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Test report of

IES LM-79-08

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

Rendered to:

ETI Solid State Lighting (Zhuhai) Ltd
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High Tech District, Zhuhai City, Guangdong Prov., China

NVC VIETNAM TECHNOLOGY AND LIGHTING COMPANY LIMITED
Lot CN23-1, Yen Phong Industrial park, Dong Phong commune, Yen
Phong district, Bac Ninh province, Vietnam

For products:

Under cabinet and shelf light

Models No.:

535091###(##=61-70,#=0-9)

Test Date: Oct. 9, 2020 to Oct. 10, 2020

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Template No.: LC-RT-PL-001 Rev.1.4

Test Note: *The product is a 5000K product and ## can be 61-70 and 0-9 and represent different client and sales districts.*

Complied by:

Fish Tan

Oct. 13, 2020

Fish Tan

Reviewed by:

Lin Qiu

Oct. 13, 2020

Lin Qiu

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1. General

1.1 Product Information

Brand Name	ETI
Product Type	Under cabinet and shelf light
Model Number	535091###(##=61-70,#=0-9)
Rated Inputs	120VAC, 60Hz
Rated Power	13W
Rated Light output	1000lm
Declared CCT	5000K
Power Supply	Intergrated in luminaires
LED Package, Array or Module	SPMWHX228XXXXXXXXX, Samsung Electronics Co., LTD.
Receipt Samples	1 unit
Sample Code of lab.	201008106002
Date of Receipt Samples	Oct. 8, 2020
Note	-

1.2 Standards or methods

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

No.	Name
ANSI/NEMA/ ANSLG C78.377-2011 or 2015 or 2017	Specifications for the Chromaticity of Solid State Lighting Products
ANSI C82.77-2002	Harmonic Emission Limits—Related Power Quality Requirements for Lighting Equipment
CIE Pub. No. 13.3-1995	Method of Measuring and Specifying Color Rendering of Light Sources
CIE Pub. No. 15:2004	Colorimetry
IES LM-79-08	Electrical and Photometric Measurements of Solid-State Lighting Products

1.3 Equipment list

Instrument	ID	Model name	Cal. date	Next cal. Date
AC Power supply	LC-I-987	APW-120N	2020-01-06	2021-01-05
AC Power supply	LC-I-989	APW-120N	2020-01-06	2021-01-05
Power analyzer	LC-I-928	WT210	2019-12-29	2020-12-28
Power analyzer	LC-I-954	WT210	2019-12-26	2020-12-25
Multimeter	LC-I-972	FLUKE	2020-07-20	2021-07-19
Photometric colorimetric electric system* (2 meter sphere)	LC-I-956	HAAS-2000	Before use	Before use
Standard lamp**	LC-PL-I-011	D204C	2020-07-14	2021-07-13
Luminous Flux Standard Lamp***	LC-PL-I-003	24V/100W	2020-07-14	2021-07-13
Goniophotometer(with mirror)	LC-I-902	GMS-2000	2020-04-23	2021-04-22
Wireless temperature transmitter	LC-I-PL-009	DWLR-DLR	2020-01-03	2021-01-02
Wireless temperature transmitter	LC-I-PL-008	DWLR-DLR	2020-01-03	2021-01-02

Note:

* Bandwidth of spectroradiometer is 1 nm.

** halogen lamp, 100W, omni-directional type, and its traceability to NIM.

*** halogen lamp, 100W, omni-directional type, and its traceability to NIM.

2. Test conducted and method

The lamp/luminaire was operated at least 2 hours to reach stabilization and temperature equilibrium before test.

2.1 Ambient Condition

The ambient temperature in which measurements are being taken was maintained at $25\text{ }^{\circ}\text{C} \pm 1\text{ }^{\circ}\text{C}$; the air flow around the sample(s) being tested did not affect the performance.

2.2 Power Supply Characteristics

The AC power supply had a sinusoidal voltage wave shape at the prescribed frequency (60 Hz) such that the RMS summation of the harmonic components does not exceed 3 percent of the fundamental during operation of the test item.

The voltage of AC power supply (RMS voltage) applied to the device under test was regulated to within ± 0.2 percent under load.

2.3 Seasoning and Stabilization

No seasoning was performed in accordance with IESNA LM-79-08. And before the measurement, the sample was stabilized until the light output and power variations were less than 0.5% in 30 minutes intervals (3 readings, 15 minutes apart).

2.4 Electrical Instrumentation

The calibration uncertainties of the instruments for AC voltage and current were less than 0.2 percent, and the calibration uncertainty of the AC power meter was less than 0.5 percent (95 % confidence interval, $k=2$).

2.5 Color Measurement Method

Spectral radiant flux was measured by a sphere (2 meter)-spectroradiometer system, and the color characteristics (Color rendering index, correlated color temperature, chromaticity coordinate) were calculated from these by software automatically.

2.6 Total Luminous Flux Measurement Method

Total luminous flux was measured by type C goniophotometer system.

Light intensity distribution was measured by a type C goniophotometer (with mirror) which can keep the sample in burn position when the tests conduct, and the total luminous flux was calculated from the intensity data by software automatically.

2.7 Luminous Intensity Distribution Measurement Method

Luminous intensity distribution was measured by a mirror-type goniophotometer (Type C) which can keep the sample in burn position when the tests conduct, and the kinds of graph were generated by software automatically.

2.8 Spatial Non-uniformity of Chromaticity

The customer did not require this measurement.

3. Test Result Summary

3.1 Electrical data

Criteria Item	Result(Sphere)	Result(Goniophotometer)
Input Voltage & Frequency	120.05 V~60Hz	120.01 V~60Hz
Input Current(A)	0.121	0.121
Total Power(W)	12.13	12.08
Power Factor	0.834	0.835
Off-state Power(W)	-	-

3.2 Photometric data

Criteria Item	Result(Sphere)	Result(Goniophotometer)
Total Lumens(lm)	-	1049.54
Luminaire Efficacy(lm/W)	-	86.88
Correlated Color Temperature (CCT)(K)	5287	-
Color Rendering Index (CRI)	95.4	-
R9	95	-
Chromaticity Coordinate (x,y)	x = 0.3374 y = 0.3420	-
Chromaticity Coordinate (u,v)	u = 0.2099 v = 0.3191	-
Chromaticity Coordinate (u',v')	u' = 0.2099 v' = 0.4787	-
Duv	-0.0017	-
Zone Lumens between 0-60 °	-	64.06%
Beam Angle(50%Imax)	-	C0/180=112.2° C90/270=129.2°

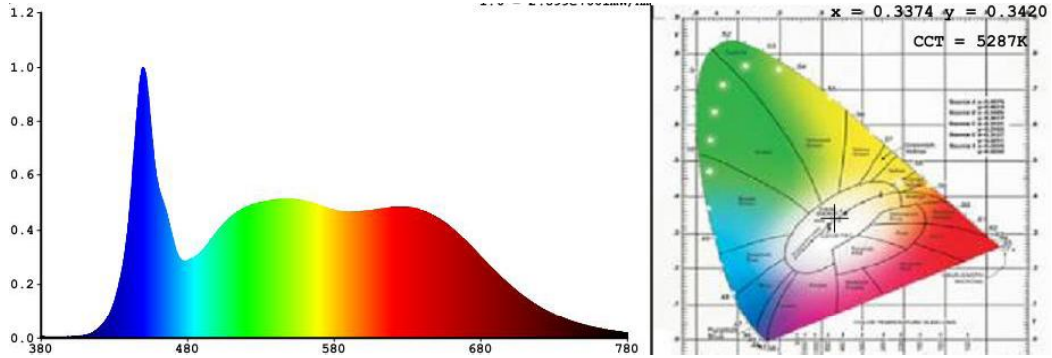
3.3 Color Rendering Details

R1	R2	R3	R4	R5	R6	R7	R8
98	96	91	95	97	92	96	98
R9	R10	R11	R12	R13	R14	R15	-
95	89	94	75	97	95	99	-

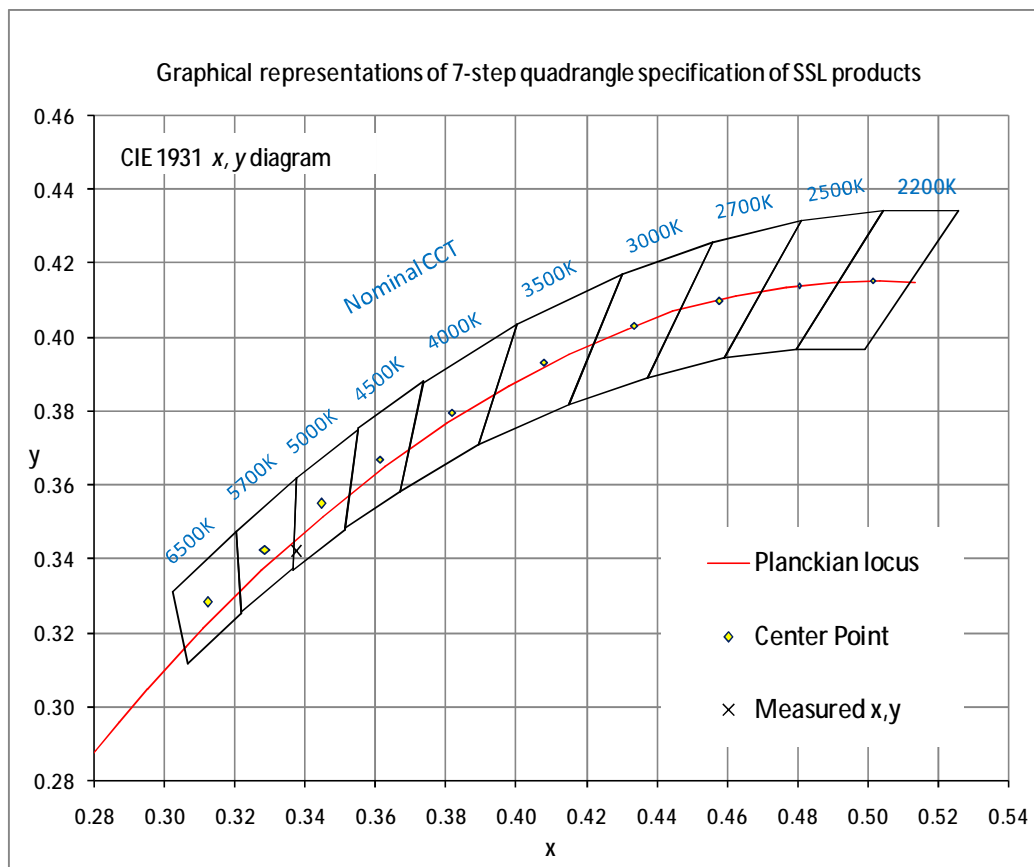
Note: N/A

4. Test Data

4.1 Spectral Distribution



4.2 ANSI Chromaticity Quadrangles Diagram



4.3 Goniometry Test Data

CIE Type	Semi-Direct	Basic Luminous Shape	Rectangular w/Sides
Spacing Criteria (0-180)	1.54	Luminous Length	0.99 m
Spacing Criteria (90-270)	1.26	Luminous Width	0.02 m
Spacing Criteria (Diagonal)	1.46	Luminous Height	0.01 m
Test Distance	30.02 m		

4.4 Zonal Lumen Summary

Zone	Lumens	%Lamp	%Fixt
0-20	103.37	9.80	9.80
0-30	221.54	21.10	21.10
0-40	367.20	35.00	35.00
0-60	672.30	64.10	64.10
0-80	885.28	84.30	84.30
0-90	936.81	89.30	89.30
10-90	910.24	86.70	86.70
20-40	263.83	25.10	25.10
20-50	420.12	40.00	40.00
40-70	429.73	40.90	40.90
60-80	212.98	20.30	20.30
70-80	88.35	8.40	8.40
80-90	51.53	4.90	4.90
90-110	60.86	5.80	5.80
90-120	80.45	7.70	7.70
90-130	94.50	9.00	9.00
90-150	109.15	10.40	10.40
90-180	112.73	10.70	10.70
110-180	51.87	4.90	4.90
0-180	1049.54	100.00	100.00

Total Luminaire Efficiency = 100.00%

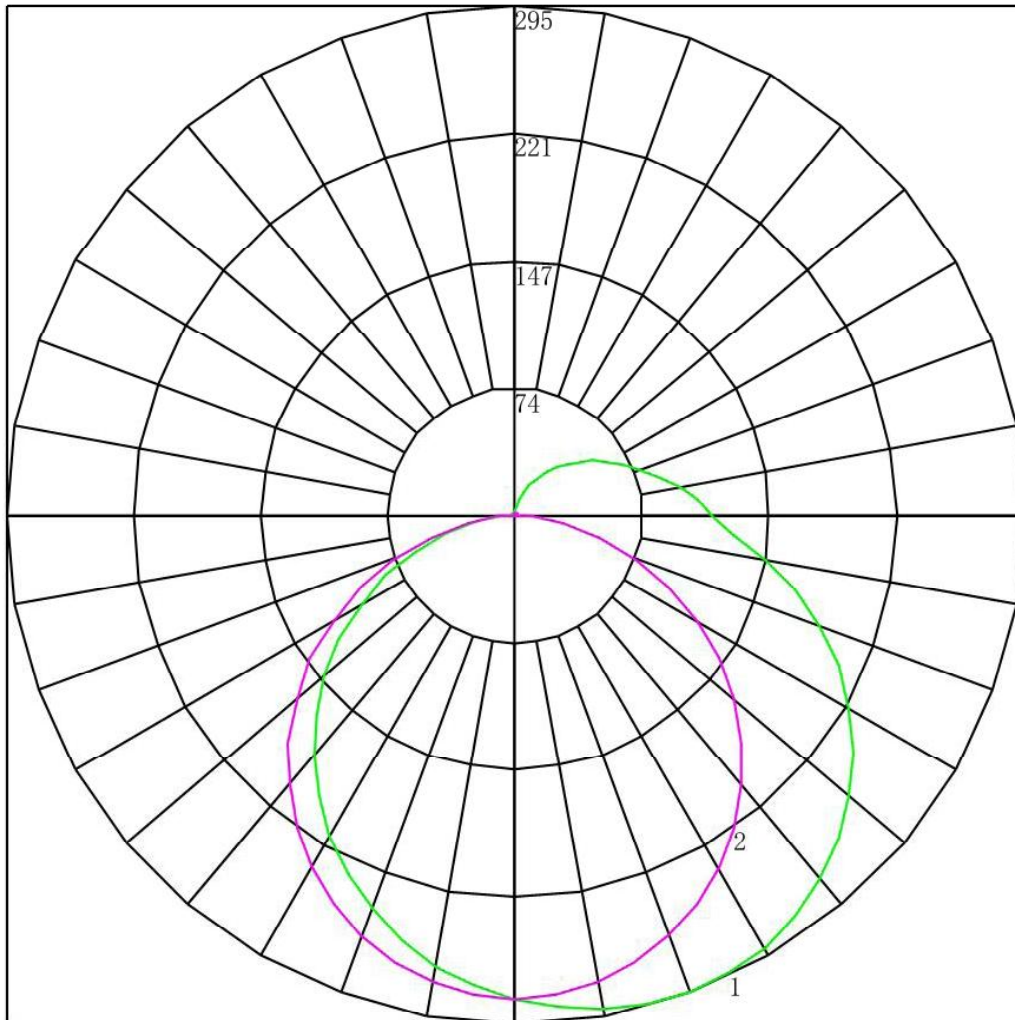
ZONAL LUMEN SUMMARY

Zone	Lumens
0-10	26.57
10-20	76.80
20-30	118.17
30-40	145.66
40-50	156.29
50-60	148.81
60-70	124.63
70-80	88.35
80-90	51.53
90-100	34.64
100-110	26.23
110-120	19.58
120-130	14.05
130-140	9.26
140-150	5.39
150-160	2.57
160-170	0.87
170-180	0.15



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4.5 Polar Curves



Maximum Candela = 294.723 Located At Horizontal Angle = 0, Vertical Angle = 20

1 - Vertical Plane Through Horizontal Angles (0 - 180)

2 - Vertical Plane Through Horizontal Angles (90 - 270)



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4.6 Candela Tabulation

	<u>0</u>	<u>15</u>	<u>30</u>	<u>45</u>	<u>60</u>	<u>75</u>	<u>90</u>	<u>105</u>	<u>120</u>	<u>135</u>
0	279.920	279.920	279.920	279.920	279.920	279.920	279.920	279.920	279.920	279.920
5	285.717	285.724	285.381	283.664	282.938	281.142	278.522	276.708	275.911	274.102
10	291.067	290.220	288.949	286.190	283.163	279.739	274.823	270.689	268.885	267.246
15	294.010	292.783	290.888	286.235	281.271	275.577	268.328	262.906	260.237	257.729
20	294.723	293.460	290.166	284.115	277.309	269.287	259.894	252.316	249.651	246.498
25	292.940	291.884	287.415	279.695	271.363	260.824	248.708	239.963	236.454	233.282
30	289.462	288.153	282.630	273.200	262.761	250.371	235.853	225.799	225.676	218.172
35	283.577	281.946	275.454	264.946	252.356	237.791	220.878	209.734	204.697	201.799
40	275.283	274.077	266.515	254.481	239.743	223.673	203.964	191.951	186.455	183.847
45	265.385	264.048	255.411	241.987	225.329	207.291	185.922	172.493	167.220	169.414
50	252.989	251.815	242.547	227.599	209.158	189.553	165.850	152.040	147.173	145.147
55	239.613	237.695	228.010	211.767	191.320	169.960	144.967	130.139	125.326	124.805
60	223.205	221.817	211.582	194.582	172.308	149.144	122.008	107.830	104.064	103.786
65	206.529	204.459	193.841	175.187	151.904	127.651	98.148	84.527	81.629	82.226
70	187.178	185.388	173.935	154.303	130.370	104.256	75.099	61.901	60.142	60.756
75	167.560	165.734	153.712	133.465	108.882	80.364	51.014	39.773	39.510	39.963
80	147.763	144.779	132.449	111.950	86.585	57.375	28.416	20.405	20.950	21.380
85	127.966	125.617	112.771	92.149	66.043	36.786	9.923	5.700	6.128	6.630
90	114.055	110.326	97.784	77.490	51.089	21.988	1.083	0.860	1.081	1.308
95	106.118	102.500	89.974	69.822	43.836	15.246	0.541	0.815	0.991	1.128
100	96.577	93.010	80.539	60.395	35.548	12.305	0.496	0.815	0.946	1.128
105	86.054	81.632	69.932	52.367	30.952	10.540	0.451	0.769	0.901	1.037
110	76.869	72.772	62.709	46.819	27.483	9.229	0.406	0.634	0.856	1.037
115	69.111	65.666	56.298	41.767	24.465	8.098	0.361	0.543	0.766	0.812
120	62.066	58.875	50.519	37.302	21.716	7.102	0.361	0.498	0.676	0.722
125	55.378	52.443	44.966	33.152	19.193	6.288	0.406	0.453	0.495	0.586
130	48.690	46.371	39.683	29.183	16.895	5.428	0.361	0.453	0.405	0.451
135	42.091	40.344	34.493	25.168	14.552	4.524	0.361	0.317	0.315	0.406
140	36.027	34.497	29.301	21.470	12.210	3.709	0.541	0.317	0.405	0.361
145	30.320	28.785	24.470	17.816	10.047	2.805	0.496	0.453	0.406	0.451
150	24.523	23.343	19.684	14.208	7.885	2.126	0.677	0.543	0.540	0.631
155	19.083	17.991	15.124	10.825	5.676	1.448	0.812	0.724	0.721	0.722
160	13.911	13.133	10.971	7.307	3.693	1.222	1.037	0.905	0.901	0.947
165	9.096	8.501	6.770	4.420	2.387	1.177	1.173	1.041	1.081	1.128
170	4.905	4.408	3.294	2.436	1.577	1.403	1.308	1.267	1.261	1.218
175	1.694	1.574	1.490	1.443	1.397	1.403	1.398	1.448	1.397	1.353
180	0.727	0.727	0.727	0.727	0.727	0.727	0.727	0.727	0.727	0.727

Vert. Angles Horizontal Angles

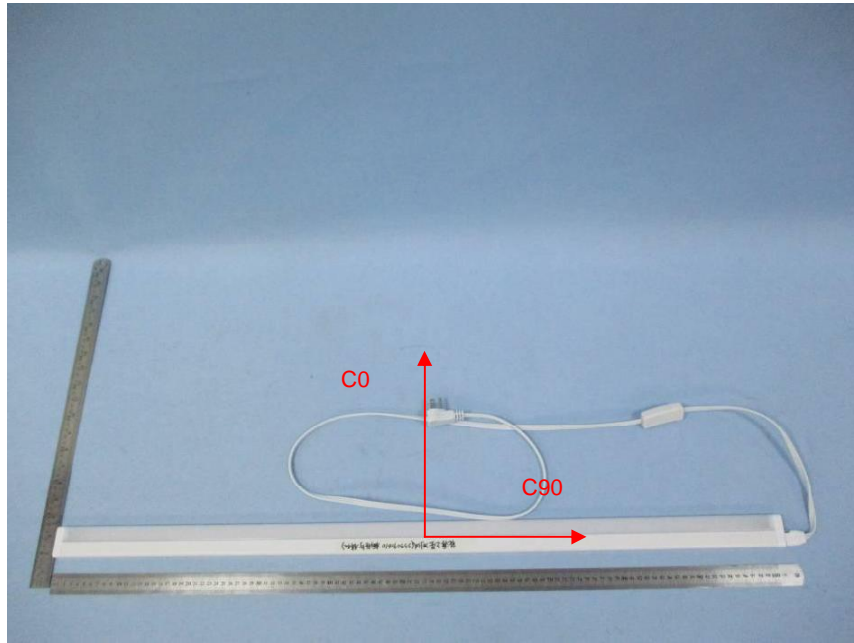
	<u>150</u>	<u>165</u>	<u>180</u>
0	279.920	279.920	279.920
5	274.233	273.626	273.321
10	266.288	265.306	265.563
15	256.989	255.726	255.041
20	245.389	243.988	243.180
25	232.072	230.676	229.804
30	217.222	216.014	215.001
35	200.881	199.643	198.949
40	183.637	182.509	181.739
45	164.768	164.249	163.458
50	145.132	145.090	144.018
55	124.864	125.121	124.488
60	108.949	104.253	104.246
65	82.611	82.666	82.754
70	61.486	61.797	61.798
75	40.767	45.903	40.842
80	22.122	22.713	22.294



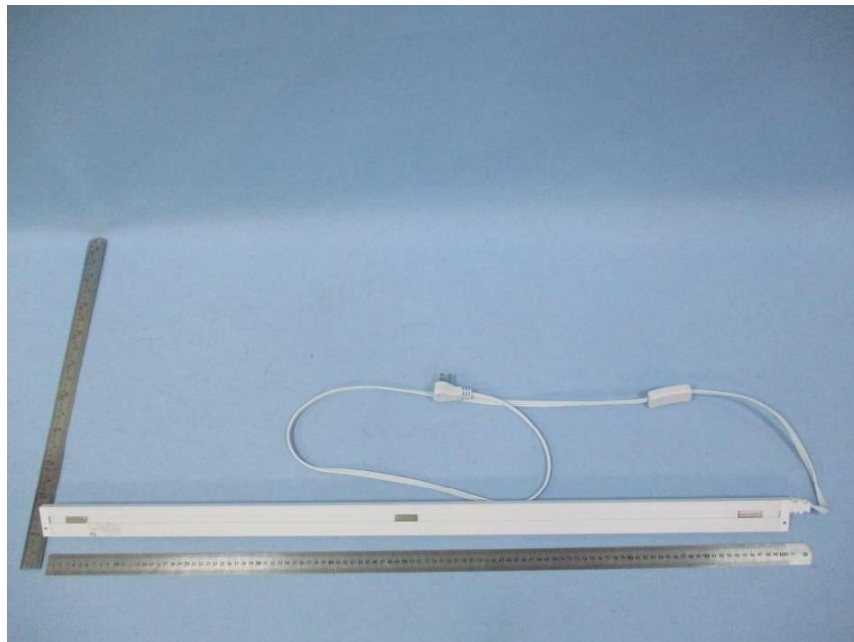
4.6 Candela Tabulation—Count.

85	7.269	7.781	7.847
90	1.490	1.439	3.121
95	1.264	1.349	1.338
100	1.219	1.304	1.248
105	1.128	1.259	1.248
110	1.128	1.169	1.159
115	0.993	1.035	0.981
120	0.858	0.810	0.803
125	0.677	0.674	0.713
130	0.496	0.540	0.535
135	0.406	0.360	0.446
140	0.407	0.450	0.446
145	0.496	0.450	0.446
150	0.587	0.584	0.535
155	0.722	0.720	0.803
160	0.993	0.855	0.981
165	1.083	1.079	0.981
170	1.264	1.259	1.248
175	1.399	1.304	1.338
180	0.727	0.727	0.727

Appendix A Product Photo



Picture 1



Picture 2

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