



TEST REPORT

According to ANSI/IES LM-80-15
For

Shenzhen Refond Optoelectronic Co., Ltd.

1 to 8th Floor, Building #1, 10th Industrial Zone, Tian Liao Community, Gong Ming Area, Guang
Ming New

Model: 5050

Report Type: 6000 Hours Test Report		Product Type: LED Package	
Test Engineer:	Pote Wang	<i>Pote Wang</i>	
Report Number:	R2DG170425053-10		
Test Date:	2017-05-03 to 2018-01-08		
Report Date:	2018-06-09		
Reviewed By:	Blake Zhang / EE Engineer	<i>Blake Zhang</i>	
Test Facility:	Test facility was located at No.69,Pulongcun ,Puxinhu Industrial Area, Tangxia , Dongguan, Guangdong, China.		
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Accreditation:	The IAS Accreditation Number TL-460.		

Note: The test data was only valid for the test sample(s). This test report is prepared for the customer shown above and for the device described herein. It may not be duplicated or used in part without prior written consent from Bay Area Compliance Laboratories Corp. (Dongguan).

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1 - General Information

1.1 Description of LED Light Sources

Sample Size:

75 PCS samples were received on 2017-04-25. The samples were numbered from 1 to 25, 26 to 50 and 51 to 75.

Manufacturer:	Shenzhen Refond Optoelectronic Co., Ltd.
Part Number:	5050
Part Type:	LED Package
Drive Level:	DC 20mA
Power:	0.18W
Die Spacing:	0.688mm

Sampling Method:

LED samples for IESNA LM-80 testing consist of units built from a minimum of three manufacturing lots with each manufacturing lot built from different wafer lots built on non-consecutive days.

These manufacturing lots are picked to represent a wide parametric distribution.

1.2 Standards Used:

ANSI/IES LM-80-15: IES Approved Method for Measuring Lumen Maintenance of LED Light Sources.

CIE 127:2007: Measurement of LEDs (This standard was not accredited by IAS)

ENERGY STAR® Requirements for the Use of LM-80 Data (This standard was not accredited by IAS)

1.3 Testing Equipment

Device	Manufacture	Model No	Serial No	Calibration date	Calibration due date
0.3m integrating sphere	EVERFINE	Diameter 0.3m	1011119	2018-03-18	2019-03-18
Programmable Test Power for LEDs	EVERFINE	LED300E	1008002	2018-03-26	2019-03-26
High accuracy array spectroradiometer	EVERFINE	HAAS-2000	1012016T	2018-03-18	2019-03-18
Standard Light Source	EVERFINE	D062	1011064	2018-01-15	2019-01-15
Precision digital stabilized DC power supply	EVERFINE	WY605-V110	G115987CJ7321114	2018-03-26	2019-03-26
Multilayer aging machine	BACL	B2-270	20022	2018-03-13	2019-03-13
Digital CC&CV DC Power Supply	EVERFINE	WY5015	11090007	2018-03-26	2019-03-26
Digital CC&CV DC Power Supply	EVERFINE	WY5015	11090005	2018-03-26	2019-03-26
Digital CC&CV DC Power Supply	EVERFINE	WY5015	11090006	2018-03-26	2019-03-26

1.4 Drive Level

Samples are driven with a constant direct current (DC) during maintenance test, photometric and electrical measurement. The current value was regulated to within $\pm 3\%$ of the specified value of the manufacturer during maintenance test, and was within $\pm 0.5\%$ during photometric and electrical measurement test.

1.5 Ambient Conditions for Maintenance Test

For lumen maintenance test, samples within one data set, were installed on cooling boards in thermal chambers with minimal ambient airflow. The case temperature and ambient temperature was monitored by thermocouples which one was soldered to the coldest DUTs' case (TMP_{LED}) location, while the other is mounted at a distance of 5 mm above the TMP location.

During life testing, TMP_{LED} of the coldest LEDs were maintained at a temperature that was greater than or equal to 2°C below the corresponding nominal case temperature. Surrounding air was maintained at a temperature that was greater than or equal to 5°C below the corresponding nominal case temperature. Thermocouples were shielded from direct DUT optical radiation and comply with ASTM E230 Table 1 "Special Limits".

Samples were connected to DC power supply in series circuits with a constant current. The forward current was regulated to within ±3% of the specified value of the manufacturer.

The relative humidity within chamber was kept less than 65% during test.

For photometry measurement, the ambient temperature during test was set to 25°C ± 2°C, RH <65%.

1.6 Photometric Measurement Method and Uncertainty

Integrating sphere and spectroradiometer is used to measure luminous flux and chromaticity coordinate u'v'. 2π measurement was used and sample was driven by DC power supply. The forward current was regulated to within ±0.5% of the nominal value. The test system was calibrated by halogen reference lamp. The ambient temperature during test was set to 25°C ± 2°C, RH <65%. The temperature measurement point was located in the sphere and the temperature was detected by a temperature probe.

The uncertainty of the light output measurements is U=1.59% (K=2), at the 95% confidence level. The uncertainty of the correlated color temperature measurements is U=21K (K=2), at the 95% confidence level.

The uncertainty of the temperature is U=0.8671°C (K=2), at the 95% confidence level.

1.7 Statement of Traceability

Bay Area Compliance Laboratories Corp. (Dongguan) attested that all calibration has been performed using suitable standards traceable to National Primary Standards and International System of Units (SI).

1.8 Sample Set

Data Set 1: 55°C, 20mA

Part Number: 5050
Number of Units: 25
Case Temperature: >53°C
Ambient Temperature: >50°C
Life Test Drive Current: 20mA
Measurement Current: 20mA

Data Set 2: 85°C, 20mA

Part Number: 5050
Number of Units: 25
Case Temperature: >83°C
Ambient Temperature: >80°C
Life Test Drive Current: 20mA
Measurement Current: 20mA

Data Set 3: 105°C, 20mA

Part Number: 5050
Number of Units: 25
Case Temperature: >103°C
Ambient Temperature: >100°C
Life Test Drive Current: 20mA
Measurement Current: 20mA

2 - Summary of Test Result

Data Set:	Sample Size	Failures Observed:	Test Interval	Test Duration	α :	β :	Reported TM-21 L ₇₀ Lifetime	Reported TM-21 L ₉₀ Lifetime
1	25	0	1000hrs	6000hrs	2.118E-06	1.003	>36000hrs	>36000hrs
2	25	0	1000hrs	6000hrs	2.388E-06	1.002	>36000hrs	>36000hrs
3	25	0	1000hrs	6000hrs	2.773E-06	1.001	>36000hrs	>36000hrs

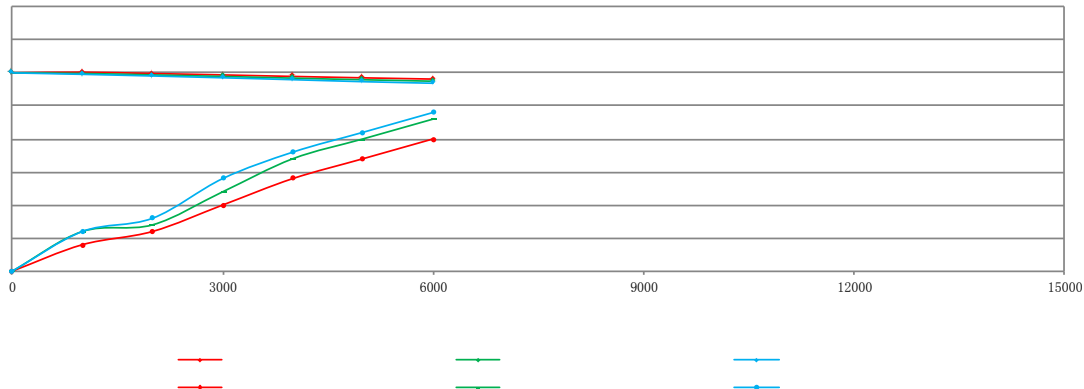
Average Lumen Maintenance (Percentage of Initial Luminous Flux)

Data Set:	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs
1	100.10%	99.90%	99.69%	99.46%	99.25%	99.06%
2	99.91%	99.69%	99.46%	99.20%	98.96%	98.74%
3	99.78%	99.53%	99.26%	98.97%	98.67%	98.43%

Average Chromaticity Shift

Data Set:	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs
1	0.0004	0.0006	0.0010	0.0014	0.0017	0.0020
2	0.0006	0.0007	0.0012	0.0017	0.0020	0.0023
3	0.0006	0.0008	0.0014	0.0018	0.0021	0.0024

Average Lumen Maintenance and Chromaticity Shift VS. Time



3 - Test Data

3.1 Data Set 1, 55°C, 20mA (Lumen Maintenance)

No.	Φ(lm)	Lumen Maintenance (%)					
	0hr(Initial)	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs
1	13.55	100.15	99.93	99.78	99.63	99.48	99.41
2	13.51	100.07	99.93	99.70	99.48	99.19	99.11
3	13.45	100.22	100.07	99.85	99.63	99.48	99.26
4	13.51	99.85	99.63	99.48	99.33	99.11	98.89
5	13.58	99.93	99.71	99.56	99.26	99.19	98.90
6	12.87	99.84	99.46	99.30	99.07	98.91	98.76
7	13.40	100.15	99.85	99.78	99.48	99.25	99.10
8	13.47	99.93	99.63	99.41	99.33	99.11	98.74
9	13.16	100.08	99.92	99.62	99.47	99.32	99.09
10	13.60	100.07	99.93	99.78	99.41	99.19	99.12
11	13.52	100.15	100.07	99.78	99.70	99.56	99.33
12	13.29	100.30	100.15	100.08	99.92	99.62	99.55
13	13.36	100.22	100.15	99.85	99.48	99.25	99.03
14	13.39	100.07	99.93	99.78	99.63	99.48	99.25
15	13.50	100.15	99.85	99.56	99.33	99.04	98.81
16	13.25	100.23	100.08	99.85	99.55	99.17	98.79
17	13.36	100.07	99.85	99.48	99.25	99.18	99.10
18	13.28	100.08	99.92	99.55	99.47	99.10	98.95
19	13.20	100.15	100.08	99.85	99.70	99.55	99.39
20	13.19	100.30	100.15	100.00	99.70	99.47	99.39
21	13.49	100.22	100.07	99.85	99.70	99.48	99.18
22	13.38	100.07	99.85	99.63	99.33	99.10	98.95
23	13.49	100.15	99.85	99.63	99.33	98.96	98.81
24	13.30	100.08	99.77	99.55	99.25	98.95	98.80
25	12.95	99.92	99.69	99.54	99.15	99.00	98.84
Avg.	13.36	100.10	99.90	99.69	99.46	99.25	99.06
Med.	13.39	100.08	99.92	99.70	99.47	99.19	99.09
st dev	0.1847	0.1260	0.1823	0.1876	0.2043	0.2131	0.2369
Min.	12.87	99.84	99.46	99.30	99.07	98.91	98.74
Max.	13.60	100.30	100.15	100.08	99.92	99.62	99.55

3.2 Data Set 1, 55°C, 20mA (Forward Voltage)

No.	Forward Voltage (V)						
	Ohr(Initial)	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs
1	7.506	7.524	7.496	7.521	7.516	7.515	7.511
2	7.487	7.504	7.484	7.501	7.497	7.485	7.502
3	7.498	7.517	7.490	7.513	7.509	7.498	7.515
4	7.504	7.522	7.495	7.519	7.514	7.513	7.513
5	7.507	7.521	7.500	7.524	7.518	7.517	7.528
6	7.517	7.535	7.517	7.532	7.527	7.521	7.536
7	7.518	7.529	7.514	7.531	7.526	7.520	7.527
8	7.521	7.539	7.517	7.536	7.531	7.528	7.533
9	7.530	7.547	7.522	7.544	7.539	7.527	7.541
10	7.515	7.533	7.514	7.529	7.524	7.512	7.533
11	7.507	7.535	7.516	7.532	7.531	7.515	7.533
12	7.485	7.504	7.477	7.500	7.499	7.485	7.507
13	7.481	7.493	7.480	7.496	7.494	7.480	7.493
14	7.507	7.517	7.503	7.521	7.518	7.513	7.527
15	7.472	7.491	7.479	7.496	7.492	7.488	7.498
16	7.490	7.503	7.482	7.502	7.497	7.483	7.507
17	7.501	7.520	7.494	7.519	7.514	7.510	7.520
18	7.496	7.515	7.493	7.513	7.513	7.496	7.519
19	7.476	7.488	7.469	7.492	7.493	7.476	7.498
20	7.477	7.499	7.479	7.502	7.502	7.486	7.506
21	7.509	7.530	7.502	7.527	7.527	7.518	7.527
22	7.475	7.498	7.480	7.496	7.494	7.489	7.494
23	7.511	7.532	7.526	7.537	7.536	7.520	7.545
24	7.495	7.516	7.502	7.521	7.520	7.514	7.527
25	7.510	7.524	7.516	7.527	7.526	7.519	7.535
Avg.	7.500	7.517	7.498	7.517	7.514	7.505	7.519
Med.	7.504	7.520	7.496	7.521	7.516	7.513	7.520
st dev	0.0159	0.0162	0.0165	0.0152	0.0147	0.0165	0.0154
Min.	7.472	7.488	7.469	7.492	7.492	7.476	7.493
Max.	7.530	7.547	7.526	7.544	7.539	7.528	7.545

3.3 Data Set 1, 55°C, 20mA (Chromaticity Shift)

No.	u'	v'	CCT(K)	Chromaticity Shift ($\Delta u'v'$)					
				0hr(Initial)	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs
1	0.1838	0.4199	17239	0.0004	0.0008	0.0011	0.0014	0.0017	0.0019
2	0.1850	0.4157	19568	0.0005	0.0004	0.0006	0.0010	0.0011	0.0014
3	0.1825	0.4172	19339	0.0005	0.0010	0.0007	0.0008	0.0013	0.0017
4	0.1832	0.4203	17164	0.0006	0.0008	0.0012	0.0013	0.0016	0.0017
5	0.1821	0.4183	18763	0.0003	0.0003	0.0009	0.0011	0.0013	0.0020
6	0.1812	0.4121	24861	0.0004	0.0007	0.0010	0.0011	0.0015	0.0017
7	0.1830	0.4178	18756	0.0001	0.0001	0.0010	0.0012	0.0014	0.0021
8	0.1822	0.4182	18777	0.0002	0.0003	0.0009	0.0014	0.0016	0.0022
9	0.1832	0.4133	22387	0.0003	0.0006	0.0010	0.0014	0.0017	0.0022
10	0.1820	0.4173	19454	0.0004	0.0007	0.0010	0.0015	0.0017	0.0023
11	0.1815	0.4178	19271	0.0002	0.0004	0.0009	0.0014	0.0016	0.0019
12	0.1843	0.4140	21216	0.0006	0.0012	0.0009	0.0015	0.0016	0.0019
13	0.1830	0.4138	21975	0.0006	0.0013	0.0012	0.0016	0.0018	0.0019
14	0.1829	0.4167	19602	0.0004	0.0006	0.0010	0.0016	0.0018	0.0022
15	0.1825	0.4175	19197	0.0003	0.0006	0.0013	0.0016	0.0017	0.0020
16	0.1839	0.4156	20084	0.0002	0.0005	0.0018	0.0023	0.0027	0.0030
17	0.1826	0.4163	19989	0.0002	0.0006	0.0008	0.0011	0.0013	0.0020
18	0.1847	0.4145	20632	0.0002	0.0006	0.0009	0.0013	0.0014	0.0016
19	0.1843	0.4143	21012	0.0004	0.0006	0.0010	0.0015	0.0018	0.0020
20	0.1835	0.4140	21554	0.0005	0.0005	0.0010	0.0015	0.0017	0.0020
21	0.1814	0.4212	17198	0.0005					

3.4 Data Set 2, 85°C, 20mA (Lumen Maintenance)

No.	Φ(lm)	Lumen Maintenance (%)					
	Ohr(Initial)	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs
26	13.25	99.85	99.77	99.47	99.17	98.87	98.72
27	13.44	99.93	99.55	99.48	99.33	99.18	98.88
28	13.27	99.77	99.70	99.40	99.10	98.87	98.72
29	13.33	99.55	99.32	99.10	98.87	98.80	98.65
30	13.36	99.85	99.40	99.18	98.95	98.65	98.43
31	13.45	99.93	99.55	99.33	98.96	98.66	98.36
32	13.27	99.77	99.70	99.40	99.17	99.02	98.79
33	13.30	100.15	99.92	99.77	99.47	99.17	98.87
34	13.18	99.70	99.54	99.24	99.17	98.94	98.71
35	13.41	99.85	99.48	99.11	98.81	98.58	98.43
36	13.22	99.92	99.77	99.62	99.24	98.87	98.64
37	13.25	100.15	99.92	99.77	99.47	99.17	98.72
38	13.50	99.93	99.70	99.63	99.26	99.04	98.67
39	13.40	99.78	99.55	99.33	99.18	98.88	98.73
40	13.55	99.93	99.70	99.34	99.11	98.97	98.89
41	13.25	100.08	99.85	99.55	99.17	98.94	98.72
42	13.20	99.92	99.77	99.39	99.32	99.09	98.94
43	13.42	99.85	99.63	99.33	99.18	98.96	98.88
44	13.43	99.93	99.78	99.48	99.26	98.96	98.88
45	13.39	100.15	99.85	99.70	99.48	99.25	99.10
46	13.44	100.07	99.85	99.63	99.48	99.11	98.66
47	13.30	99.92	99.77	99.55	99.32	99.10	98.72
48	13.48	100.15	99.85	99.63	99.33	99.18	98.89
49	13.38	99.93	99.93	99.70	99.33	99.03	98.95
50	13.45	99.78	99.48	99.33	98.96	98.66	98.51
Avg.	13.36	99.91	99.69	99.46	99.20	98.96	98.74
Med.	13.38	99.92	99.70	99.47	99.18	98.96	98.72
st dev	0.1023	0.1512	0.1697	0.1959	0.1885	0.1848	0.1782
Min.	13.18	99.55	99.32	99.10	98.81	98.58	98.36
Max.	13.55	100.15	99.93	99.77	99.48	99.25	99.10

3.5 Data Set 2, 85°C, 20mA (Forward Voltage)

No.	Forward Voltage (V)						
	0hr(Initial)	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs
26	7.490	7.522	7.498	7.518	7.520	7.501	7.519
27	7.497	7.515	7.497	7.511	7.513	7.503	7.510
28	7.491	7.505	7.488	7.508	7.508	7.500	7.509
29	7.468	7.499	7.483	7.495	7.496	7.488	7.502
30	7.490	7.505	7.483	7.501	7.505	7.493	7.509
31	7.485	7.508	7.498	7.511	7.514	7.494	7.519
32	7.498	7.529	7.512	7.525	7.527	7.509	7.524
33	7.492	7.507	7.490	7.507	7.510	7.503	7.510
34	7.500	7.527	7.504	7.521	7.523	7.516	7.530
35	7.499	7.515	7.498	7.510	7.512	7.505	7.511
36	7.521	7.543	7.521	7.541	7.544	7.526	7.543
37	7.508	7.520	7.504	7.520	7.521	7.505	7.522
38	7.478	7.503	7.481	7.498	7.499	7.483	7.508
39	7.472	7.499	7.481	7.493	7.494	7.487	7.494
40	7.483	7.499	7.482	7.494	7.494	7.483	7.495
41	7.470	7.489	7.479	7.492	7.491	7.475	7.501
42	7.471	7.482	7.472	7.483	7.483	7.467	7.484
43	7.522	7.542	7.516	7.535	7.535	7.529	7.547
44	7.480	7.503	7.488	7.499	7.499	7.493	7.509
45	7.474	7.491	7.468	7.486	7.486	7.480	7.496
46	7.487	7.498	7.489	7.500	7.500	7.495	7.510
47	7.478	7.505	7.490	7.501	7.500	7.492	7.504
48	7.474	7.492	7.470	7.488	7.488	7.472	7.489
49	7.478	7.496	7.472	7.491	7.491	7.485	7.501
50	7.469	7.486	7.478	7.489	7.490	7.475	7.498
Avg.	7.487	7.507	7.490	7.505	7.506	7.494	7.510
Med.	7.485	7.505	7.488	7.501	7.500	7.493	7.509
st dev	0.0152	0.0161	0.0143	0.0153	0.0160	0.0158	0.0152
Min.	7.468	7.482	7.468	7.483	7.483	7.467	7.484
Max.	7.522	7.543	7.521	7.541	7.544	7.529	7.547

3.6 Data Set 2, 85°C, 20mA (Chromaticity Shift)

No.	u'	v'	CCT(K)	Chromaticity Shift ($\Delta u'v'$)					
	0hr(Initial)			1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs
26	0.1838	0.4160	19812	0.0005	0.0004	0.0010	0.0016	0.0017	0.0023
27	0.1818	0.4158	20693	0.0006	0.0006	0.0013	0.0016	0.0020	0.0023
28	0.1829	0.4140	21914	0.0004	0.0007	0.0009	0.0015	0.0019	0.0022
29	0.1842	0.4140	21310	0.0007	0.0005	0.0017	0.0022	0.0026	0.0028
30	0.1847	0.4145	20652	0.0004	0.0004	0.0009	0.0014	0.0019	0.0022
31	0.1823	0.4162	20186	0.0007	0.0011	0.0012	0.0016	0.0020	0.0023
32	0.1844	0.4136	21554	0.0006	0.0008	0.0015	0.0019	0.0024	0.0027
33	0.1847	0.4162	19292	0.0006	0.0004	0.0009	0.0014	0.0019	0.0022
34	0.1860	0.4135	20958	0.0005	0.0007				

FINAL

3.8 Data Set 3, 105°C, 20mA (Forward Voltage)

No.	Forward Voltage (V)						
	Ohr(Initial)	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs
51	7.487	7.508	7.485	7.504	7.508	7.501	7.502
52	7.477	7.496	7.478	7.492	7.495	7.481	7.490
53	7.503	7.532	7.507	7.527	7.529	7.524	7.535
54	7.480	7.501	7.490	7.504	7.506	7.498	7.512
55	7.479	7.491	7.473	7.493	7.495	7.480	7.492
56	7.484	7.508	7.496	7.508	7.510	7.504	7.508
57	7.480	7.493	7.481	7.495	7.496	7.491	7.503
58	7.486	7.504	7.479	7.500	7.501	7.496	7.508
59	7.471	7.489	7.465	7.484	7.484	7.479	7.483
60	7.503	7.528	7.510	7.530	7.530	7.518	7.538
61	7.487	7.500	7.480	7.502	7.502	7.497	7.500
62	7.475	7.496	7.478	7.498	7.499	7.486	7.502
63	7.493	7.505	7.490	7.508	7.508	7.494	7.514
64	7.497	7.517	7.490	7.512	7.512	7.497	7.519
65	7.491	7.509	7.490	7.505	7.505	7.491	7.512
66	7.491	7.518	7.491	7.513	7.513	7.502	7.519
67	7.489	7.518	7.491	7.513	7.513	7.507	7.519
68	7.473	7.502	7.483	7.498	7.502	7.492	7.502
69	7.477	7.501	7.480	7.496	7.496	7.488	7.502
70	7.495	7.519	7.498	7.521	7.521	7.513	7.527
71	7.467	7.486	7.466	7.487	7.548	7.481	7.494
72	7.487	7.500	7.480	7.501	7.500	7.495	7.500
73	7.512	7.528	7.509	7.530	7.530	7.524	7.536
74	7.494	7.523	7.503	7.519	7.517	7.502	7.524
75	7.482	7.501	7.480	7.496	7.495	7.482	7.502
Avg.	7.486	7.507	7.487	7.505	7.509	7.497	7.510
Med.	7.487	7.504	7.485	7.504	7.506	7.496	7.508
st dev	0.0108	0.0128	0.0121	0.0127	0.0144	0.0130	0.0146
Min.	7.467	7.486	7.465	7.484	7.484	7.479	7.483
Max.	7.512	7.532	7.510	7.530	7.548	7.524	7.538

Bay Area Compliance Laboratories Corp. (Dongguan)

No.69, Pulongcun, Puxinhu Industrial Area Taangxia

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