



LM-80-08

TEST AND MEASUREMENT REPORT (10,000 HRS)

For

**Xicato Inc.**

101 Daggett Dr.  
San Jose, CA 95134, USA

**Model: XCA19803050CCA**

<b>Report Type:</b> Original Report		<b>Product Type:</b> LED Module	
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**DOCUMENT REVISION HISTORY**

<b>Revision Number</b>	<b>Report Number</b>	<b>Description of Revision</b>	<b>Date of Revision</b>
0	R1409229-10,000Hrs	Original Report	2016-05-11

## 1 GENERAL INFORMATION

### 1.1 Product Description for Equipment Under Test (EUT)

The Xicato LED module model XCA19803050CCA is used for light source. The module is an enclosed PCB LED with sealed silicon aperture. The module is mounted on a round 45mm dia. 8.5mm high aluminum base for testing purpose.

The LED module model XCA19803050CCA has the following photometric characteristics:

- a) Target Correlated Color Temperature (CCT): 3000K.
- b) Total luminous flux: Approximately 5000 lumens.
- c) Color Rendering Index (CRI): Above 80.

### 1.2 Sampling Method

The samples were randomly gathered by the manufacturer and distributed to the BAEL Laboratory for testing.

### 1.3 Number of Samples

A total of 26 LED modules were used for 10,000 hours testing which were equally divided for 90°C and 55°C elevated temperature stressed test.

### 1.4 Electrical and Mechanical Description of the EUT

Listed Wattage	Listed Current	LED Type	Dimensions (inch)	Manufacturer	Model Number
50W	1.4 A	LED Module	28.5mm (L) x 23.5mm (W) x 5.5mm (H)	XICATO, Inc.	XCA19803050CCA

## 1.5 Product Family

The tested product model XCA19803050CCA is constructed as COB (Chip On Board) with one common phosphor layer overlaying all dies, and satisfies the conditions set forth in Section 3.7 of the ENERGY STAR Program Guidance Regarding LED Package, LED Array and LED Module Lumen Maintenance Performance Data Supporting Qualification of Lighting Products Sept 9 2011 for equivalent product models to be qualified as Energy Star products as described in the table below.

Type	Product Family	Module Part Number	# of LEDs	Minimum Die Spacing (mm)	Current (mA)	Strings	Current/String (mA)	Maximum Power Density (mW/mm <sup>2</sup> )	
Tested Module	XCA	XCA19803050CCA	48 (4x12)	0.2	1400	4	350	1050	
Equivalent Modules	XCA	XCA1980ZZ13CCA	12 (2x6)	0.2	700	2	350	1050	
		XCA1980ZZ20CCA	20 (2x10)	0.2	700	2	350	1050	
		XCA1980ZZ30CCA	30 (3x10)	0.2	1050	3	350	1050	
		XCA1980ZZ40CCA	40 (4x10)	0.2	1400	4	350	1050	
		XCA19V8ZZ13CCA	12 (2x6)	0.2	700	2	350	1050	
		XCA19V8ZZ20CCA	20 (2x10)	0.2	700	2	350	1050	
		XCA19V8ZZ30CCA	30 (3x10)	0.2	1050	3	350	1050	
		XCA19V8ZZ40CCA	40 (4x10)	0.2	1400	4	350	1050	
		XCA19V8ZZ50CCA	48 (4x12)	0.2	1400	4	350	1050	
		XCA1995ZZ13CCA	16 (2x8)	0.2	700	2	350	1050	
		XCA1995ZZ20CCA	27 (3x9)	0.2	1050	3	350	1050	
		XCA1995ZZ30CCA	48 (4x12)	0.2	1050	4	262.5	787.5	
		XCA19V9ZZ13CCA	16 (2x8)	0.2	700	2	350	1050	
		XCA19V9ZZ20CCA	27 (3x9)	0.2	1050	3	350	1050	
		XCA19V9ZZ30CCA	48 (4x12)	0.2	1050	4	262.5	787.5	
		XTM	XTM19BT0113CCA	16 (2x8)	0.2	700	2	350	1050
			XTM19BT0120CCA	27 (3x9)	0.2	1050	3	350	1050
			XTM1980ZZ13CCA	12 (2x6)	0.2	700	2	350	1050
	XTM1980ZZ20CCA		20 (2x10)	0.2	700	2	350	1050	
	XTM1980ZZ30CCA		30 (3x10)	0.2	1050	3	350	1050	
	XTM1980ZZ40CCA		40 (4x10)	0.2	1400	4	350	1050	
	XTM1980ZZ50CCA		48 (4x12)	0.2	1400	4	350	1050	
	XTM19V8ZZ13CCA		12 (2x6)	0.2	700	2	350	1050	
	XTM19V8ZZ20CCA		20 (2x10)	0.2	700	2	350	1050	
	XTM19V8ZZ30CCA		30 (3x10)	0.2	1050	3	350	1050	
	XTM19V8ZZ40CCA		40 (4x10)	0.2	1400	4	350	1050	
	XTM19V8ZZ50CCA		48 (4x12)	0.2	1400	4	350	1050	
	XTM1995ZZ13CCA		16 (2x8)	0.2	700	2	350	1050	
XTM1995ZZ20CCA	27 (3x9)		0.2	1050	3	350	1050		
XTM1995ZZ30CCA	48 (4x12)	0.2	1050	4	262.5	787.5			

		XTM19V9ZZ13CCA	16 (2x8)	0.2	700	2	350	1050
		XTM19V9ZZ20CCA	27 (3x9)	0.2	1050	3	350	1050
		XTM19V9ZZ30CCA	48 (4x12)	0.2	1050	4	262.5	787.5
		XTM19BT0113CCA	16 (2x8)	0.2	700	2	350	1050
		XTM19BT0120CCA	27 (3x9)	0.2	1050	3	350	1050
	XIM	XIM1980ZZ13A2A	12 (2x6)	0.2	700	2	350	1050
		XIM1980ZZ20A2A	20 (2x10)	0.2	700	2	350	1050
		XIM1980ZZ30A2A	30 (3x10)	0.2	1050	3	350	1050
		XIM1980ZZ13A3A	12 (2x6)	0.2	700	2	350	1050
		XIM1980ZZ20A3A	20 (2x10)	0.2	700	2	350	1050
		XIM1980ZZ30A3A	30 (3x10)	0.2	1050	3	350	1050
		XIM19V8ZZ13A2A	12 (2x6)	0.2	700	2	350	1050
		XIM19V8ZZ20A2A	20 (2x10)	0.2	700	2	350	1050
		XIM19V8ZZ30A2A	30 (3x10)	0.2	1050	3	350	1050
		XIM19V8ZZ13A3A	12 (2x6)	0.2	700	2	350	1050
		XIM19V8ZZ20A3A	20 (2x10)	0.2	700	2	350	1050
		XIM19V8ZZ30A3A	30 (3x10)	0.2	1050	3	350	1050
		XIM1995ZZ13A2A	16 (2x8)	0.2	700	2	350	1050
		XIM1995ZZ20A2A	27 (3x9)	0.2	1050	3	350	1050
		XIM1995ZZ13A3A	16 (2x8)	0.2	700	2	350	1050
		XIM1995ZZ20A3A	27 (3x9)	0.2	1050	3	350	1050
		XIM19V9ZZ13A2A	16 (2x8)	0.2	700	2	350	1050
		XIM19V9ZZ20A2A	27 (3x9)	0.2	1050	3	350	1050
		XIM19V9ZZ13A3A	16 (2x8)	0.2	700	2	350	1050
XIM19V9ZZ20A3A	27 (3x9)	0.2	1050	3	350	1050		
<b>ZZ</b>	<b>27 (2700 K), 30 (3000 K), 35 (3500 K) or 40 (4000 K)</b>							

## 1.6 Objective

The objective of this test report is to demonstrate the product model XCA19803050CCA meets the requirements for LED module as required by the Energy Star Program Requirements, Product Specification for Luminaires (Light Fixtures) Eligibility Criteria Ver. 1.2.

## 1.7 Test Method

### 1.7.1 Standards

The test report is prepared on behalf of XICATO, Inc. in accordance with the following American National Standards, International Commission on Illumination, and Illumination Engineering Society of North America:

- IESNA LM-78-2007 Approved Method for Total Luminous Flux Measurement of Lamps Using an Integrating Sphere Photometer
- IES LM-79-08 Approved Method: Electrical and Photometric Measurements of Solid-State Lighting Products (Not to include Sec 9.2 and 10.0 for Luminous Intensity)
- IES LM-80-08 Approved Method: Measuring Lumen Maintenance of LED Light Sources

### 1.7.2 Lumen Maintenance, Testing Duration and Interval

The testing duration was 10000 hours with the initial measurement at 0 hour. The interval measurements were 1000, 2000, 3000, 4000, 5000, 6000, 7000, 8000, 9000, and 10000 hours.

### 1.7.3 Operating Cycle

There was no operating cycle to the tested LED samples. The sample LEDs were turned on continuously for the testing.

### 1.7.4 Drive Current during Lifetime Test

Each sample of the LED modules was powered by an individual Mean Well power supply model LPC-60-1400 to provide 30Vdc of typical voltage drive and 1.40Amp of current drive. The Mean Well power supplies were in turn powered at the regulated 120Vac by the Behlman AC Power Source. The voltage, frequency, and Total Harmonic Distortion of the AC source were monitored and logged by the BMI Data Logger.

### 1.7.5 Case Temperature Measurement Point

The Case Temperature for each tested LED module during temperature stressed test was measured and logged by the Yokogawa Hybrid Recorder. Type T thermocouple was used and was attached to the “hot spot” located on the side of the LED Module as specified by the manufacturer. Case temperatures were controlled to not lower than minus 2°C from 90°C and 55°C the target tested temperatures.

### 1.7.6 Surrounding Temperature and Humidity

The surrounding air temperature inside each test chamber was maintained to not lower than minus 5°C of the target tested temperature. The humidity was maintained at less than 65% RH.

### **1.7.7 Airflow**

The airflow inside each test chamber was maintained in order to avoid thermal stratification and to minimize drafts in the immediate vicinity of the test samples. Air flow was kept to the minimum.

### **1.7.8 Uncertainty**

The photometric measurement was performed by the Labsphere Diode Array DAS-1100 and the 1.5m Everfine Integrating Sphere. The total uncertainty of the light output measurement was estimated, at the 95% confidence level, not to exceed  $\pm 3.8\%$  over the wavelength range of 390 nm to 760 nm.

## **1.8 Test Facility**

The test site used by BACL Corp. to collect radiated and conducted emissions measurement data is located at the facility in Sunnyvale, California, USA.

The test site at BACL Corp. has been fully described in reports submitted to the Federal Communication Commission (FCC) and Voluntary Control Council for Interference (VCCI). The details of these reports have been found to be in compliance with the requirements of Section 2.948 of the FCC Rules on February 11 and December 10, 1997, and Article 8 of the VCCI regulations on December 25, 1997. The test site also complies with the test methods and procedures set forth in CISPR 22:2008 §10.4 for measurements below 1 GHz and §10.6 for measurements above 1 GHz as well as ANSI C63.4-2003, ANSI C63.4-2009, TIA/EIA-603 & CISPR 24:2010.

The Federal Communications Commission and Voluntary Control Council for Interference have the reports on file and they are listed under FCC registration number: 90464 and VCCI Registration No.: R-3729, C-4176, G-469, and T-1206. The test site has been approved by the FCC and VCCI for public use and is listed in the FCC Public Access Link (PAL) database.

BACL Corp. is an American Association for Laboratory Accreditation (A2LA) accredited laboratory (Lab Code 3297-02).



## 1.9 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
BACL	Elevated Temperature Stress Test Chamber	/	/	N/A	N/A
Dickson	Temperature & Humidity Recorder	THDX	03346010	2015-05-05	2017-05-05
Yokogawa	Hybrid Recorder (60 Channels)	DR230	12C510042	2016-02-08	2017-02-08
Labsphere	Diode Array	DAS-1100	5795	Within calibration	Within calibration
Everfine	Integrating sphere	1.5m	0111466	Within calibration	Within calibration
Everfine	Power Supply for Standard Lamp and LED Module	WY305	809024	See Note	See Note
Labsphere	Standard Lamp	SLC-1400	J101, K101, L101	2012-02-02	Within manufacturer 100 hours of use
MeanWell	AC-DC Power Adaptor	LPC-60-1400	N/A	N/A	N/A
Fluke	True RMS Multimeter, for Voltage Measurement	179	78490059	2015-07-06	2016-07-06
Fluke	True RMS Multimeter, for Current Measurement	189	89920092	2016-03-31	2017-03-31
BACL	LED Electrical Test fixture	/	/	N/A	N/A
Behlman	AC Power Source	BL+30-1-C1-1	06953	N/A	N/A
BMI	Data Logger	3030A	35558	2015-10-22	2016-10-22

Note: Current was measured by Fluke 198; forward voltage was measured by Fluke 179.

**Statement of Traceability: Bay Area Compliance Laboratories Corp.** certifies that all calibrations have been performed using suitable standards traceable to the NATIONAL INSTITUTE of STANDARDS and TECHNOLOGY (NIST).

## 1.10 Electrical Rating for the Photometric Measurement

<b>Voltage</b>	35 V (typical)
<b>Current</b>	1.400 Amp
<b>Power</b>	50 W

## 2 SUMMARY OF TEST RESULTS

Data Set	90°C
Number of Samples	13
Failure Observed	0
Test Interval and Test Duration	0h, 1000h, 2000h, 3000h, 4000h, 5000h, 6000h, 7000h, 8000h, 9000h, 10000h
Average Lumen Maintenance at 6000 hours	99.96%
Average Chromaticity Shift at 10000 hours	0.0009
Reported TM-21 L70 Lifetime	> 55,000 hours

Data Set	55°C
Number of Samples	13
Failure Observed	0
Test Interval and Test Duration	0h, 1000h, 2000h, 3000h, 4000h, 5000h, 6000h, 7000h, 8000h, 9000h, 10000h
Average Lumen Maintenance at 6000 hours	99.84%
Average Chromaticity Shift at 6000 hours	0.0010
Reported TM-21 L70 Lifetime	> 55,000 hours

### 3 SUMMARY OF TEST DATA

#### 3.1 Primary Photometric and Electrical Measurements

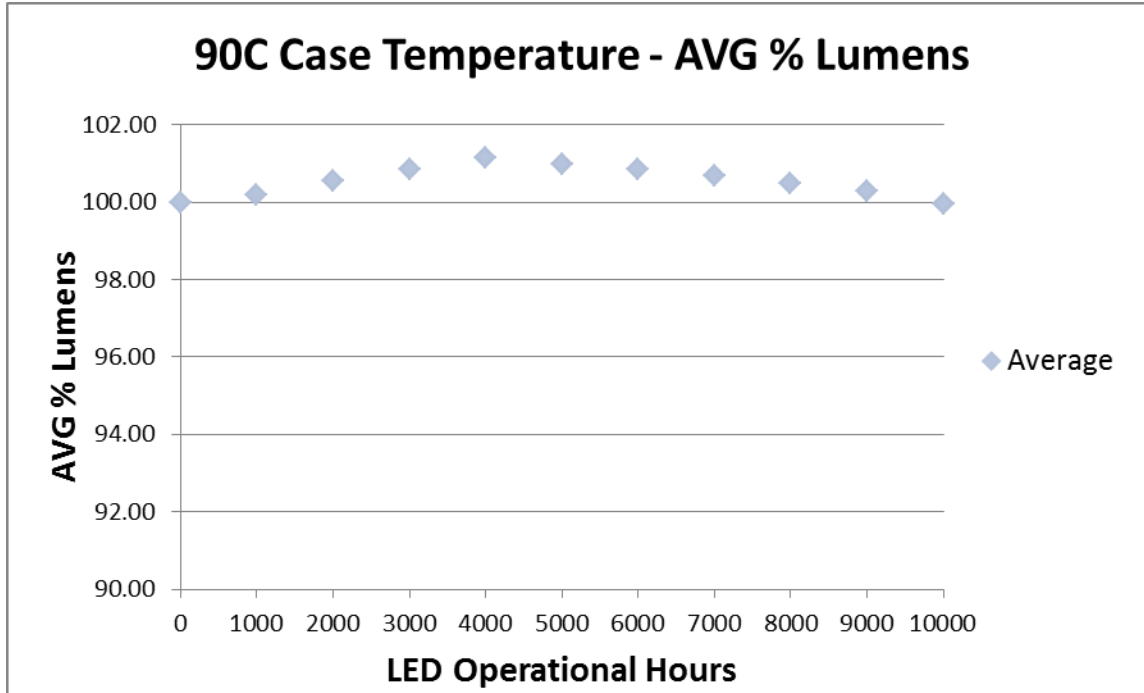
Sample Serial Number	Forward Voltage (V)	Current (A)	Power (W)	Luminous Flux (Lumens)	Efficacy (Lm/W)	CCT (K)	CRI	Chroma x	Chroma y	Chroma u'	Chroma v'
<b>90°C LED Module</b>											
#875	34.67	1.400	48.54	4712	97.08	2964	82.3	0.4402	0.4064	0.2517	0.5228
#876	34.68	1.400	48.55	4686	96.52	2970	82.2	0.4398	0.4063	0.2515	0.5227
#877	34.56	1.400	48.38	4755	98.28	2963	82.2	0.4404	0.4067	0.2517	0.5229
#878	34.49	1.400	48.29	4699	97.32	2956	82.4	0.4411	0.4073	0.2519	0.5233
#879	34.57	1.400	48.40	4748	98.10	2971	82.1	0.4396	0.4060	0.2515	0.5225
#880	34.57	1.400	48.40	4737	97.88	2963	82.2	0.4400	0.4060	0.2517	0.5226
#881	34.64	1.400	48.50	4690	96.71	2965	82.2	0.4402	0.4066	0.2516	0.5229
#882	34.61	1.400	48.45	4669	96.36	2965	82.5	0.4403	0.4068	0.2516	0.5230
#883	34.55	1.400	48.37	4604	95.18	2954	82.3	0.4410	0.4068	0.2520	0.5231
#884	34.57	1.400	48.40	4685	96.80	2952	82.3	0.4412	0.4069	0.2521	0.5231
#885	34.74	1.400	48.64	4713	96.90	2952	82.4	0.4414	0.4075	0.2520	0.5234
#886	34.57	1.400	48.40	4537	93.74	2960	82.2	0.4404	0.4063	0.2518	0.5228
#887	34.74	1.400	48.64	4725	97.15	2963	82.4	0.4403	0.4067	0.2516	0.5229
Average	34.61	1.400	48.46	4689.2	96.77	2961	82.3	0.4405	0.4066	0.2517	0.5229
Minimum	34.49	1.400	48.29	4537	93.74	2952	82.1	0.4396	0.4060	0.2515	0.5225
Maximum	34.74	1.400	48.64	4755	98.28	2971	82.5	0.4414	0.4075	0.2521	0.5234
Median	34.57	1.400	48.40	4699	96.90	2963	82.3	0.4403	0.4067	0.2517	0.5229
S.T. Deviation	0.08	0.000	0.11	60.1	1.22	6.3	0.11	0.0006	0.0004	0.0002	0.0003

Sample Serial Number	Forward Voltage (V)	Current (A)	Power (W)	Luminous Flux (Lumens)	Efficacy (Lm/W)	CCT (K)	CRI	Chroma x	Chroma y	Chroma u'	Chroma v'
<b>55°C LED Module</b>											
#892	34.57	1.400	48.40	4711	97.34	2955	82.4	0.4409	0.4068	0.2520	0.5230
#893	34.41	1.400	48.17	4730	98.19	2964	82.3	0.4399	0.4059	0.2517	0.5225
#894	34.75	1.400	48.65	4801	98.68	2970	82.1	0.4398	0.4065	0.2514	0.5228
#895	34.68	1.400	48.55	4723	97.28	2960	82.2	0.4405	0.4067	0.2517	0.5229
#896	34.64	1.400	48.50	4676	96.42	2952	82.3	0.4415	0.4077	0.2519	0.5235
#897	34.71	1.400	48.59	4664	95.98	2954	82.3	0.4414	0.4075	0.2520	0.5234
#898	34.53	1.400	48.34	4704	97.31	2965	82.3	0.4401	0.4064	0.2516	0.5228
#899	34.52	1.400	48.33	4779	98.89	2968	82.2	0.4399	0.4062	0.2516	0.5227
#900	34.64	1.400	48.50	4618	95.22	2953	82.6	0.4410	0.4067	0.2521	0.5230
#901	34.60	1.400	48.44	4666	96.33	2968	82.2	0.4399	0.4063	0.2515	0.5227
#902	34.53	1.400	48.34	4758	98.42	2957	82.3	0.4409	0.4070	0.2519	0.5231
#903	34.66	1.400	48.52	4721	97.29	2962	82.2	0.4406	0.4071	0.2516	0.5231
#904	34.68	1.400	48.55	4756	97.96	2966	82.2	0.4404	0.4070	0.2515	0.5230
Average	34.61	1.400	48.45	4715.9	97.33	2965	83.9	0.4405	0.4068	0.2517	0.5230
Minimum	34.41	1.400	48.17	4618	95.22	2952	83.6	0.4398	0.4059	0.2514	0.5225
Maximum	34.75	1.400	48.65	4801	98.89	2980	86.3	0.4415	0.4077	0.2521	0.5235
Median	34.64	1.400	48.50	4721	97.31	2962	83.7	0.4405	0.4067	0.2517	0.5230
S.T. Deviation	0.11	0.000	0.15	45.3	0.97	8.7	0.76	0.0006	0.0006	0.0002	0.0003

Environmental Conditions	
Relative Humidity	35%-47%
Ambient Temperature	24°C - 27°C
Photometric Measurement Date(s)	2014-10-08 to 09

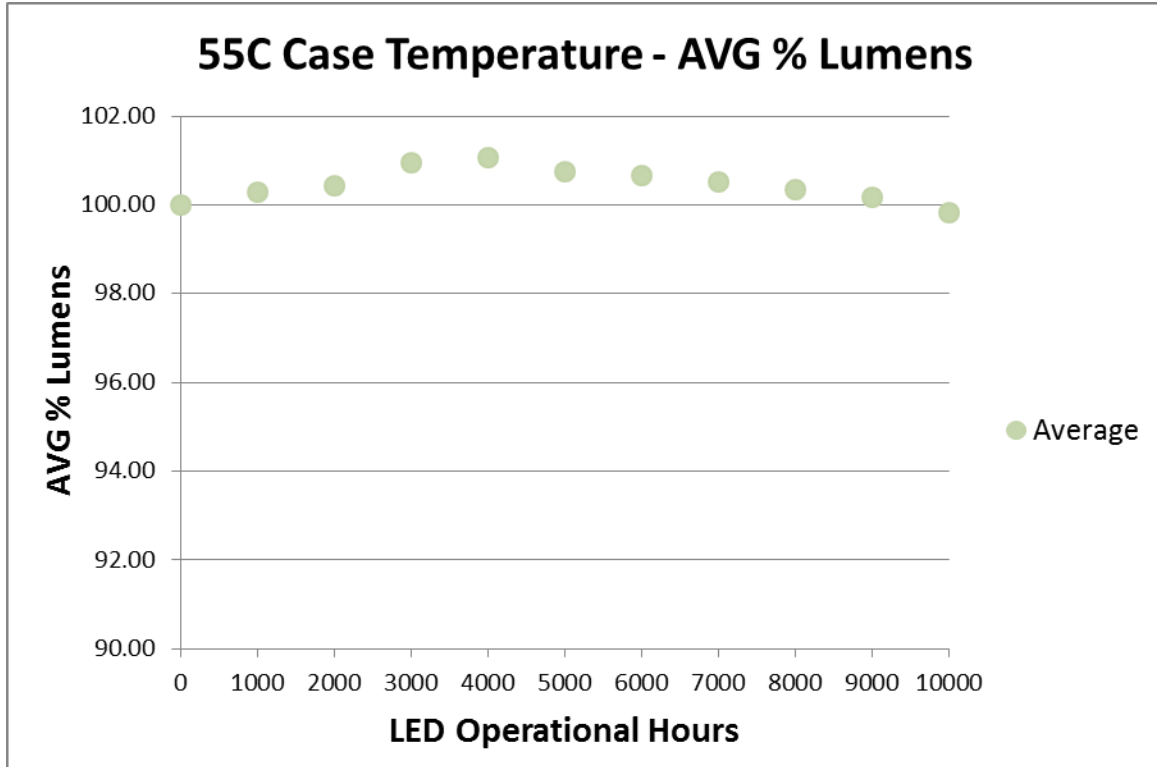
### 3.2 Lumen Maintenance - 90°C Case Temperature

Sample Serial Number	Hours									
	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
#875	100.00	99.81	100.76	100.53	100.59	100.53	100.38	100.42	100.04	99.62
#876	99.36	99.87	100.02	100.19	99.81	99.53	99.49	99.21	99.06	99.04
#877	100.11	99.87	99.94	100.69	100.40	100.17	100.00	99.68	99.39	99.33
#878	99.72	101.06	101.72	101.36	101.45	101.21	101.19	101.00	100.68	100.57
#879	100.06	100.44	100.70	100.84	100.40	100.06	100.04	99.85	99.71	99.37
#880	100.38	100.51	100.84	101.14	100.93	100.61	100.49	100.25	99.94	99.54
#881	99.89	100.02	100.28	100.55	100.00	100.17	99.98	99.89	99.51	99.25
#882	100.43	100.04	99.81	100.49	100.30	100.24	100.06	100.00	99.72	99.36
#883	100.89	102.06	102.15	102.69	102.19	102.11	101.89	101.67	101.74	101.39
#884	99.94	100.47	100.77	100.98	100.75	100.62	100.38	100.13	99.94	99.68
#885	100.15	100.64	101.29	100.85	100.79	100.79	100.62	100.28	100.02	99.51
#886	101.17	102.45	102.49	103.84	104.17	104.41	104.23	103.99	104.03	103.31
#887	100.13	99.87	100.42	100.87	100.74	100.61	100.30	100.00	100.00	99.53
Average	100.17	100.55	100.86	101.16	100.96	100.85	100.70	100.49	100.29	99.96
Minimum	99.36	99.81	99.81	100.19	99.81	99.53	99.49	99.21	99.06	99.04
Maximum	101.17	102.45	102.49	103.84	104.17	104.41	104.23	103.99	104.03	103.31
Median	100.11	100.44	100.76	100.85	100.74	100.61	100.38	100.13	99.94	99.53
S.T. Deviation	0.47	0.85	0.84	1.01	1.14	1.24	1.22	1.21	1.30	1.18



### 3.3 Lumen Maintenance - 55°C Case Temperature

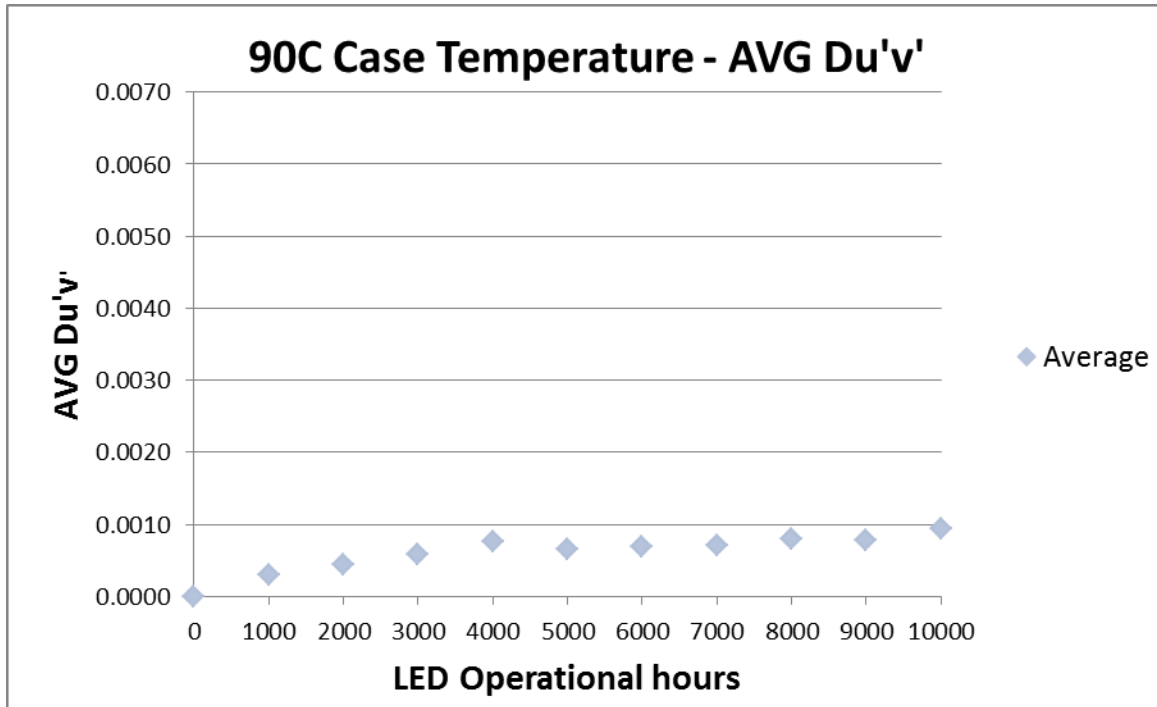
Sample Serial Number	Hours									
	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
#892	100.40	101.44	101.93	101.72	101.51	101.46	101.63	101.44	101.13	100.96
#893	99.77	99.94	100.82	100.76	100.70	100.51	100.34	100.32	99.96	99.68
#894	100.23	99.58	100.06	100.21	99.73	99.63	99.40	99.35	99.23	98.81
#895	100.11	100.53	101.12	101.04	100.80	100.59	100.51	100.32	100.25	100.00
#896	100.75	101.01	101.48	101.26	101.43	101.03	100.68	100.60	100.45	100.21
#897	100.32	100.75	101.07	101.11	100.64	100.75	100.51	100.28	100.06	99.59
#898	100.40	101.57	101.72	101.79	100.81	101.36	101.30	101.08	101.00	100.57
#899	100.00	99.85	100.13	100.15	99.77	99.46	99.37	99.18	99.10	98.87
#900	101.32	101.36	101.84	102.06	101.69	101.69	101.52	101.21	100.93	100.61
#901	100.43	100.19	100.51	100.75	100.32	100.28	100.19	99.91	99.61	99.21
#902	100.21	100.34	101.20	101.58	100.88	101.03	100.74	100.65	100.48	100.08
#903	100.32	100.17	100.53	101.02	100.89	100.72	100.61	100.42	100.32	99.96
#904	99.56	98.93	99.81	100.59	100.48	100.08	100.08	99.85	99.77	99.35
Average	100.29	100.44	100.94	101.08	100.74	100.66	100.53	100.36	100.18	99.84
Minimum	99.56	98.93	99.81	100.15	99.73	99.46	99.37	99.18	99.10	98.81
Maximum	101.32	101.57	101.93	102.06	101.69	101.69	101.63	101.44	101.13	100.96
Median	100.32	100.34	101.07	101.04	100.80	100.72	100.51	100.32	100.25	99.96
S.T. Deviation	0.43	0.78	0.76	0.59	0.59	0.68	0.70	0.67	0.64	0.67





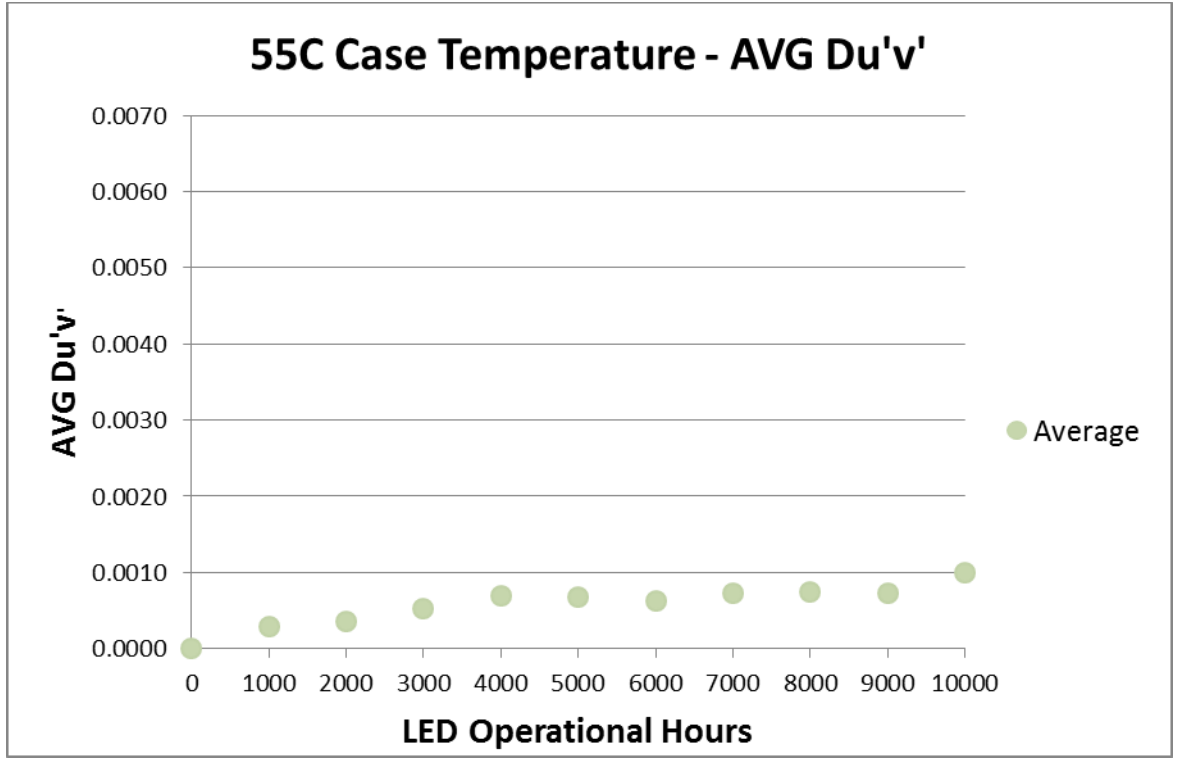
### 3.4 Chromaticity Shift - 90°C Case Temperature

Sample Serial Number	Hours									
	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
#875	0.0001	0.0004	0.0005	0.0005	0.0005	0.0005	0.0006	0.0008	0.0008	0.0010
#876	0.0003	0.0005	0.0006	0.0007	0.0006	0.0007	0.0008	0.0008	0.0009	0.0010
#877	0.0002	0.0004	0.0005	0.0007	0.0006	0.0006	0.0006	0.0008	0.0007	0.0008
#878	0.0001	0.0003	0.0005	0.0006	0.0005	0.0005	0.0006	0.0007	0.0006	0.0007
#879	0.0003	0.0005	0.0005	0.0006	0.0006	0.0007	0.0007	0.0008	0.0007	0.0009
#880	0.0003	0.0003	0.0004	0.0008	0.0006	0.0006	0.0007	0.0008	0.0008	0.0009
#881	0.0003	0.0004	0.0006	0.0007	0.0006	0.0006	0.0006	0.0007	0.0007	0.0009
#882	0.0003	0.0007	0.0009	0.0011	0.0009	0.0009	0.0010	0.0011	0.0011	0.0012
#883	0.0006	0.0006	0.0009	0.0011	0.0010	0.0009	0.0010	0.0011	0.0011	0.0012
#884	0.0004	0.0004	0.0007	0.0008	0.0008	0.0008	0.0007	0.0007	0.0008	0.0010
#885	0.0003	0.0003	0.0004	0.0006	0.0005	0.0005	0.0006	0.0007	0.0005	0.0008
#886	0.0003	0.0003	0.0006	0.0009	0.0007	0.0007	0.0008	0.0008	0.0008	0.0009
#887	0.0004	0.0004	0.0006	0.0007	0.0007	0.0007	0.0007	0.0006	0.0008	0.0009
Average	0.0003	0.0004	0.0006	0.0008	0.0007	0.0007	0.0007	0.0008	0.0008	0.0009
Minimum	0.0001	0.0003	0.0004	0.0005	0.0005	0.0005	0.0006	0.0006	0.0005	0.0007
Maximum	0.0006	0.0007	0.0009	0.0011	0.0010	0.0009	0.0010	0.0011	0.0011	0.0012
Median	0.0003	0.0004	0.0006	0.0007	0.0006	0.0007	0.0007	0.0008	0.0008	0.0009
S.T. Deviation	0.0001	0.0001	0.0002	0.0002	0.0002	0.0001	0.0001	0.0001	0.0002	0.0001



### 3.5 Chromaticity Shift - 55°C Case Temperature

Sample Serial Number	Hours									
	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
#892	0.0004	0.0004	0.0005	0.0007	0.0007	0.0007	0.0008	0.0008	0.0008	0.0011
#893	0.0004	0.0005	0.0006	0.0006	0.0007	0.0007	0.0008	0.0008	0.0008	0.0010
#894	0.0001	0.0001	0.0003	0.0005	0.0005	0.0004	0.0004	0.0004	0.0003	0.0008
#895	0.0003	0.0003	0.0005	0.0007	0.0007	0.0006	0.0007	0.0007	0.0008	0.0009
#896	0.0003	0.0003	0.0004	0.0006	0.0007	0.0005	0.0006	0.0007	0.0006	0.0009
#897	0.0004	0.0004	0.0006	0.0008	0.0007	0.0007	0.0008	0.0008	0.0009	0.0011
#898	0.0002	0.0005	0.0006	0.0007	0.0008	0.0007	0.0008	0.0008	0.0008	0.0010
#899	0.0003	0.0004	0.0005	0.0008	0.0007	0.0007	0.0009	0.0007	0.0007	0.0011
#900	0.0004	0.0003	0.0006	0.0008	0.0008	0.0007	0.0008	0.0008	0.0008	0.0011
#901	0.0002	0.0005	0.0007	0.0008	0.0009	0.0008	0.0009	0.0009	0.0008	0.0011
#902	0.0002	0.0003	0.0005	0.0008	0.0006	0.0006	0.0007	0.0008	0.0007	0.0010
#903	0.0002	0.0002	0.0004	0.0006	0.0006	0.0005	0.0006	0.0006	0.0007	0.0009
#904	0.0002	0.0003	0.0005	0.0007	0.0007	0.0006	0.0008	0.0007	0.0007	0.0009
Average	0.0003	0.0004	0.0005	0.0007	0.0007	0.0006	0.0007	0.0007	0.0007	0.0010
Minimum	0.0001	0.0001	0.0003	0.0005	0.0005	0.0004	0.0004	0.0004	0.0003	0.0008
Maximum	0.0004	0.0005	0.0007	0.0008	0.0009	0.0008	0.0009	0.0009	0.0009	0.0011
Median	0.0003	0.0003	0.0005	0.0007	0.0007	0.0007	0.0008	0.0008	0.0008	0.0010
S.T. Deviation	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001



# 4 LM-21 Lumen Projection



## TM-21 Inputs

**Instructions**

Yellow fields are completed by the user. Fields not used should be left blank. Cyan fields are calculated based on user entries.

First, enter a description of the LED light source tested. Then complete the fields labeled "LM-80 Testing Details". Test duration must be at least 6,000 hours. If only one case temperature data set is to be used (no interpolation), complete only "Tested case temperature 1". For only two case temperature data sets, complete 1 and 2.

Next, further to the right, in the corresponding box(es) for each tested case temperature, enter the test data along with the time (in hours) at which each measurement was taken. Data entered must be normalized then averaged measured data (per TM-21 sections 5.2.1 and 5.2.2). If case temperatures have different test durations, enter data up to the lowest of the test durations for all of the case temperatures.

Enter drive current, *in-situ* temperature data and the percentage of initial lumens to project to in the fields labeled "In-Situ Inputs".

Results can be tailored to estimate lumen maintenance at a specific time by entering a value (t) in the yellow field. A complete TM-21

Description of LED Light Source Tested (manufacturer, model, catalog number)

Manufacturer: XICATO; Model: 19mm 8030-5000 lm

LM-80 Testing Details	
Total number of units tested per case temperature	13
Number of failures:	0
Number of units measured:	13
Test duration (hours):	10000
Tested drive current (mA):	1400
Tested case temperature 1 (T <sub>c</sub> , °C):	90
Tested case temperature 2 (T <sub>c</sub> , °C):	55
Tested case temperature 3 (T <sub>c</sub> , °C):	

### LM-80 Test Inputs

Test Data for 90°C Case Temperature		Test Data for 55°C Case Temperature		Tested Case Temperature 3	
Time (hours)	Lumen Maintenance (%)	Time (hours)	Lumen Maintenance (%)	Time (hours)	Lumen Maintenance (%)
0	100.00%	0	100.00%		
1000	100.17%	1000	100.29%		
2000	100.55%	2000	100.44%		
3000	100.86%	3000	100.94%		
4000	101.16%	4000	101.08%		
5000	100.96%	5000	100.74%		
6000	100.85%	6000	100.66%		
7000	100.70%	7000	100.53%		
8000	100.49%	8000	100.36%		
9000	100.29%	9000	100.18%		
10000	99.96%	10000	99.35%		

In-Situ Inputs	
Drive current for each LED package/array/module (mA):	1400
In-situ case temperature (T <sub>c</sub> , °C):	25
Percentage of initial lumens to project to (e.g. for L <sub>70</sub> , enter 70):	70

Results	
Time (t) at which to estimate lumen maintenance (hours):	55,000
Lumen maintenance at time (t) (%):	91.61%
Reported L70 (hours):	>55000

Calculations:	
Minimum Case Temperature (T <sub>s,1</sub> ) for Extrapolation (K):	363.15
α <sub>1</sub>	0.0000
B <sub>1</sub>	1.0203
Maximum Case Temperature (T <sub>s,2</sub> ) for Extrapolation (K):	N/A
α <sub>2</sub>	N/A
B <sub>2</sub>	N/A
E <sub>a</sub> /k <sub>b</sub>	
k <sub>b</sub> (eV/K)	8.6173E-05
E <sub>a</sub> (eV)	
A	
B <sub>0</sub>	1.0203
In Situ Case Temperature (T <sub>s,i</sub> ) (K):	298.15
α <sub>i</sub>	0.0000
Calculated L70 (hrs):	192000
Reported L70 (hrs):	>55000

Table 1: Report at each LM-80 Test Condition					
Case Temperature 1		Case Temperature 2		Case Temperature 3	
Temperature (°C):	90	Temperature (°C):	55	Temperature (°C):	
Temperature (°K):	363.15	Temperature (°K):	328.15	Temperature (°K):	
α:	1.96E-06	α:	2.44E-06	α:	
B:	1.02	B:	1.02	B:	
Calculated L70 (hrs):	192000	Calculated L70 (hrs):	155000	Calculated L70 (hrs):	
Reported L70 (hrs):	>55000	Reported L70 (hrs):	>55000	Reported L70 (hrs):	

Table 2: Report for Interpolation (based on in-situ temperature)

$T_{s,1}$ (°C)	90.00
$T_{s,1}$ (K)	363.15
$\alpha_1$	1.9590E-06
$B_1$	1.0203
$T_{s,2}$ (°C)	
$T_{s,2}$ (K)	N/A
$\alpha_2$	N/A
$B_2$	N/A
$E_a/k_b$	
A	
$B_0$	1.0203
$T_{s,i}$ (°C)	25
$T_{s,i}$ (K)	298.15
$\alpha_i$	1.9590E-06

Table 1: Report at each LM-80 Test Condition			
Description of LED Light Source Tested (manufacturer, model, catalog number)		Manufacturer: XICATO; Model: 19mm 8030-5000 lm	
Test Condition 1 - 90°C Case Temp		Test Condition 2 - 55°C Case Temp	
Sample size	13	Sample size	13
Number of failures	0	Number of failures	0
DUT drive current used in the test (mA)	1400	DUT drive current used in the test (mA)	1400
Test duration (hours)	10,000	Test duration (hours)	10,000
Test duration used for projection (hour to hour)	5,000 - 10,000	Test duration used for projection (hour to hour)	5,000 - 10,000
Tested case temperature (°C)	90	Tested case temperature (°C)	55
$\alpha$	1.959E-06	$\alpha$	2.443E-06
B	1.020	B	1.022
Reported L70(10k) (hours)	>55000	Reported L70(10k) (hours)	>55000

Table 2: Interpolation Report (projection based on <i>in-situ</i> temperature entered)	
$T_{s,1}$ (°C)	90.00
$T_{s,1}$ (K)	363.15
$\alpha_1$	1.959E-06
$B_1$	1.020
$T_{s,2}$ (°C)	-
$T_{s,2}$ (K)	-
$\alpha_2$	-
$B_2$	-
$E_a/k_b$	-
A	-
$B_0$	1.020
$T_{s,i}$ (°C)	25.00
$T_{s,i}$ (K)	298.15
$\alpha_i$	1.959E-06
Reported L70(10k) at 25°C	>55000

Report Generated By: Thomas Tu	Notes:
Company: Bay Area Compliance Laboratory Corp.	
Date: 04/28/2016	

## 5 Photographs

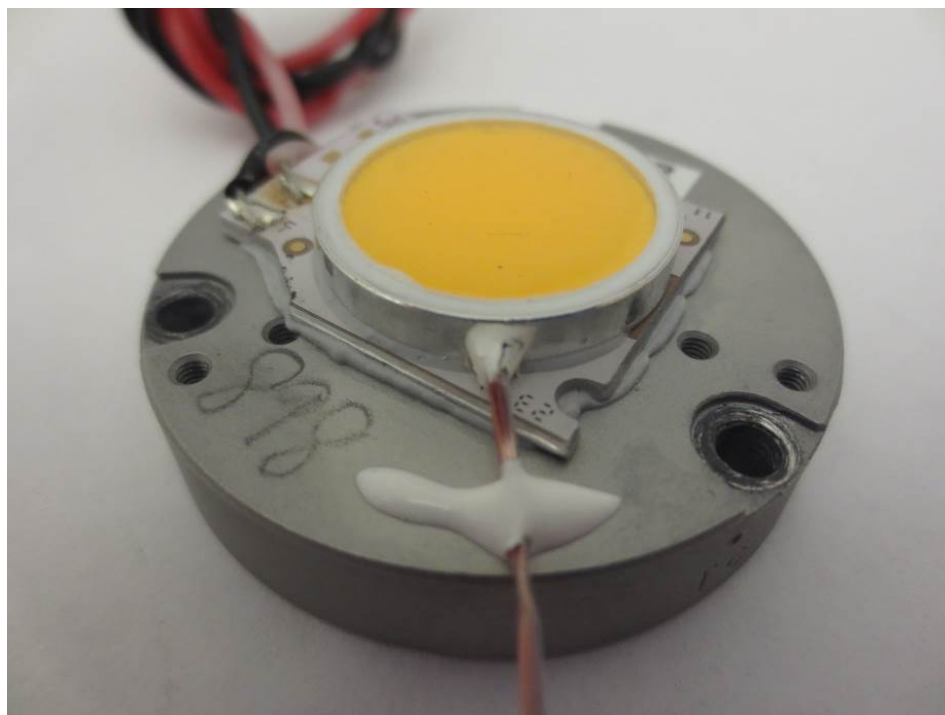
### 5.1 EUT – Top and Side View



### 5.2 EUT – Bottom and Side View



### 5.3 EUT – Temperature Measurement Point



**- End of Report -**