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TESTING
CNAS L3337

IESNA SUSTAINING MEMBER

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Test report of

In Situ Temperature Measurement and TM-21

Rendered to:

Imminent Teknologies Limited
Suite 5, Valley Towers, Valley Road, Birkirkara BKR9022, Malta

For products:

LED MODULE

Models No.:

BLU-FLEXI-9.6W-827-IP20-5M

Test Date:	Sep. 23, 2019 to Sep. 29, 2019
Test Lab.:	**LCTECH Guangdong Testing Services Co., Ltd.** 2/F., Building II, Technology and Enterprise Development Center, Guangyuan Road, Xiaolan, Zhongshan, Guangdong, China Tel:+86-760-22833366 Fax:+86-760-22833399 E-mail:Service@lccert.com http://www.lccert.com
Test Sites:	2/F., Building II & 1/F., Building I, Technology and Enterprise Development Center, Guangyuan Road, Xiaolan, Zhongshan, Guangdong, China
Template No.:	LC-RT-PL-015 Rev.1.2
Test Note:	

Complied by:		**Reviewed by:**	
Kargel Yuan	Kargel Yuan	**Henry Li**	Henry Li
Project Engineer		**Technical Manager**	
Sep. 30, 2019		**Sep. 30, 2019**	

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1. General

1.1 Product Information

Brand Name	BLUi
Product Type	LED STRIP LIGHT
Model Number	BLU-FLEXI-9.6W-827-IP20-5M
Rated Inputs	24VDC
Rated Power	9.6W
Rated Light output	940lm
Declared CCT	2700K
Power Supply	Integrated in luminaire
LED Package, Array or Module	Model: SPMWHx228xxxxxxxxx, Samsung Electronics Co., LTD
Receipt Samples	1 unit
Sample Code of lab.	190919109001
Date of Receipt Samples	Sep. 19, 2019
Note	-

1.2 Standards or methods

The following standards are partly or totally used or referenced for test:

No.	Name
IEC 60598-1:2014+A1: 2017 Clause 12.4.1	Luminaires- Part 1: General requirements and tests
IES LM-80:2008*	Solid State Lighting Luminaires – Lumen Maintenance
IES LM-80:2015*	Measuring Luminous Flux and Color Maintenance of LED Packages, Arrays and Modules
IES TM-21-11	Projecting Long Term Lumen Maintenance of LED Light Sources
IES LM-84-14 Annex A*	Recommendations for measurement of In-situ conditions LED case Temperature, Ts

Note:

**For reference only, IES LM-80-08, IES LM-80-15 and IES LM-84-14 is not in the scope of CNAS(L3337) recognition.*

1.3 Equipment list

Instrument	ID	Model name	Cal. date	Next cal. Date
AC Power supply	LC-I-923	CHP-500	2019-01-08	2020-01-07
AC Power supply	LC-I-987	APW-110N	2019-01-08	2020-01-07
Power analyzer	LC-I-928	WT210	2019-01-02	2020-01-01
Power analyzer	LC-I-954	WT210	2019-03-12	2020-03-11
Multimeter	LC-I-972	Fluke 17B	2019-07-29	2020-07-28
J thermocouple	LC-I-096	TT-J-30-SLE(200 m/r)	2019-02-27	2020-02-26
Data acquisition/Switch unit	LC-I-098	34970A	2019-02-27	2020-02-26
T&H recorder	LC-I-958	DWRP-B(0)	2019-08-08	2020-08-07

2. Test conducted and method

The luminaire provided by the client was installed to simulate intended usage to record the maximum temperature that can be encountered under the intended use.

2.1 Ambient Condition

Test was conducted in an ambient temperature of 25 ± 5 °C. Ambient temperature variations above or below 25 °C was respectively subtracted from or added to temperatures recorded at points on the luminaire.

The ambient temperature was measured by a thermocouple which was immersed in 15 ml of mineral oil in a glass container which was placed in the horizontal plane passing through the midpoint of the luminaire's vertical axis at a horizontal distance from the luminaire equal to at least 3 times the luminaire diameter

2.2 Temperature Stabilization

Measurements were not taken until the luminaire has stabilized thermally whose temperatures is changing at a rate less than 1 °C per hour.

2.3 Thermocouples

Temperatures recorded at points on LED was measured by means of thermocouples. Type J thermocouple was used. The thermocouples have conductors of 0.05mm ^{2}(30AWG), and complied with the requirements specified in ASTM MNL 12 and limits of error specified in NIST ITS 90 and ISA MC96.1.

2.4 Thermocouples contact

Thermocouples were directly in contact with the TMP_{LED} location described in LM-80 test report. In order to gain the maximum temperature, if appropriate, more than one thermocouple were contact in these locations. For details information, please refer to clause 3.3 for the photo of thermocouple contact..

3. Test Result Summary

3.1 Electrical data

Criteria Item	Result
Input Voltage & Frequency	24.01 V
Input Current(A)	0.400
Total Power(W)	9.60
Power Factor	1.000
Current on each LED(mA)	65

3.2 Temperature data

Criteria Item	Result
Total operated period(hours)	3.6
Ambient temperature(℃)	25.4
Measured Temperature @TMP_{LED}(℃)	37.0
Maximum Temperature @TMP_{LED}(Normalized to 25°C) (℃)	**36.6**

3.3 Lumen Maintenance Projection (IESNA TM-21 Method)

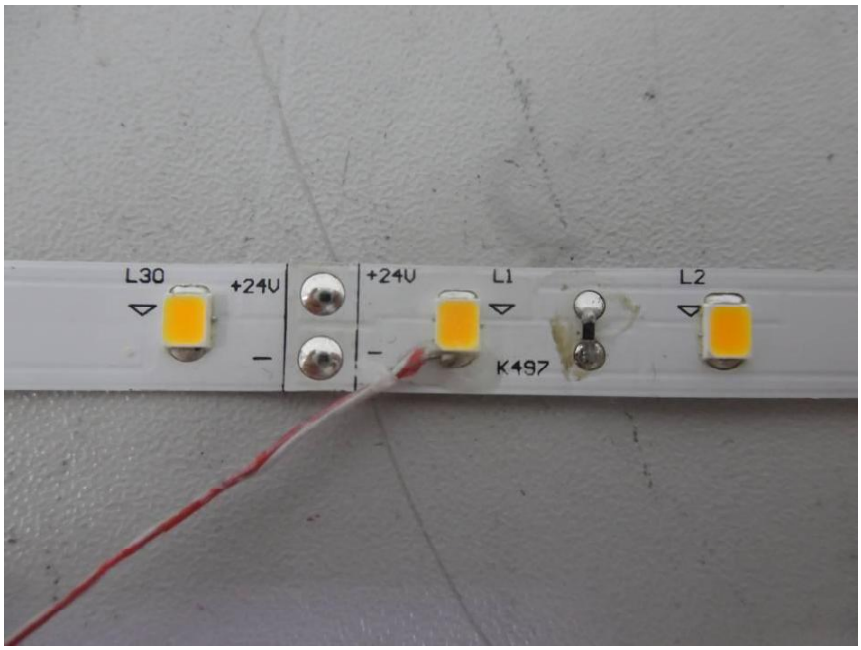
Criteria Item	Result
10000 hours lumen maintenance of LED light source	98.99%
forward current on each LED light source	65 mA
Projected L_{80} lumen maintenance life	**159000 hours**
Reported L_{80} lumen maintenance life	**>60000 hours**

Note: 1. Please refer to section3.6 for details of TM-21 inputs and results.

3.4 LM-80 Information

Report originated by	Bay Area Compliance Laboratories Corp. (Dongguan).		
Manufactured by	Samsung Electronics Co., LTD		
LM-80 report No.	RSZ151022511-10		
LED Model	SPMWHx228xxxxxxxxx		
LED Part Number	SPMWHx228xxxxxxxxx		
Number of LED light source tested	25 units per case temperature		
Drive Current	65mA		
Case temperature	55℃	85℃	105℃
lumen maintenance during 10000 hours test	99.00%	98.53%	97.53%
Color maintenance(Δu'v') during 10000 hours test	0.0024	0.0026	0.0029

3.5 Thermocouple Contact Photo



Part View

Over View

3.6 TM-21 input and output

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". If the in-situ values falls between two cases temperatures, enter only those two case temperature data sets in Tested case temperature 1 and 2 in ascending temperature order. 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). 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 report will appear on the next tab labeled "Report".

LM-80 Test Inputs

Description of LED Light Source Tested (manufacturer, model, catalog number)
Model: SPMWHx228xxxxxxxxx, Samsung Electronics Co., LTD

LM-80 Testing Details	
Total number of units tested per case temperature:	25
Number of failures:	0
Number of units measured:	25
Test duration (hours):	10000
Tested drive current (mA):	65
Tested case temperature 1 (T_c, °C):	55
Tested case temperature 2 (T_c, °C):	85
Tested case temperature 3 (T_c, °C):	105

Test Data for 55°C Case Temperature		Test Data for 85°C Case Temperature		Test Data for 105°C Case Temperature	
Time (hours)	Lumen Maintenance (%)	Time (hours)	Lumen Maintenance (%)	Time (hours)	Lumen Maintenance (%)
0	100.00%	0	100.00%	0	100.00%
1000	100.30%	1000	100.21%	1000	100.11%
2000	100.16%	2000	100.04%	2000	99.85%
3000	100.01%	3000	99.85%	3000	99.55%
4000	99.84%	4000	99.67%	4000	99.26%
5000	99.70%	5000	99.50%	5000	98.96%
6000	99.56%	6000	99.31%	6000	98.67%
7000	99.43%	7000	99.10%	7000	98.39%
8000	99.27%	8000	98.91%	8000	98.10%
9000	99.12%	9000	98.72%	9000	97.81%
10000	99.00%	10000	98.53%	10000	97.53%

***In-Situ* Inputs**

Drive current for each LED package/array/module (mA):	65
In-situ case temperature (T_c, °C):	36.6
Percentage of initial lumens to project to (e.g. for L_{70}, enter 70):	80

Results

Time (t) at which to estimate lumen maintenance (hours):	10,000
Lumen maintenance at time (t) (%):	98.99%
Reported L80 (hours):	>60000

TM-21 Input

TM-21 Report

Table 1: Report at each LM-80 Test Condition

Description of LED Light Source Tested (manufacturer, model, catalog number)	Model: SPMWHx228xxxxxxxxx, Samsung Electronics Co., LTD		
	Test Condition 1 - 55°C Case Temp	Test Condition 2 - 85°C Case Temp	Test Condition 3 - 105°C Case Temp
Sample size	25	25	25
Number of failures	0	0	0
DUT drive current used in the test (mA)	65	65	65
Test duration (hours)	10,000	10,000	10,000
Test duration used for projection (hour to hour)	5,000 - 10,000	5,000 - 10,000	5,000 - 10,000
Tested case temperature (°C)	55	85	105
α	1.432E-06	1.985E-06	2.914E-06
B	1.004	1.005	1.004
Reported L80(10k) (hours)	>60000	>60000	>60000

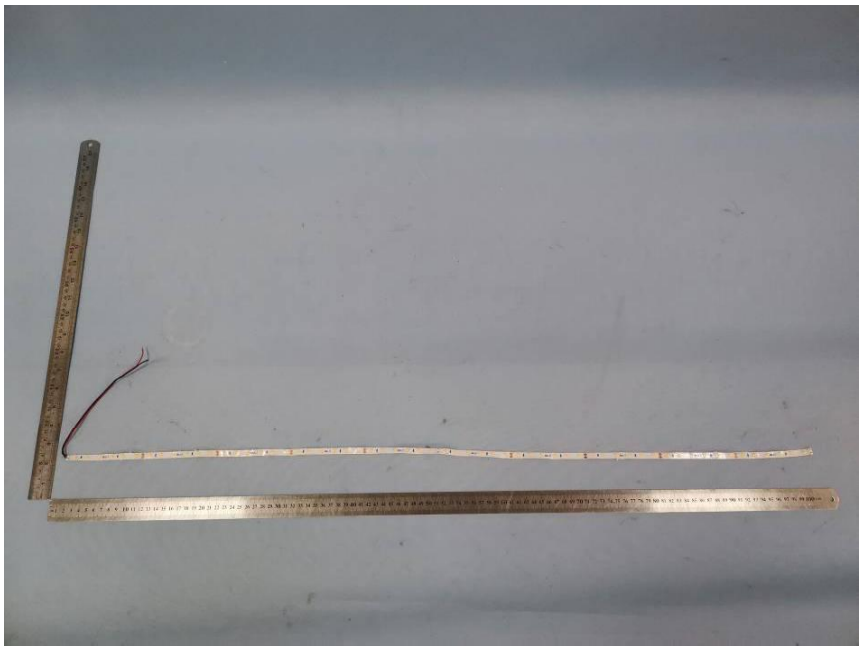
Table 2: Interpolation Report (projection based on *in-situ* temperature entered)

$T_{s,1}$ (°C)	55.00
$T_{s,1}$ (K)	328.15
α_1	1.432E-06
B_1	1.004
$T_{s,2}$ (°C)	-
$T_{s,2}$ (K)	-
α_2	-
B_2	-
E_a/k_b	-
A	-
B_0	1.004
$T_{s,i}$ (°C)	36.60
$T_{s,i}$ (K)	309.75
α_i	1.432E-06
Reported L80(10k) at 36.6°C (hours)	>60000

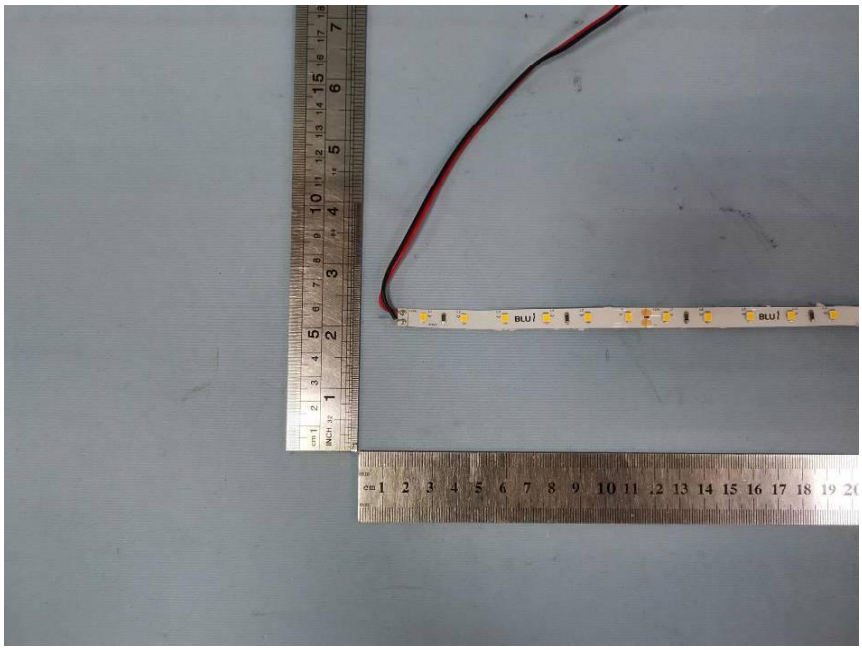
Report Generated By:Kargel Yuan	Notes:
Company: LCTECH (Zhongshan) Testing Service Co., Ltd	
Date: Sep. 30, 2019	

TM-21 Output

Appendix A Product Photo



Picture 1



Picture 2

****End of test report****