

Classified
Cooper Lighting Solutions Photometric Lab
1121 Highway 74 South
Peachtree City, GA 30269



Scaled data based on original data using
LM-79-08 Approved Method: Electrical and Photometric Measurements of Solid-State
Lighting Products

Test Report Prepared for
Cooper Lighting Solutions
(formerly Eaton)

Brand: HALO

Report Number: P832733

Luminaire Tested: **HLBT407FS5*-935**

Issue Date: 05/14/2024

Test Information

Test Method: LM-79-08
Report Number: P832733
Test Lab: ETA Testing Technology
Issue Date: 05/14/2024
Manufacturer: COOPER LIGHTING SOLUTIONS (FORMERLY EATON)
Product Line: HALO
Catalog Number: HLBT407FS5*-935
Description: HALO SLIM RETROFIT 4 inch 90 CRI COLOR SELECTABLE FIXTURE
Light Source: 3500K CCT, 90 CRI LEDS
Ballast/Driver: ELECTRONIC DRIVER

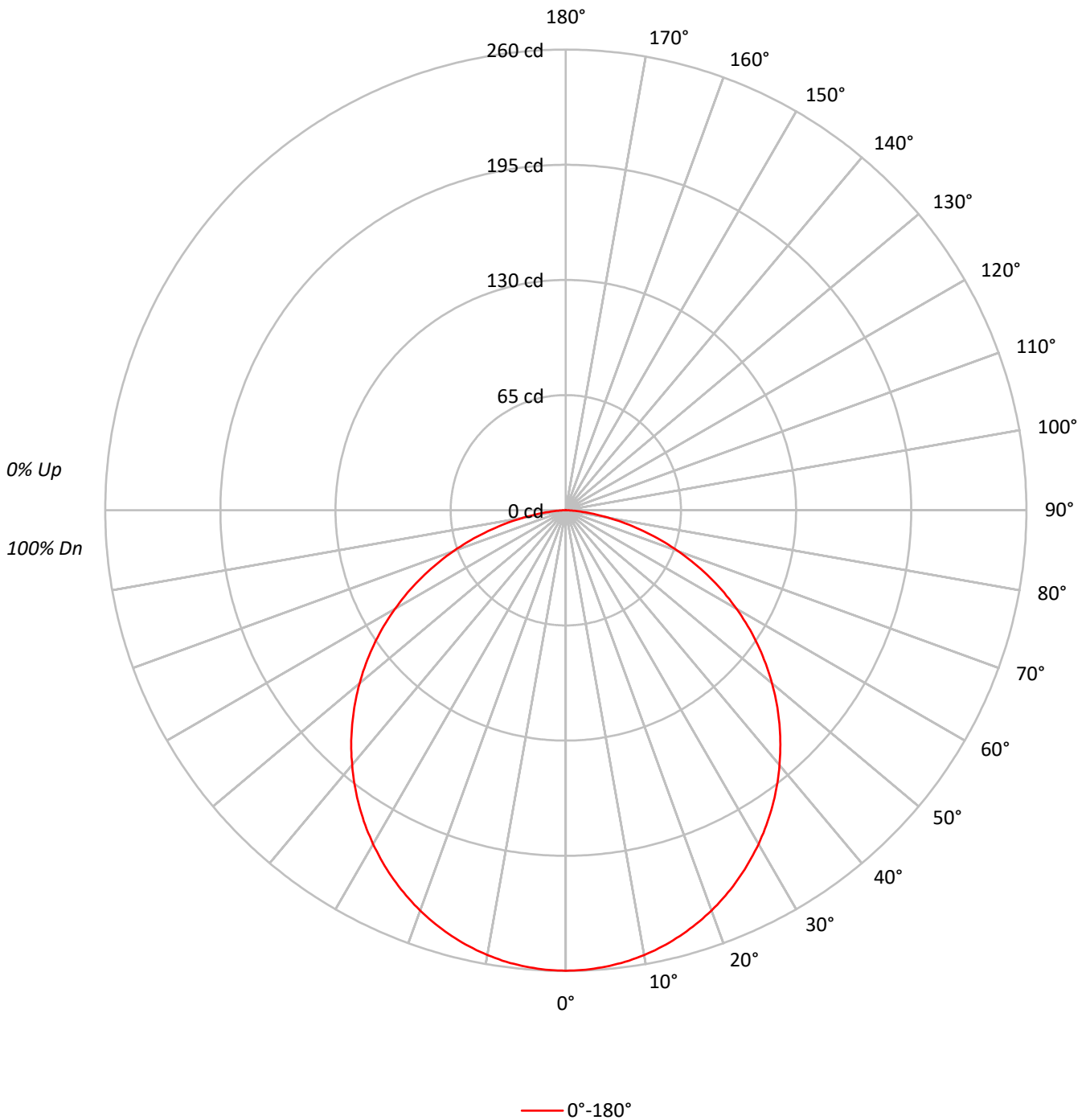
Summary

Lumens per Lamp: N/A
Luminaire Lumens: 725.2 lumens
Efficiency: N/A
Efficacy: 93.0 lumens/watt
Spacing Criteria (0/90/45): 1.24 / 1.24 / 1.36
Luminous Opening: Circular (Dia: 0.3' x H: 0')
CIE Type: Direct

Input Watts (W): 7.8
Input Voltage (V): 120
Input Current (Ain): NR
Voltage Rise (V): NR
Power Factor: NR
Total Harmonic Distortion (THDi): NR
Frequency (hertz): 60
Stabilization Time: NR
Operation Time: NR
Ambient Temperature (°C): NR
Test Distance: 25 FT

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Luminous Intensity Polar Plot





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COEFFICIENT OF UTILIZATION - ZONAL CAVITY METHOD:

RF	20				20				20				20				20			20	
RC	80				70				50				30				10			0	
RW	70	50	30	10	70	50	30	10	50	30	10	50	30	10	50	30	10	50	30	10	0
RCR																					
0	119	119	119	119	116	116	116	116	111	111	111	106	106	106	102	102	102	100	100	100	100
1	109	104	100	96	106	102	98	95	98	95	92	94	91	89	90	88	86	84	84	84	84
2	99	91	84	78	96	89	83	77	85	80	76	82	78	74	79	75	72	70	70	70	70
3	90	80	72	65	88	78	71	65	75	69	63	72	67	62	70	65	61	59	59	59	59
4	83	71	62	55	80	69	61	55	67	60	54	64	58	53	62	57	53	50	50	50	50
5	76	63	54	48	74	62	54	47	60	52	47	58	51	46	56	50	46	44	44	44	44
6	70	57	48	41	68	56	47	41	54	47	41	52	46	41	51	45	40	38	38	38	38
7	65	52	43	37	63	51	42	36	49	42	36	48	41	36	46	40	36	34	34	34	34
8	61	47	38	33	59	46	38	33	45	38	32	44	37	32	43	36	32	30	30	30	30
9	57	43	35	29	55	43	35	29	41	34	29	40	34	29	39	33	29	27	27	27	27
10	53	40	32	27	52	39	32	27	38	31	26	37	31	26	36	30	26	24	24	24	24

AVERAGE LUMINANCE (cd/sqm):

	0°
0°	39577
5°	39530
10°	39415
15°	39208
20°	38957
25°	38628
30°	38262
35°	37812
40°	37312
45°	36739
50°	36009
55°	35098
60°	33928
65°	32321
70°	30053
75°	26711
80°	21748
85°	14676



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ZONAL LUMENS:

Zone	Lumens	% Fixture
0°-10°	24.6	3.4
10°-20°	70.2	9.7
20°-30°	105.9	14.6
30°-40°	127.2	17.5
40°-50°	131.5	18.1
50°-60°	118.1	16.3
60°-70°	88.7	12.2
70°-80°	48.1	6.6
80°-90°	10.9	1.5
90°-100°	0.0	0.0
100°-110°	0.0	0.0
110°-120°	0.0	0.0
120°-130°	0.0	0.0
130°-140°	0.0	0.0
140°-150°	0.0	0.0
150°-160°	0.0	0.0
160°-170°	0.0	0.0
170°-180°	0.0	0.0
0°-30°	200.7	27.7
0°-40°	327.9	45.2
0°-60°	577.5	79.6
0°-90°	725.2	100.0
90°-120°	0.0	0.0
90°-150°	0.0	0.0
90°-180°	0.0	0.0
0°-180°	725.2	100.0

CANDELA DISTRIBUTION:

	0°	Flux
0°	260	
5°	259	25
15°	249	70
25°	230	106
35°	203	127
45°	171	131
55°	132	118
65°	90	89
75°	45	48
85°	8	11
90°	1	



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CANDELA DISTRIBUTION (FULL):

	0°
0°	259.9
0.5°	259.8
1°	259.8
1.5°	259.7
2°	259.6
2.5°	259.5
3°	259.4
3.5°	259.2
4°	259.0
4.5°	258.8
5°	258.6
5.5°	258.3
6°	258.0
6.5°	257.7
7°	257.4
7.5°	257.0
8°	256.7
8.5°	256.2
9°	255.8
9.5°	255.3
10°	254.9
10.5°	254.3
11°	253.8
11.5°	253.3
12°	252.7
12.5°	252.1
13°	251.5
13.5°	250.8
14°	250.2
14.5°	249.4
15°	248.7
15.5°	248.0
16°	247.2
16.5°	246.4
17°	245.6
17.5°	244.8
18°	244.0
18.5°	243.1
19°	242.2
19.5°	241.3
20°	240.4
20.5°	239.4
21°	238.5
21.5°	237.4
22°	236.4



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CANDELA DISTRIBUTION (continued):

	0°
22.5°	235.4
23°	234.3
23.5°	233.3
24°	232.2
24.5°	231.0
25°	229.9
25.5°	228.7
26°	227.6
26.5°	226.4
27°	225.2
27.5°	223.9
28°	222.7
28.5°	221.4
29°	220.1
29.5°	218.9
30°	217.6
30.5°	216.2
31°	214.8
31.5°	213.5
32°	212.1
32.5°	210.7
33°	209.3
33.5°	207.8
34°	206.4
34.5°	204.9
35°	203.4
35.5°	201.9
36°	200.5
36.5°	198.9
37°	197.3
37.5°	195.8
38°	194.2
38.5°	192.6
39°	191.0
39.5°	189.4
40°	187.7
40.5°	186.0
41°	184.4
41.5°	182.7
42°	181.0
42.5°	179.3
43°	177.6
43.5°	175.9
44°	174.1
44.5°	172.3



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CANDELA DISTRIBUTION (continued):

	0°
45°	170.6
45.5°	168.7
46°	166.9
46.5°	165.1
47°	163.3
47.5°	161.4
48°	159.6
48.5°	157.7
49°	155.8
49.5°	153.9
50°	152.0
50.5°	150.1
51°	148.1
51.5°	146.2
52°	144.2
52.5°	142.3
53°	140.2
53.5°	138.3
54°	136.3
54.5°	134.2
55°	132.2
55.5°	130.2
56°	128.1
56.5°	126.1
57°	124.0
57.5°	121.9
58°	119.8
58.5°	117.7
59°	115.6
59.5°	113.5
60°	111.4
60.5°	109.2
61°	107.1
61.5°	105.0
62°	102.8
62.5°	100.7
63°	98.5
63.5°	96.3
64°	94.1
64.5°	92.0
65°	89.7
65.5°	87.5
66°	85.3
66.5°	83.1
67°	80.9



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CANDELA DISTRIBUTION (continued):

	0°
67.5°	78.7
68°	76.5
68.5°	74.3
69°	72.0
69.5°	69.8
70°	67.5
70.5°	65.3
71°	63.1
71.5°	60.9
72°	58.7
72.5°	56.4
73°	54.2
73.5°	52.0
74°	49.8
74.5°	47.6
75°	45.4
75.5°	43.3
76°	41.1
76.5°	39.0
77°	36.9
77.5°	34.8
78°	32.8
78.5°	30.7
79°	28.7
79.5°	26.7
80°	24.8
80.5°	22.9
81°	21.0
81.5°	19.2
82°	17.4
82.5°	15.7
83°	14.1
83.5°	12.6
84°	11.1
84.5°	9.7
85°	8.4
85.5°	7.2
86°	6.1
86.5°	5.1
87°	4.2
87.5°	3.5
88°	2.9
88.5°	2.3
89°	1.9
89.5°	1.4

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Scaled Data Report



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CANDELA DISTRIBUTION (continued):



Signify Classified - Internal
Cooper Lighting Solutions Photometric Lab
1121 Highway 74 South
Peachtree City, GA 30269



LM-79-2019: Approved Method: Electrical and Photometric Measurements of Solid-
State Lighting Products

Report Prepared for

Cooper Lighting Solutions

HALO

Report Number: SP1-2403-328-13

Test Date: 05/03/2024

Luminaire Tested: HLT407FS5-3500K

Data in this report applies to families of products HLT407FS5-3500K.

Test Information

Test Method: LM-79-2019
 Report Number: SP1-2403-328-13
 Test Lab: COOPER LIGHTING SOLUTIONS
 Photometer: SP1 - 76IN SPHERE
 Measurement Geometry: 4π
 Issue Date: 05/03/2024
 Manufacturer: COOPER LIGHTING SOLUTIONS
 Product Line: HALO
 Catalog Number: **HLT407FSS-3500K**
 Description: HLBSL RETROFIT 4 INCH SAMPLE #2.

Spectral Parameters

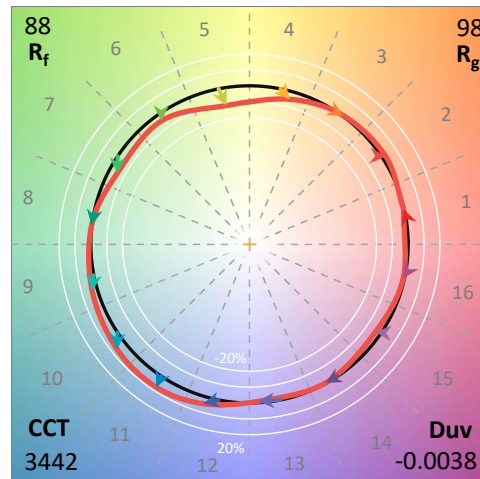
CCT (K): 3442
 CIE u': 0.2389
 CIE v': 0.5074
 Duv: -0.0038
 CIE x: 0.4045
 CIE y: 0.3818
 CIE z: 0.2137
 Peak Wavelength (nm): 632
 Dominant Wavelength (nm): 582
 Purity: 36.3

CRI (Ra):	91.8		
R1:	90.3	R9:	89.1
R2:	91.8	R10:	85.7
R3:	96.7	R11:	92.9
R4:	93.6	R12:	76.0
R5:	90.7	R13:	90.1
R6:	86.0	R14:	98.6
R7:	92.1		
R8:	93.4		

Rf: 87.6
 Rg: 97.5

Test Conditions

Stabilization Time: 21M
 Operation Time: 12H
 Room Temperature (°C) / RH%: 25.1/43%
 Sphere Temperature (°C): 24.9

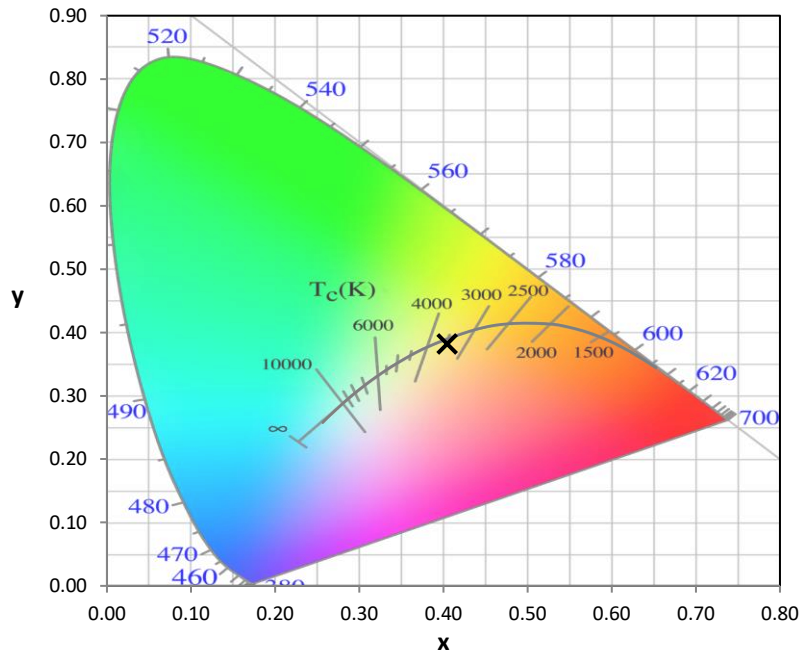


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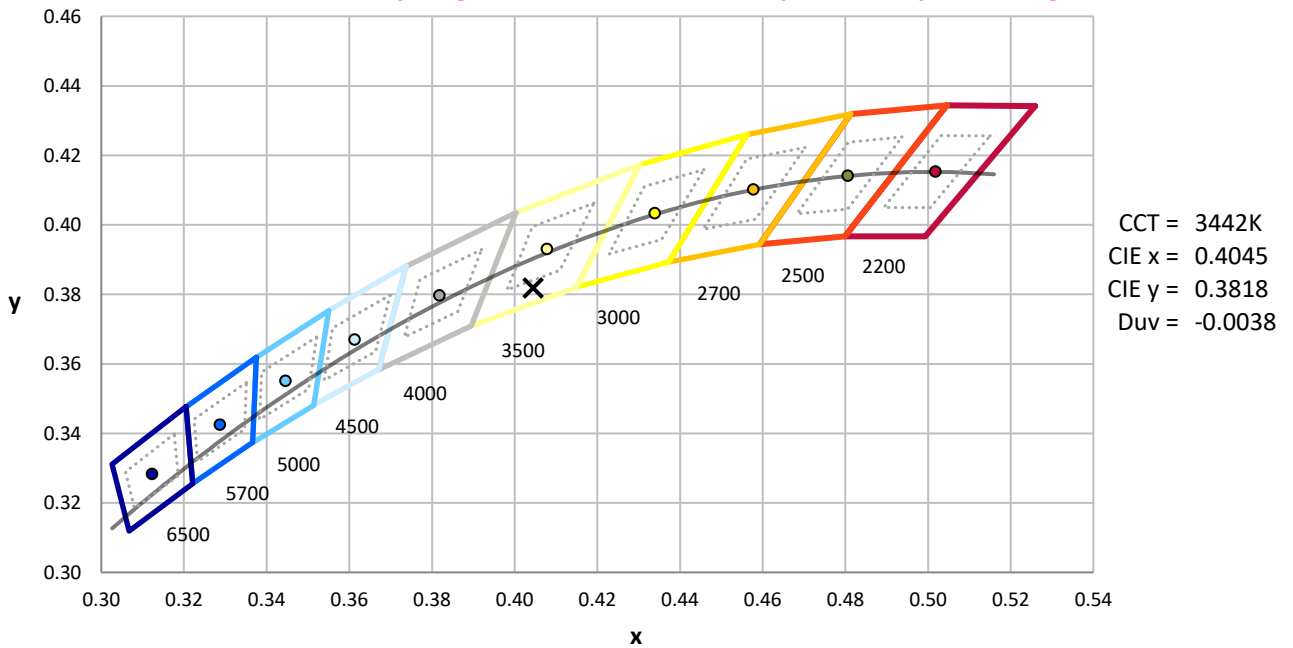
Measurement and Test Equipment			
Instrument	Identification Number	Calibration Date	Calibration Due Date
Photometer	76INCH SPHERE IN0058	2/12/2024	8/12/2024
Power Meter	XITRON 2801 IN0071	10/23/2023	10/23/2024
AC Power Source	CHROMA 61603 IN0063	10/24/2023	10/24/2024
DC Power Source	AGILENT E3634A IN0208	10/24/2023	10/24/2024
Sphere Thermometer	ONSET IN0085	10/24/2023	10/24/2024
Room Thermometer	ONSET IN0046	10/24/2023	10/24/2024

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CIE 1931 Chromaticity Diagram



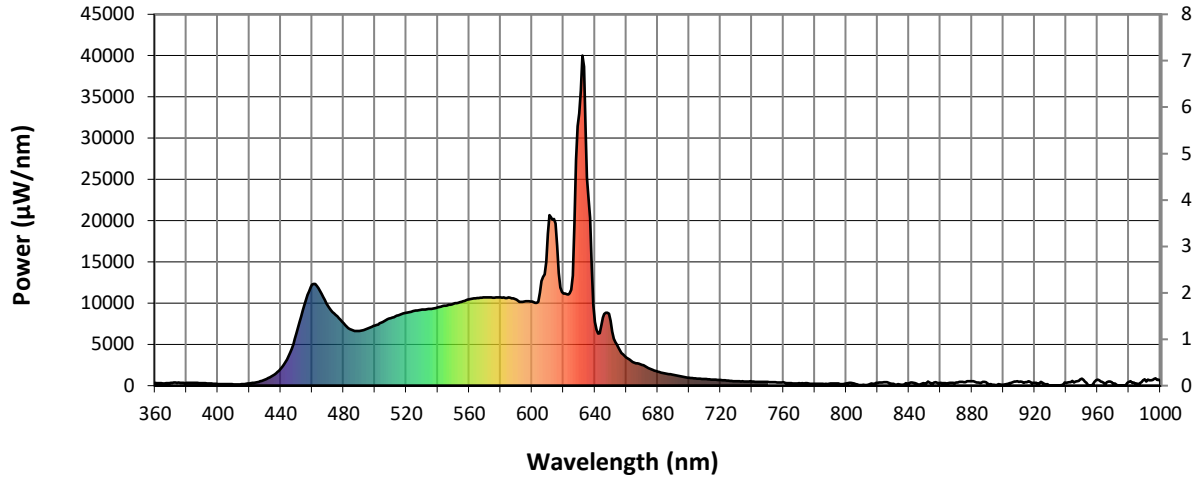
CIE 1931 Chromaticity Diagram with 2017 ANSI 7-Step and 4-Step Quadrangles



Point lies inside the ANSI 3500K 7-step quadrangle

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Photopic Flux vs. Wavelength

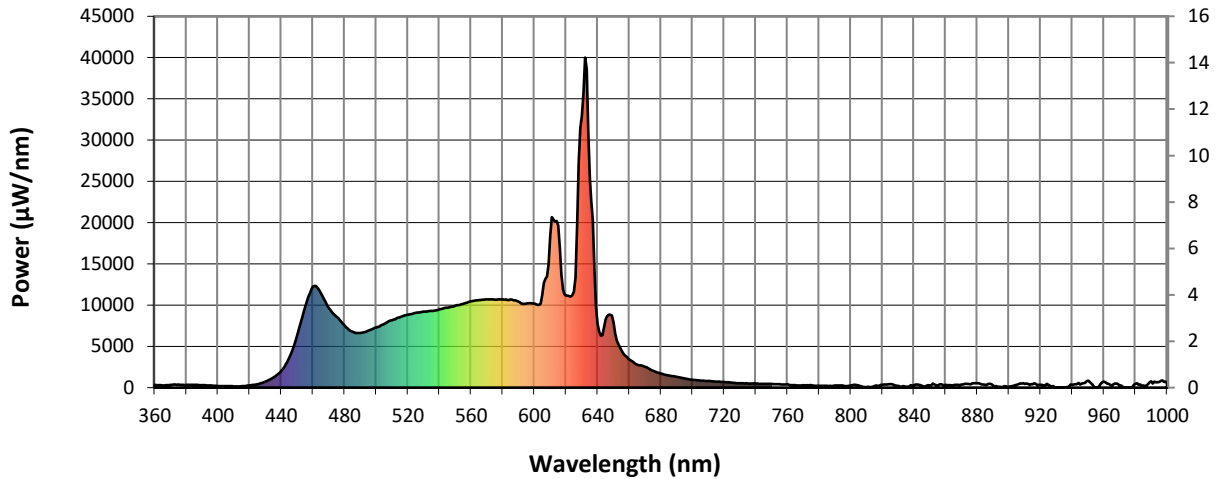


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λ (nm)	Power ($\mu\text{W}/\text{nm}$)	Lumens (ϕ/nm)	λ (nm)	Power ($\mu\text{W}/\text{nm}$)	Lumens (ϕ/nm)	λ (nm)	Power ($\mu\text{W}/\text{nm}$)	Lumens (ϕ/nm)	λ (nm)	Power ($\mu\text{W}/\text{nm}$)	Lumens (ϕ/nm)	λ (nm)	Power ($\mu\text{W}/\text{nm}$)	Lumens (ϕ/nm)
360	341	NR	490	6625	NR	620	11148	NR	750	453	NR	880	531	NR
365	263	NR	495	6888	NR	625	11645	NR	755	410	NR	885	349	NR
370	327	NR	500	7295	NR	630	32993	NR	760	401	NR	890	251	NR
375	371	NR	505	7723	NR	635	25233	NR	765	316	NR	895	52	NR
380	334	NR	510	8173	NR	640	7701	NR	770	288	NR	900	105	NR
385	328	NR	515	8529	NR	645	8263	NR	775	284	NR	905	328	NR
390	315	NR	520	8850	NR	650	7882	NR	780	239	NR	910	455	NR
395	266	NR	525	9071	NR	655	4578	NR	785	218	NR	915	416	NR
400	200	NR	530	9210	NR	660	3422	NR	790	265	NR	920	342	NR
405	171	NR	535	9310	NR	665	2772	NR	795	262	NR	925	328	NR
410	162	NR	540	9487	NR	670	2529	NR	800	269	NR	930	0	NR
415	176	NR	545	9702	NR	675	2039	NR	805	267	NR	935	25	NR
420	271	NR	550	9902	NR	680	1697	NR	810	52	NR	940	354	NR
425	432	NR	555	10144	NR	685	1473	NR	815	180	NR	945	380	NR
430	720	NR	560	10453	NR	690	1304	NR	820	331	NR	950	837	NR
435	1238	NR	565	10601	NR	695	1098	NR	825	432	NR	955	0	NR
440	2030	NR	570	10686	NR	700	949	NR	830	240	NR	960	722	NR
445	3583	NR	575	10668	NR	705	847	NR	835	104	NR	965	207	NR
450	6328	NR	580	10685	NR	710	799	NR	840	320	NR	970	234	NR
455	9747	NR	585	10688	NR	715	738	NR	845	226	NR	975	0	NR
460	12261	NR	590	10417	NR	720	688	NR	850	272	NR	980	458	NR
465	11480	NR	595	10204	NR	725	606	NR	855	282	NR	985	256	NR
470	9641	NR	600	10186	NR	730	551	NR	860	340	NR	990	756	NR
475	8562	NR	605	11250	NR	735	502	NR	865	296	NR	995	678	NR
480	7556	NR	610	18405	NR	740	493	NR	870	385	NR	1000	533	NR
485	6762	NR	615	19652	NR	745	447	NR	875	428	NR			

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Scotopic Flux vs. Wavelength



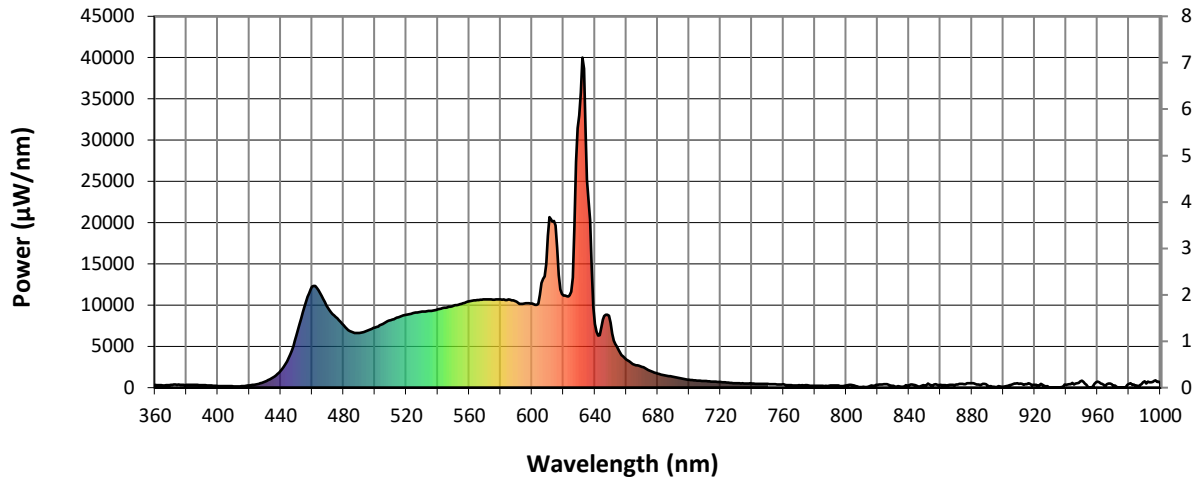
Scotopic Lumens: 1353

S/P: 1.77

λ (nm)	Power (µW/nm)	Lumens (φ/nm)	λ (nm)	Power (µW/nm)	Lumens (φ/nm)	λ (nm)	Power (µW/nm)	Lumens (φ/nm)	λ (nm)	Power (µW/nm)	Lumens (φ/nm)	λ (nm)	Power (µW/nm)	Lumens (φ/nm)
360	341	NR	490	6625	NR	620	11148	NR	750	453	NR	880	531	NR
365	263	NR	495	6888	NR	625	11645	NR	755	410	NR	885	349	NR
370	327	NR	500	7295	NR	630	32993	NR	760	401	NR	890	251	NR
375	371	NR	505	7723	NR	635	25233	NR	765	316	NR	895	52	NR
380	334	NR	510	8173	NR	640	7701	NR	770	288	NR	900	105	NR
385	328	NR	515	8529	NR	645	8263	NR	775	284	NR	905	328	NR
390	315	NR	520	8850	NR	650	7882	NR	780	239	NR	910	455	NR
395	266	NR	525	9071	NR	655	4578	NR	785	218	NR	915	416	NR
400	200	NR	530	9210	NR	660	3422	NR	790	265	NR	920	342	NR
405	171	NR	535	9310	NR	665	2772	NR	795	262	NR	925	328	NR
410	162	NR	540	9487	NR	670	2529	NR	800	269	NR	930	0	NR
415	176	NR	545	9702	NR	675	2039	NR	805	267	NR	935	25	NR
420	271	NR	550	9902	NR	680	1697	NR	810	52	NR	940	354	NR
425	432	NR	555	10144	NR	685	1473	NR	815	180	NR	945	380	NR
430	720	NR	560	10453	NR	690	1304	NR	820	331	NR	950	837	NR
435	1238	NR	565	10601	NR	695	1098	NR	825	432	NR	955	0	NR
440	2030	NR	570	10686	NR	700	949	NR	830	240	NR	960	722	NR
445	3583	NR	575	10668	NR	705	847	NR	835	104	NR	965	207	NR
450	6328	NR	580	10685	NR	710	799	NR	840	320	NR	970	234	NR
455	9747	NR	585	10688	NR	715	738	NR	845	226	NR	975	0	NR
460	12261	NR	590	10417	NR	720	688	NR	850	272	NR	980	458	NR
465	11480	NR	595	10204	NR	725	606	NR	855	282	NR	985	256	NR
470	9641	NR	600	10186	NR	730	551	NR	860	340	NR	990	756	NR
475	8562	NR	605	11250	NR	735	502	NR	865	296	NR	995	678	NR
480	7556	NR	610	18405	NR	740	493	NR	870	385	NR	1000	533	NR
485	6762	NR	615	19652	NR	745	447	NR	875	428	NR			

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Melanopic Flux vs. Wavelength



Melanopic Lumens: 567.9 M/P: 0.74

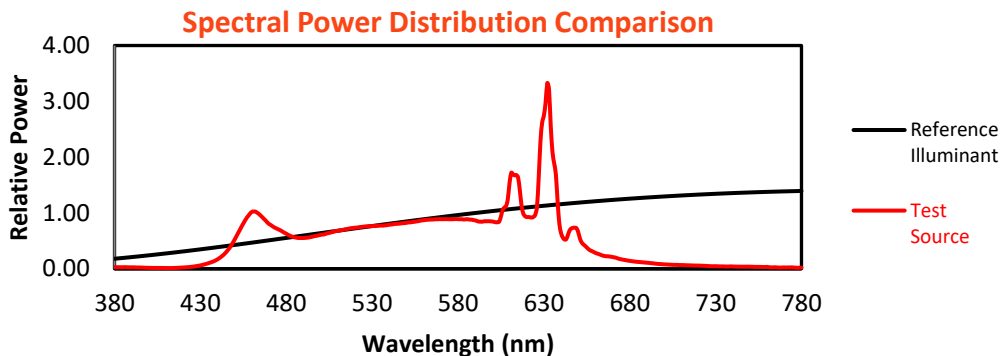
λ (nm)	Power ($\mu\text{W}/\text{nm}$)	Lumens (ϕ/nm)	λ (nm)	Power ($\mu\text{W}/\text{nm}$)	Lumens (ϕ/nm)	λ (nm)	Power ($\mu\text{W}/\text{nm}$)	Lumens (ϕ/nm)	λ (nm)	Power ($\mu\text{W}/\text{nm}$)	Lumens (ϕ/nm)	λ (nm)	Power ($\mu\text{W}/\text{nm}$)	Lumens (ϕ/nm)
360	341	NR	490	6625	NR	620	11148	NR	750	453	NR	880	531	NR
365	263	NR	495	6888	NR	625	11645	NR	755	410	NR	885	349	NR
370	327	NR	500	7295	NR	630	32993	NR	760	401	NR	890	251	NR
375	371	NR	505	7723	NR	635	25233	NR	765	316	NR	895	52	NR
380	334	NR	510	8173	NR	640	7701	NR	770	288	NR	900	105	NR
385	328	NR	515	8529	NR	645	8263	NR	775	284	NR	905	328	NR
390	315	NR	520	8850	NR	650	7882	NR	780	239	NR	910	455	NR
395	266	NR	525	9071	NR	655	4578	NR	785	218	NR	915	416	NR
400	200	NR	530	9210	NR	660	3422	NR	790	265	NR	920	342	NR
405	171	NR	535	9310	NR	665	2772	NR	795	262	NR	925	328	NR
410	162	NR	540	9487	NR	670	2529	NR	800	269	NR	930	0	NR
415	176	NR	545	9702	NR	675	2039	NR	805	267	NR	935	25	NR
420	271	NR	550	9902	NR	680	1697	NR	810	52	NR	940	354	NR
425	432	NR	555	10144	NR	685	1473	NR	815	180	NR	945	380	NR
430	720	NR	560	10453	NR	690	1304	NR	820	331	NR	950	837	NR
435	1238	NR	565	10601	NR	695	1098	NR	825	432	NR	955	0	NR
440	2030	NR	570	10686	NR	700	949	NR	830	240	NR	960	722	NR
445	3583	NR	575	10668	NR	705	847	NR	835	104	NR	965	207	NR
450	6328	NR	580	10685	NR	710	799	NR	840	320	NR	970	234	NR
455	9747	NR	585	10688	NR	715	738	NR	845	226	NR	975	0	NR
460	12261	NR	590	10417	NR	720	688	NR	850	272	NR	980	458	NR
465	11480	NR	595	10204	NR	725	606	NR	855	282	NR	985	256	NR
470	9641	NR	600	10186	NR	730	551	NR	860	340	NR	990	756	NR
475	8562	NR	605	11250	NR	735	502	NR	865	296	NR	995	678	NR
480	7556	NR	610	18405	NR	740	493	NR	870	385	NR	1000	533	NR
485	6762	NR	615	19652	NR	745	447	NR	875	428	NR			

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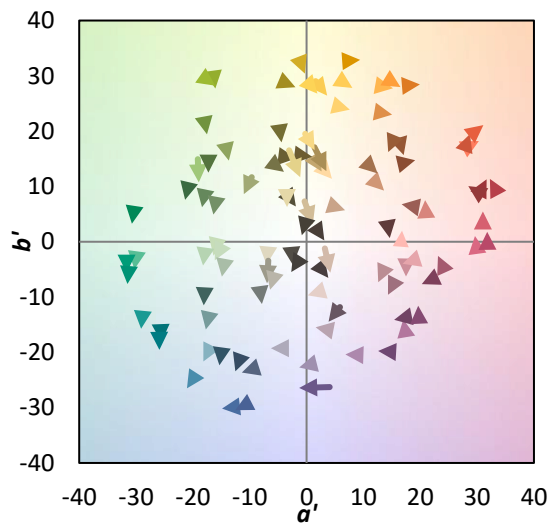
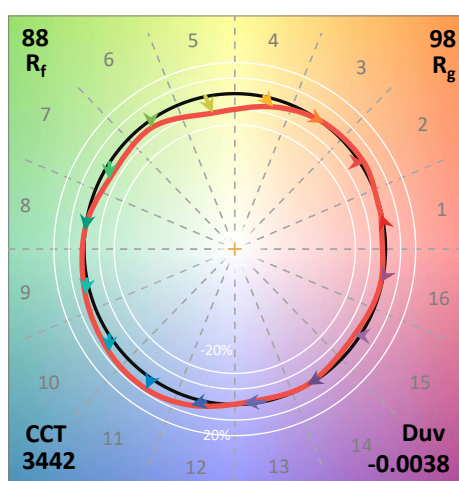
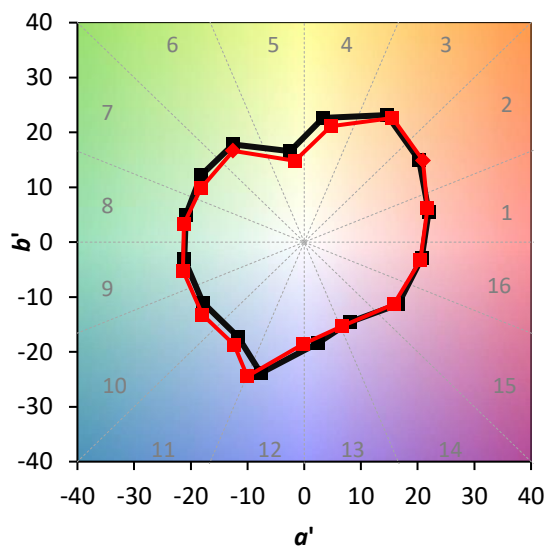
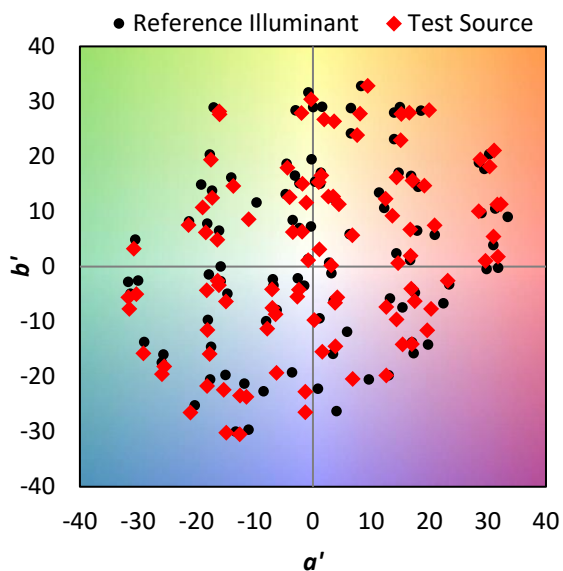
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Summary

$R_f = 87.6$
 $R_g = 97.5$
 CIE $R_a = 91.8$
 $R_9 = 89.1$



Color Vector Graphics

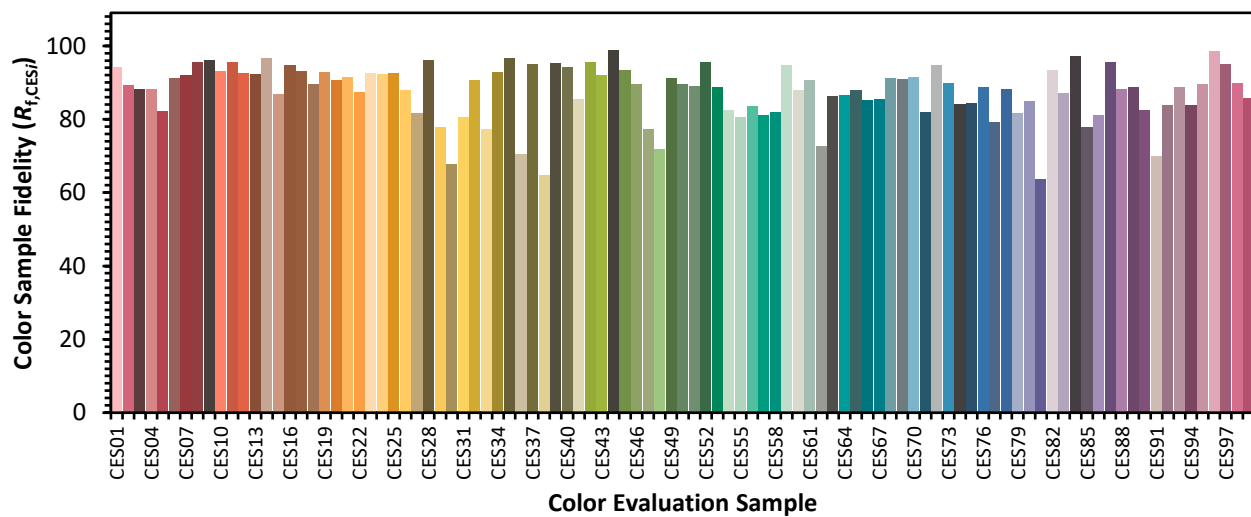


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Individual Sample Fidelity Index ($R_{f,i}$)

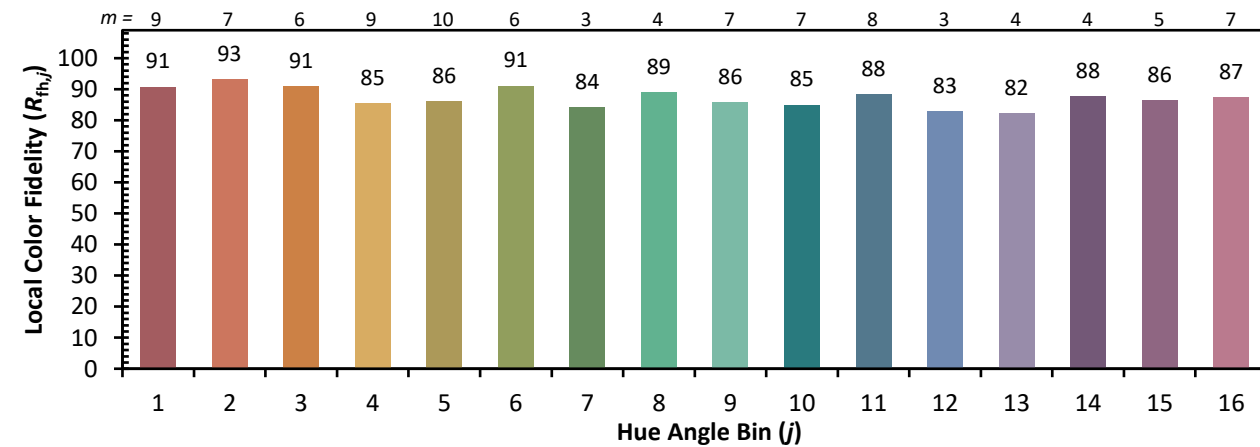
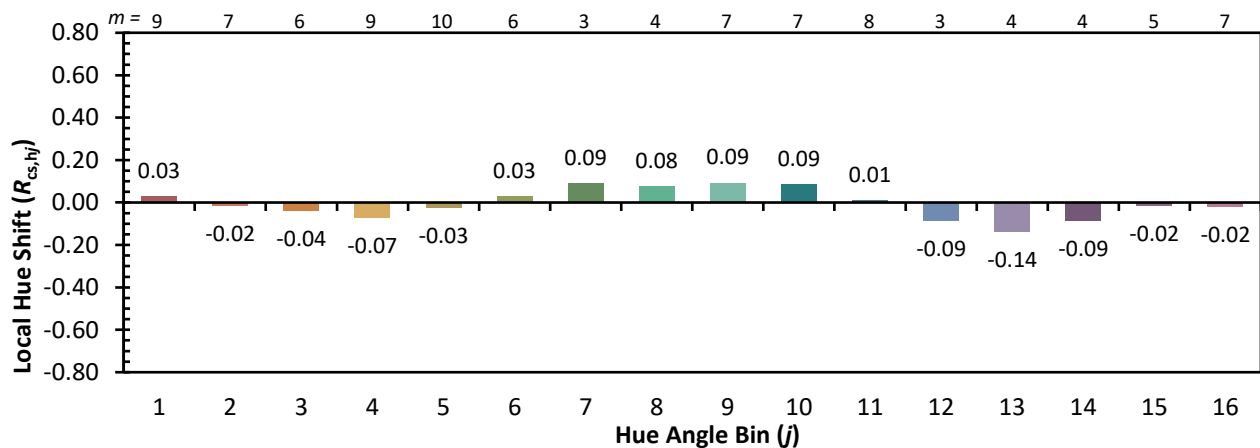
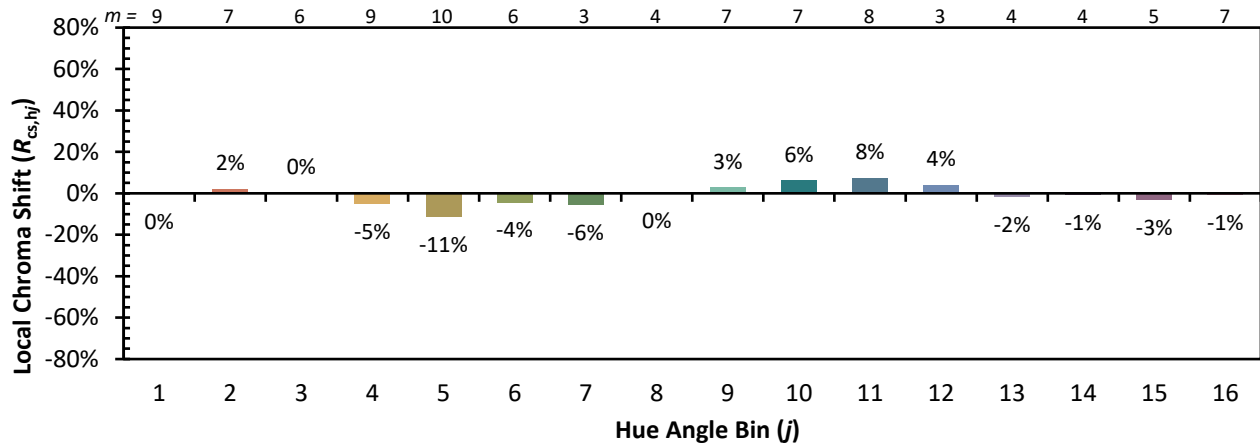
CES01 = 86	CES26 = 88	CES51 = 89	CES76 = 89
CES02 = 63	CES27 = 82	CES52 = 95	CES77 = 79
CES03 = 32	CES28 = 96	CES53 = 89	CES78 = 88
CES04 = 69	CES29 = 78	CES54 = 83	CES79 = 82
CES05 = 50	CES30 = 68	CES55 = 81	CES80 = 85
CES06 = 51	CES31 = 81	CES56 = 84	CES81 = 64
CES07 = 44	CES32 = 91	CES57 = 81	CES82 = 93
CES08 = 42	CES33 = 77	CES58 = 82	CES83 = 87
CES09 = 29	CES34 = 93	CES59 = 95	CES84 = 97
CES10 = 75	CES35 = 97	CES60 = 88	CES85 = 78
CES11 = 58	CES36 = 70	CES61 = 91	CES86 = 81
CES12 = 64	CES37 = 95	CES62 = 73	CES87 = 95
CES13 = 44	CES38 = 65	CES63 = 86	CES88 = 88
CES14 = 74	CES39 = 95	CES64 = 86	CES89 = 89
CES15 = 72	CES40 = 94	CES65 = 88	CES90 = 82
CES16 = 48	CES41 = 85	CES66 = 85	CES91 = 70
CES17 = 49	CES42 = 95	CES67 = 86	CES92 = 84
CES18 = 57	CES43 = 92	CES68 = 91	CES93 = 89
CES19 = 71	CES44 = 99	CES69 = 91	CES94 = 84
CES20 = 67	CES45 = 93	CES70 = 91	CES95 = 90
CES21 = 85	CES46 = 90	CES71 = 82	CES96 = 99
CES22 = 78	CES47 = 77	CES72 = 95	CES97 = 95
CES23 = 91	CES48 = 72	CES73 = 90	CES98 = 90
CES24 = 90	CES49 = 91	CES74 = 84	CES99 = 86
CES25 = 71	CES50 = 89	CES75 = 84	



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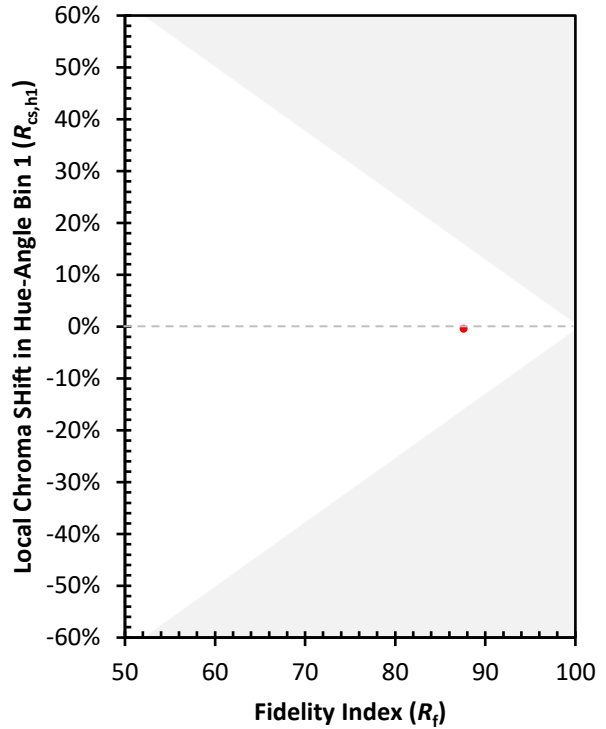
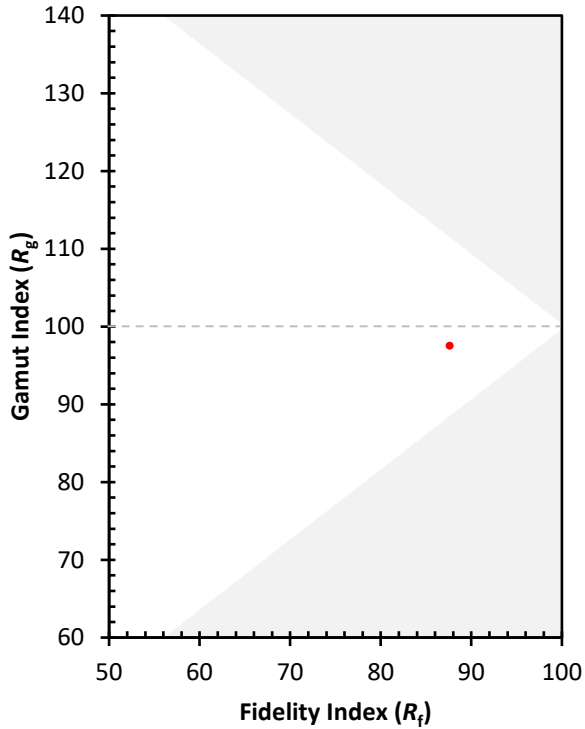
Color Rendition by Hue-Angle Bin



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Measure Comparisons



(END OF REPORT)