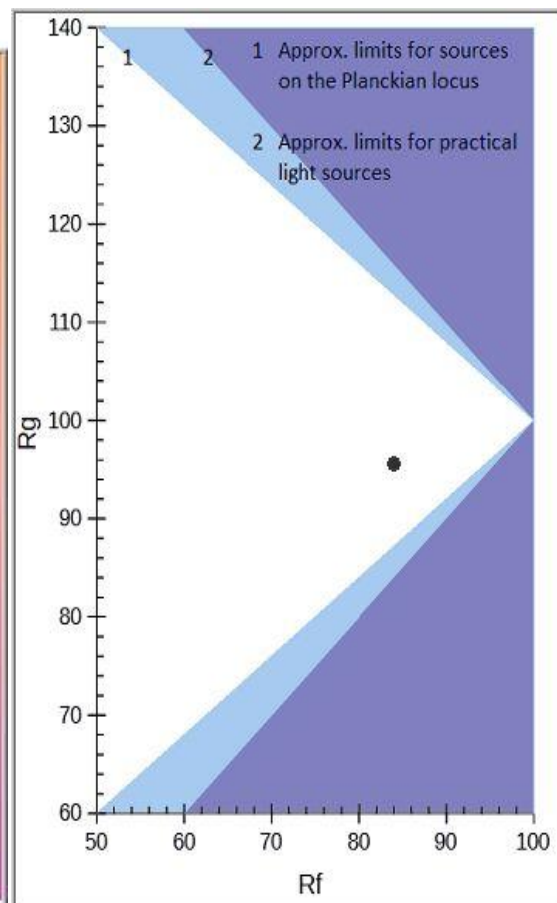
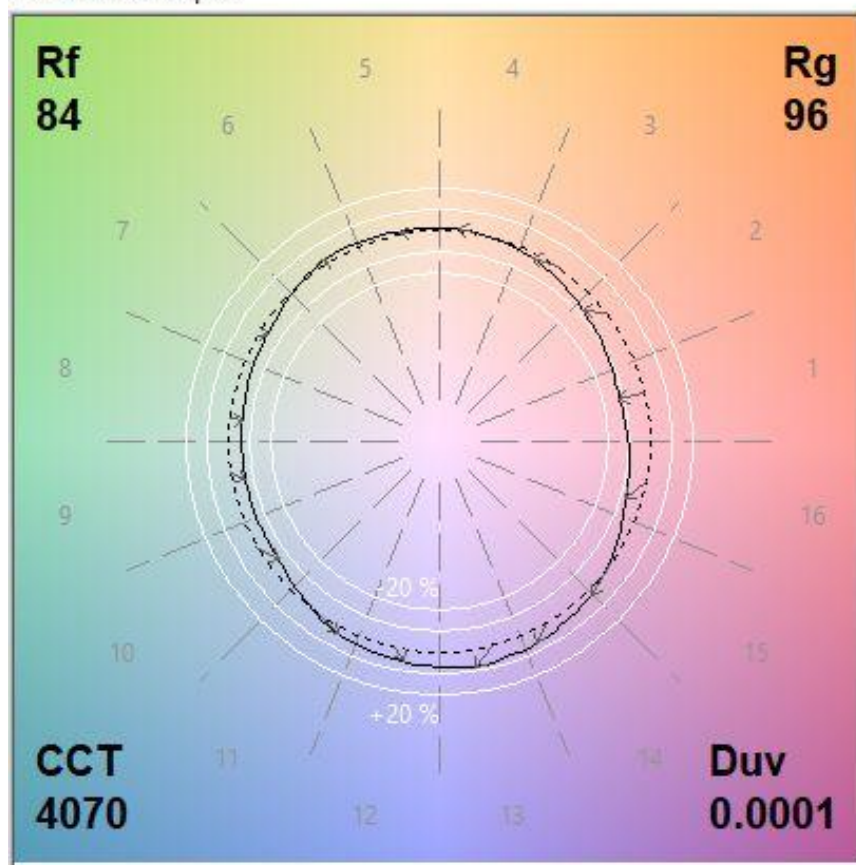
Table - Color rendition values according to TM30-18

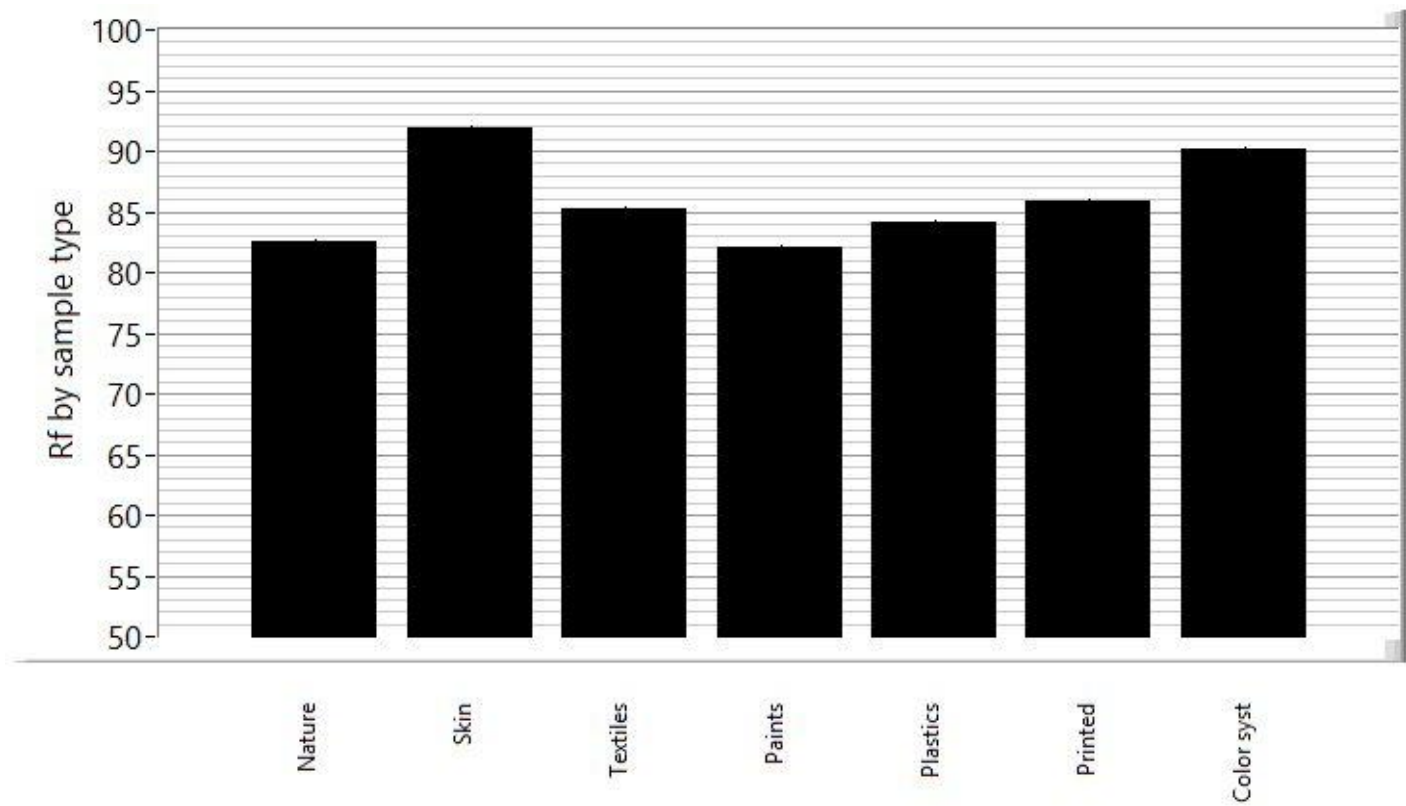


Fidelity index



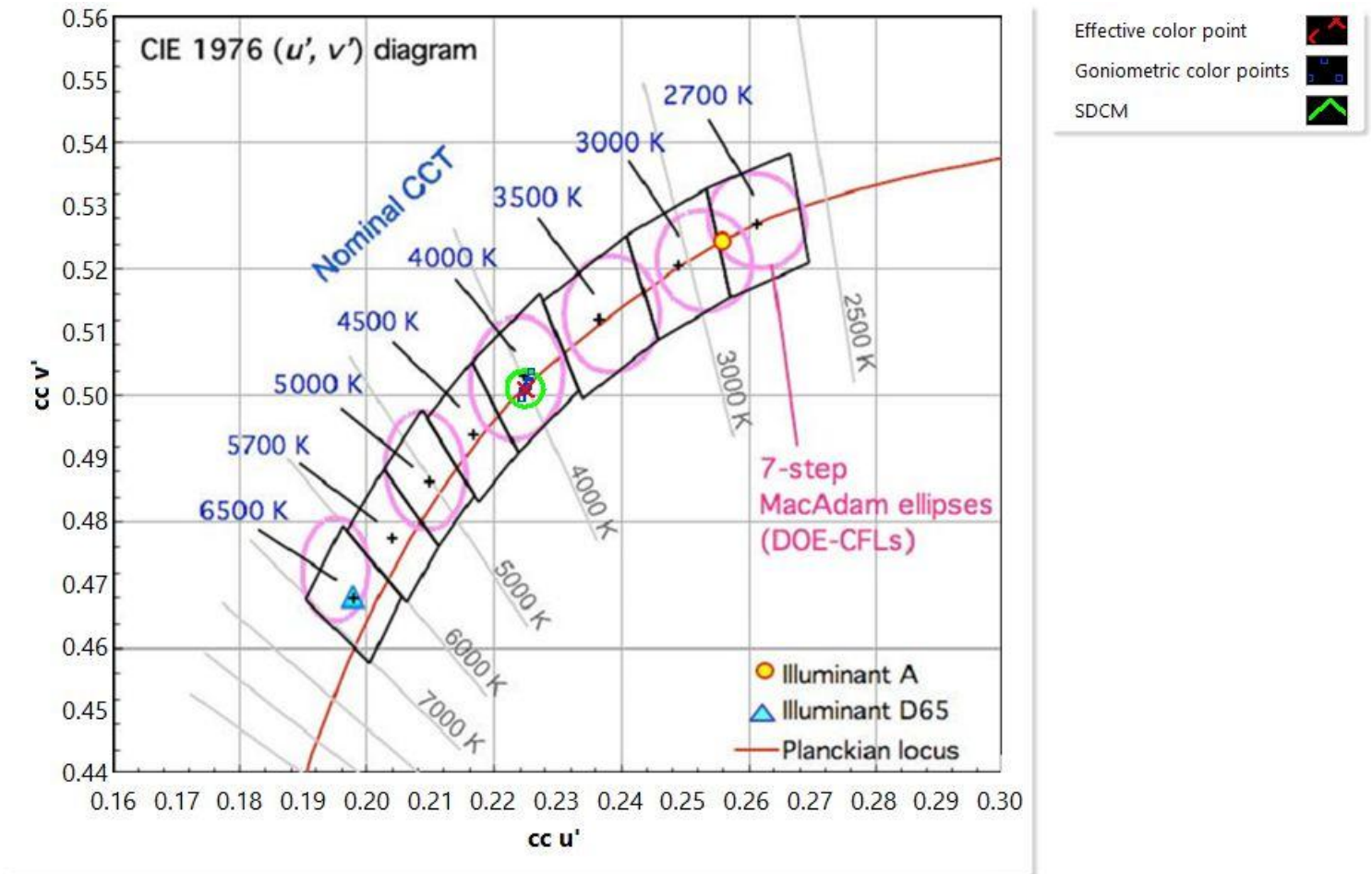
Color Vector Graphic

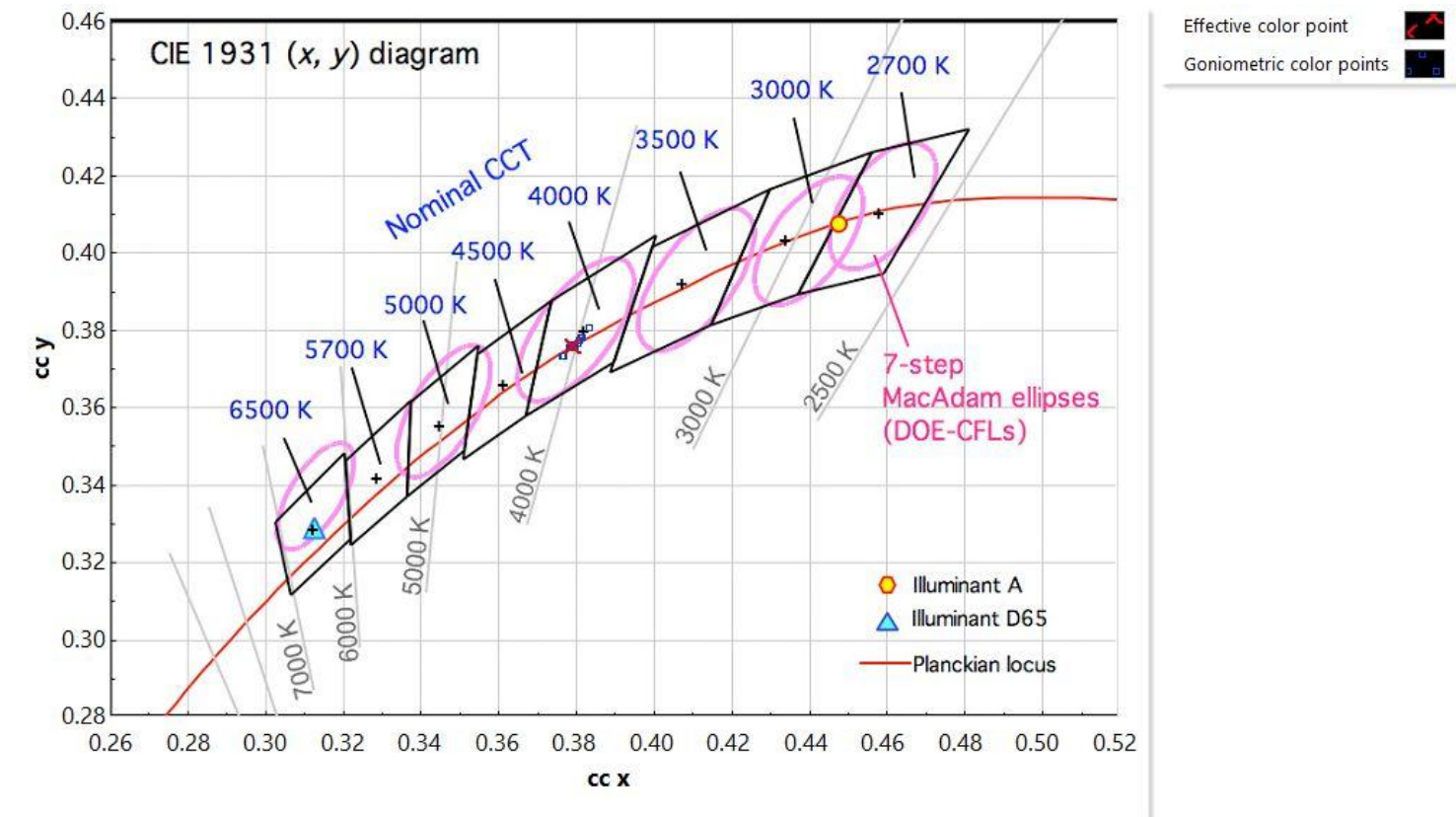


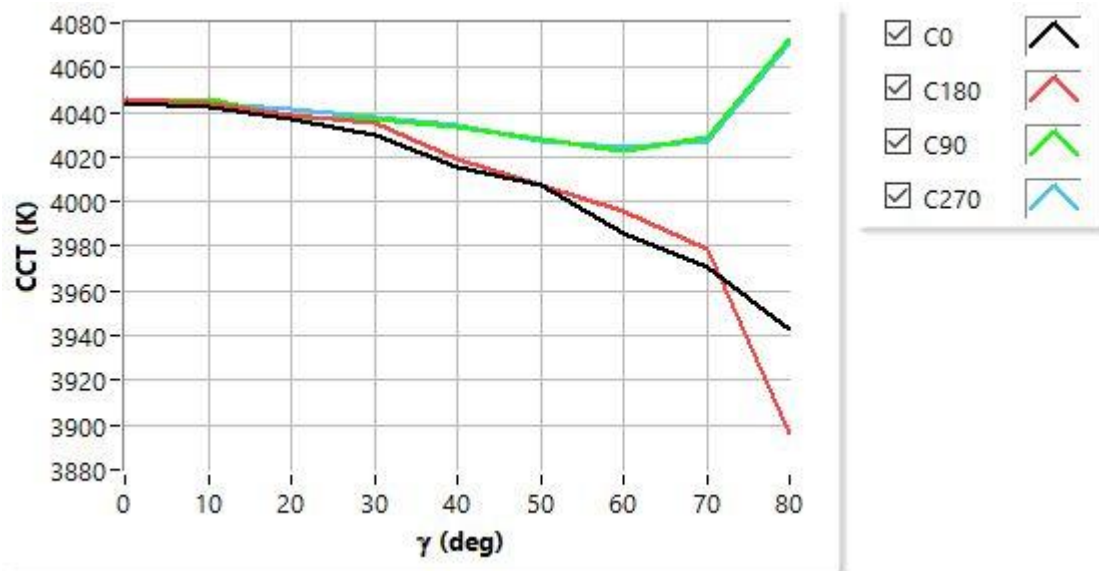


**Table - Color coordinates u'v' at different angles in CIE1976 color diagram**

C-plane	gamma	u'	v'
0	80	0.2258	0.5036
0	70	0.2256	0.5022
0	60	0.2254	0.5017
0	50	0.2251	0.5012
0	40	0.2249	0.5011
0	30	0.2246	0.5009
0	20	0.2245	0.5008
0	10	0.2245	0.5006
0	0	0.2244	0.5005
180	80	Iv < 10%	Iv < 10%
180	70	0.2254	0.5021
180	60	0.2253	0.5014
180	50	0.2252	0.5010
180	40	0.2249	0.5010
180	30	0.2246	0.5007
180	20	0.2245	0.5006
180	10	0.2244	0.5006
180	0	0.2244	0.5005
90	80	0.2242	0.4993
90	70	0.2247	0.5007
90	60	0.2248	0.5008
90	50	0.2248	0.5007
90	40	0.2246	0.5007
90	30	0.2245	0.5007
90	20	0.2245	0.5006
90	10	0.2244	0.5005
90	0	0.2244	0.5005
270	80	0.2243	0.4994
270	70	0.2248	0.5008
270	60	0.2248	0.5009
270	50	0.2248	0.5008
270	40	0.2247	0.5007
270	30	0.2245	0.5007
270	20	0.2245	0.5006
270	10	0.2244	0.5006
270	0	0.2244	0.5006

**Figure - Spatial color uniformity in CIE1976 diagram**

**Figure - Spatial color uniformity in CIE1931 diagram**

**Figure - CCT as a function of angle****Figure - CRI, Ra as a function of angle**