

VISUAL COMFORT AND COMPANY TEST REPORT

SCOPE OF WORK

LED Performance Testing

MODEL NUMBER

700FMMRAB-LED927

PROJECT NUMBER

G104941221

REPORT NUMBER

104941221CRT-032

ISSUE DATE

7/28/2022

REVISED DATE

None

TEST DATES

7/19/2022 through 7/27/2022

DOCUMENT CONTROL NUMBER

RTTDS-R-AMER-Test-3407

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REPORT NUMBER

104941221CRT-032

MODEL NUMBER(s)

700FMMRAB-LED927

REPORT RENDERED TO:

VISUAL COMFORT AND COMPANY
7400 LINDER AVE
SKOKIE, IL 60077

STATEMENT OF LIMITATION

NVLAP Lab Code 100402-0. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the federal government.

AUTHORIZATION

The testing performed was authorized by signed quote number Qu-01236637-1.

TEST STANDARDS

ANSI/IES LM-79-19: Optical and Electrical Measurements of Solid State Lighting Products

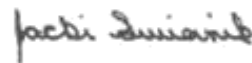
ANSI NEMA ANSLG C78.377: 2017: Specifications for the Chromaticity of Solid State Lighting (SSL) Products

In Charge of Testing:

Reviewer:



Melanie Brittain
Senior Associate Engineer
Lighting Division



Jacki Swiernik
Staff Engineer
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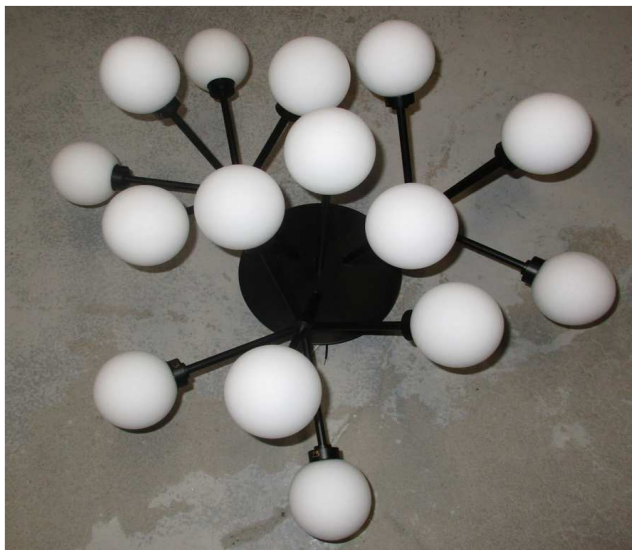
SAMPLE INFORMATION

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ITEMS RECEIVED

Item No.	Control No.	Model No.	Description	Type	Received
1	CRT2206301053-032	CRT2206301053-032	Mara Flush Mount	Production	6/30/2022
2	CRT2206301053-002	--	Globes		

SAMPLE PHOTOS - TESTED CONFIGURATIONS



SUMMARY

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PRODUCT INFORMATION AND SUMMARY OF DATA

Product Model No.:	700FMMRAB-LED927
Product Description:	Mara Flush Mount
LED Model No.:	Luminus 3020, CCT 2700K, CRI90, 3-Step, 6 chips
Driver Model No.:	MACRON, MDR-608-24-60-LD
Light Source:	LED

Criteria	Results	
	Goniophotometer	Integrating Sphere
Light Output (lumens)	1018.6	1019.0
Input Power (W) @ 120 (Vac)	42.13	41.89
Luminous Efficacy (lm/W)	24.18	24.33
Input Power Factor (I) @ 120 (Vac)	0.992	0.992

Criteria	Results
Input ATHD (%) @ 120 (Vac)	5.99
Correlated Color Temperature (K)	2728
Color Rendering Index - Ra (I)	92.2
Color Rendering Index - R9 (I)	58.0
Duv (I)	-0.0020
Chromaticity Coordinate (x)	0.454
Chromaticity Coordinate (y)	0.404
Chromaticity Coordinate (u')	0.262
Chromaticity Coordinate (v')	0.524

TEST METHODS

SEASONING IN SAMPLE ORIENTATION - LED PRODUCTS

No seasoning was performed in accordance with ANSI/IES LM-79-19

INTEGRATING SPHERE TESTING

A spectroradiometer and integrating sphere were used to measure the spectral power distribution for photometric and colorimetric data of the EUT. Electrical measurements of the unit were measured using a power analyzer. Each EUT was operated at the rated input voltage of the system in its designated orientation. The ambient temperature and relative humidity was measured at $25^{\circ}\text{C} \pm 1.2^{\circ}\text{C}$ and 10-65% respectively at a position inside of the sphere within 1.5m and at equal height of the EUT. Stabilization procedures to LM-79-19 were followed. The EUT was mounted in a 4π configuration.

TYPE C GONIOPHOTOMETER DISTRIBUTION TESTING

A Type C Mirror Goniophotometer system was used to measure the luminous intensity (candela) at each angle of distribution for the EUT. Electrical measurements of the unit were measured using a power analyzer. Each EUT was operated at the rated input voltage of the system in its designated orientation. The ambient temperature and relative humidity was measured at $25^{\circ}\text{C} \pm 1.2^{\circ}\text{C}$ and 10-65% respectively at a position within 1.5m and at equal height of the EUT. Stabilization procedures to LM-79-19 were followed. The test distance was $\geq 5x$ the longest luminous dimension of the EUT.

TYPE C GONIOPHOTOMETER DISTRIBUTION TESTING

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PHOTOMETRIC AND ELECTRICAL MEASUREMENTS

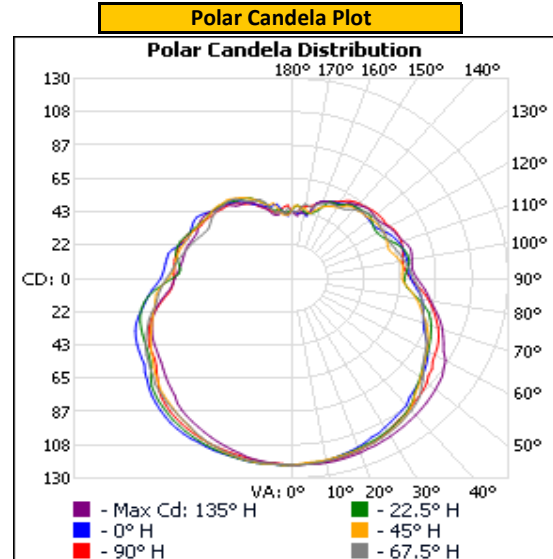
Base Orientation	Input Voltage (Vac)	Input Current (mA)	Input Power (W)	Input Power Factor ()
Up	120.20	353.2	42.13	0.992

Light Output (lm)	Efficacy (lm/W)
1018.6	24.2

LUMINOUS INTENSITY SUMMARY (candela)

Angle (°)	0	22.5	45	67.5	90
0	121	121	121	121	121
5	121	121	120	121	121
10	120	120	120	121	121
15	119	119	119	120	120
20	117	118	118	119	119
25	114	116	118	118	118
30	112	115	116	116	115
35	110	113	114	114	112
40	108	110	111	112	111
45	104	105	105	109	108
50	102	101	101	103	106
55	98	97	97	96	103
60	95	94	94	93	99
65	89	92	91	89	97
70	84	89	86	85	94
75	82	85	81	82	89
80	80	77	76	80	84
85	75	70	70	77	78
90	72	68	66	73	72
95	71	70	67	71	68
100	70	72	66	68	68
105	70	70	63	66	69
110	69	67	62	64	70
115	66	62	63	63	70
120	63	60	63	63	68
125	60	60	62	64	67
130	60	62	61	64	66
135	61	62	60	62	65
140	60	60	59	58	64
145	59	59	58	55	62
150	56	56	54	54	58
155	55	55	52	54	55
160	53	47	49	52	54
165	46	44	44	48	49
170	44	44	46	49	47
175	42	48	48	44	44
180	44	44	44	44	44

Entire luminous intensity matrix found in .IES file



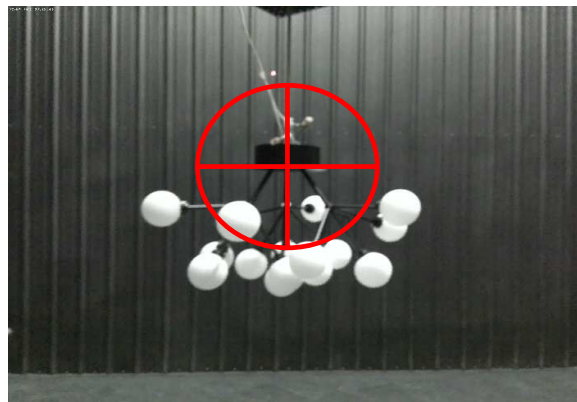
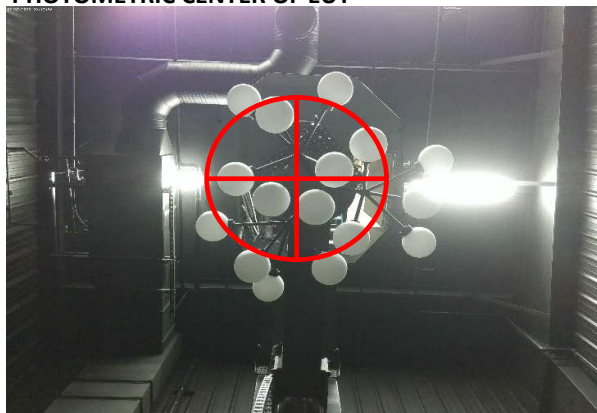
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ORIENTATION AND ALIGNMENT OF EUT

Luminous Opening		
Length (ft)	Width (ft)	Height (ft)
2.17	1.92	1.17
0°-180° H	90°-270° H	0°-180° V

Test Distance (ft)
29.6

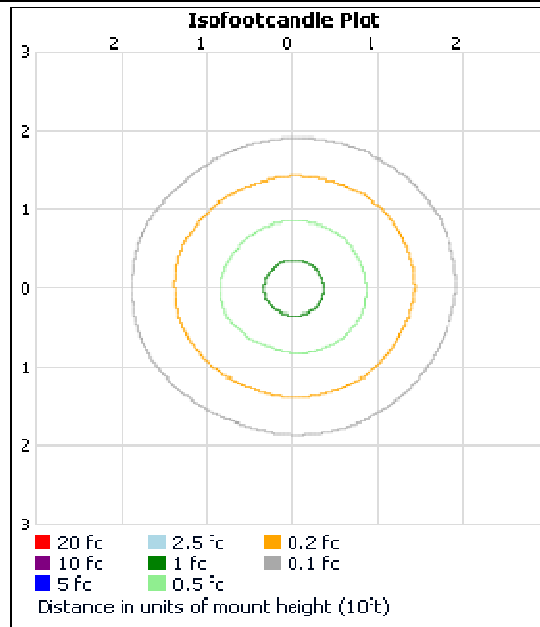
PHOTOMETRIC CENTER OF EUT



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ILLUMINANCE SUMMARY

Mounting Height: 10ft	
Isoillumination Plot	



ZONAL LUMENS

Zonal Lumen Summary					
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Zone	Lumens	Luminaire
0-30	99.8	9.8%
0-40	171.0	16.8%
0-60	345.2	33.9%
60-90	270.1	26.5%
70-100	253.7	24.9%
90-120	216.9	21.3%
0-90	615.3	60.4%
90-180	403.4	39.6%
0-180	1,018.6	100.0%

Zone	Lumens	Total	Zone	Lumens	Total
0-10	11.5	1.1%	90-100	77.5	7.6%
10-20	34.0	3.3%	100-110	73.5	7.2%
20-30	54.3	5.3%	110-120	65.8	6.5%
30-40	71.3	7.0%	120-130	57.6	5.7%
40-50	83.7	8.2%	130-140	48.5	4.8%
50-60	90.5	8.9%	140-150	37.4	3.7%
60-70	93.9	9.2%	150-160	25.3	2.5%
70-80	92.0	9.0%	160-170	13.5	1.3%
80-90	84.2	8.3%	170-180	4.2	0.4%

INTEGRATING SPHERE TESTING

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PHOTOMETRIC, RADIOMETRIC, COLORIMETRIC, AND ELECTRICAL MEASUREMENTS

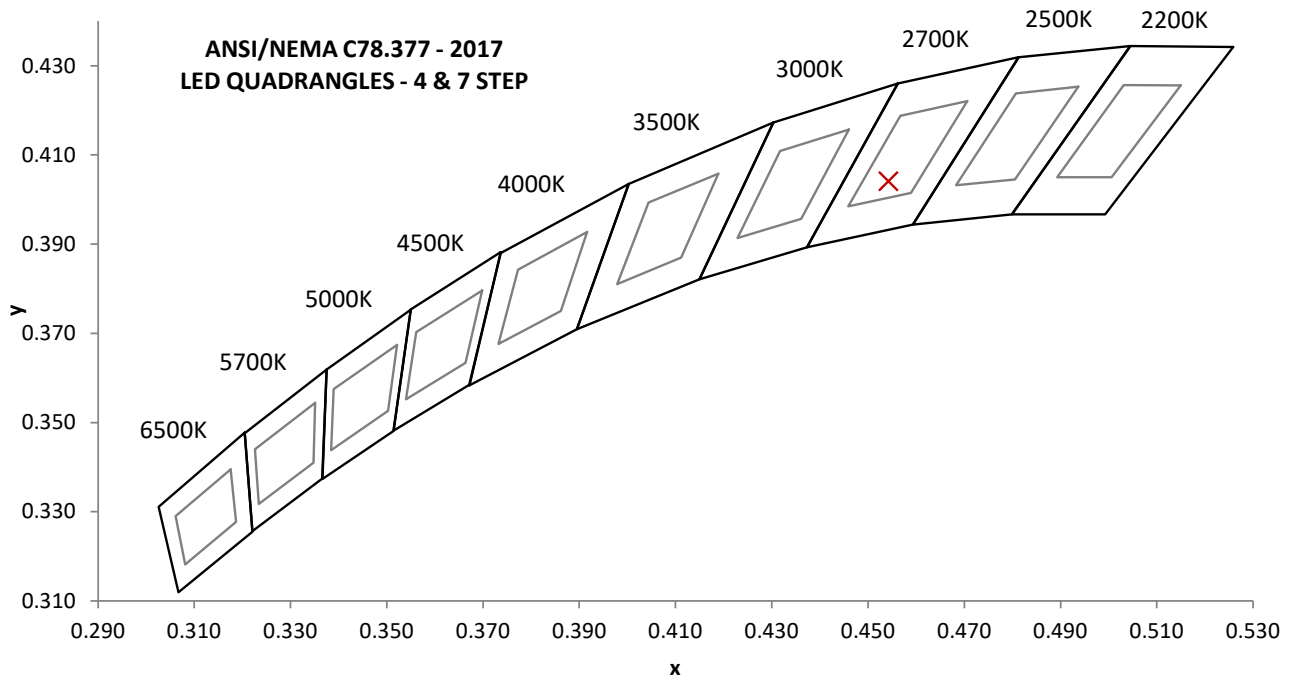
Base Orientation
Up

Input Voltage (Vac)	Input Current (mA)	Input Power (W)	Input Power Factor (l)	Input ATHD (%)
120.00	351.9	41.89	0.992	5.99

Measured at 120(Vac)

Light Output (lm)	Efficacy (lm/W)	CCT (K)	CRI - Ra (l)	CRI - R9 (l)
1019.0	24.3	2728	92.2	58.0

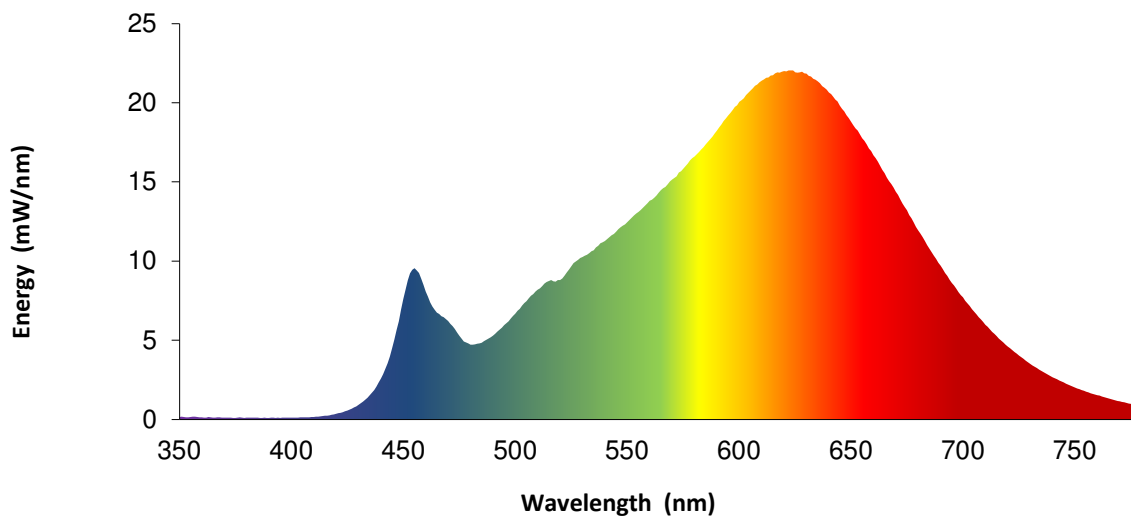
Duv (l)	1931 Chrom (x)	1931 Chrom (y)	1976 Chrom (u')	1976 Chrom (v')
-0.0020	0.454	0.404	0.262	0.524



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SPECTRAL POWER DISTRIBUTION

nm	mW/nm		nm	mW/nm		nm	mW/nm		nm	mW/nm
350	0.2		460	8.1		570	15.2		680	11.9
355	0.2		465	6.7		575	15.8		685	10.8
360	0.1		470	6.2		580	16.6		690	9.7
365	0.1		475	5.3		585	17.4		695	8.6
370	0.1		480	4.7		590	18.2		700	7.7
375	0.1		485	4.8		595	19.2		705	6.8
380	0.1		490	5.3		600	20.1		710	6.0
385	0.1		495	6.0		605	20.8		715	5.3
390	0.1		500	6.7		610	21.4		720	4.6
395	0.1		505	7.5		615	21.7		725	4.0
400	0.1		510	8.2		620	22.0		730	3.5
405	0.1		515	8.7		625	21.9		735	3.1
410	0.2		520	8.8		630	21.8		740	2.7
415	0.2		525	9.7		635	21.3		745	2.3
420	0.4		530	10.3		640	20.6		750	2.0
425	0.6		535	10.7		645	19.8		755	1.8
430	0.9		540	11.3		650	18.8		760	1.5
435	1.5		545	11.8		655	17.8		765	1.3
440	2.6		550	12.5		660	16.7		770	1.1
445	4.5		555	13.1		665	15.6		775	1.0
450	7.6		560	13.8		670	14.4		780	0.8
455	9.5		565	14.5		675	13.2		---	---



Portrayed color in graphic is estimated by wavelength (nm) and may not be exact - it is a visual representation only

EQUIPMENT LIST

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#	Equipment	Model No	Control No.	Last Cal	Cal Due
1	Elgar AC Power Supply	CW1251	---	VBU	VBU
2	Sorenson DC Power Supply	XFR 150-8	---	VBU	VBU
3	Traceable Hygrothermometer	200110913	L206	2/21/2022	2/21/2023
4	Yokogawa Power Analyzer	WT1600	E462	5/21/2022	5/21/2023
5	Fluke Thermometer	53 II	D588	6/13/2022	6/13/2023
6	Current Monitor	411	A197	8/26/2021	8/26/2024
7	3M Integrating Sphere Spectrometer System	CDS 2600	L231	7/1/2022	10/1/2022
8	LSI High Speed Mirror Goniophotometer	6440	---	4/4/2022	7/4/2022
9	Elgar AC Power Supply	CW1251	---	VBU	VBU
10	Yokogawa Power Analyzer	WT210	307-E464	6/21/2022	6/21/2023
11	Traceable Hygrothermometer	4800	L204	2/21/2022	2/21/2023
12	Sorenson DC Power Supply	XG 150-10	---	VBU	VBU
13	Omega Thermometer	DPi8-C24	M263	3/1/2022	3/1/2023
14	Multi Channel Spectroradiometer	OL 770	O230	6/1/2022	9/1/2022
15	Bosch Distance Laser	Pro GLM 20	L210	3/21/2022	3/15/2023
16	Tape Measure	Crescent	--	9/21/2021	9/21/2024

The AC power supplies used for testing have a crest factor capable of 0-3.5

REVISION HISTORY

#	Revision Date	Updated By	Reviewed By	Description of Change
---	None	---	---	---
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ANNEX A - TM-30 CALCULATIONS

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TM-30 REPORT

