QAV Technologies Sdn. Bhd. (616788-U)
116, Lintang Kampong Jawa NFIZ3,
Taman Perindustrian Bayan Lepas,
Mk. 12, 11900 Penang. MALAYSIA.
Tel No: 604 – 6438317 Fax No: 604 – 6438597
Website: www.qavtech.com

Test Report

Photometric Test

Customer	:	Dialight Penang Sdn. Bhd.
Address	:	1666, Lorong Perusahaan Maju 8, Kawasan Perusahaan Perai, 13600 Perai, Pulau Pinang
Requestor Name	:	Dialight Penang Sdn. Bhd.
Product	:	21AMB0004
Test Prime	:	Nur Awanis Binti Abdul Razak
Receive Date	:	24th February 2021
Perform Date	:	25th February 2021
Report Number	:	QAV-0221-0189
Test Location	:	116, Lintang Kg. Jawa, NFIZ 3, Taman Perindustrian Bayan Lepas, Mk. 12, 11900 Pulau Pinang.

ABSTRACT: This summary report contains the **Photometric Test** result of the **21AMB0004** provided by **Dialight Penang Sdn. Bhd.**

Prepared by: Nur Awanis Binti Abdul Razak Issue Date: 26th February 2021

INSTRUMENTATION:

Sphere Spectroradiometry instrumentation:

- CCD Spectroradiometer (S/N: 1303292)
- LS2008R Digital Power Meter (S/N: 1304003)
- LSP – 500VA AC Power Source (S/N: 9905112493)
- Calibrated Thermometer (S/N: 990038136)
- 2.0 meter Sphere with High Reflectance Coating
- HP 6622A Power Supply (S/N: 3010A-02122)
- D204 Standard Light Source traceability to National Institute of Metrology (S/N: M133806CM5401210)

Goniometry instrumentation:

- Type C Data Goniometer – 20’ (S/N: 1308095)
- LS2008R Digital Power Meter (S/N: 1307091)
- LSP-500VAR AC Power Source (S/N: 1307091)
- Calibrated Thermometer (S/N: 990038120)
- HP 6633A DC Power Supply (S/N: 3524A-05692)
- D204 Standard Light Source traceability to National Institute of Metrology (S/N: M133806CM5401210)

TEST OBJECTIVE:

The measurement in this document is carried out in accordance with the measurement method specified in IES LM-79-08.

Goniometric measurement:

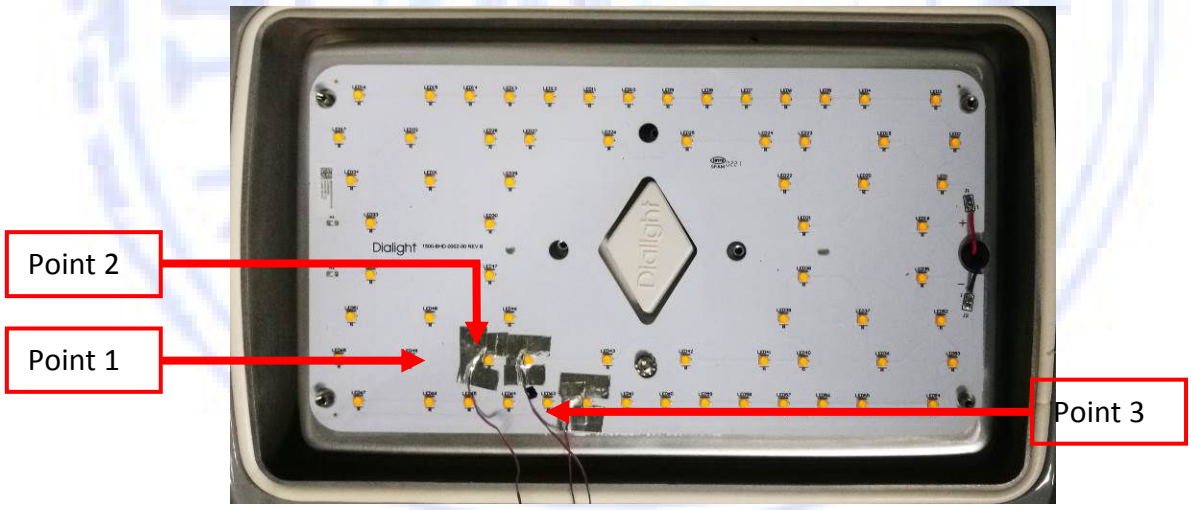
Measure distribution photometry and input electrical parameters and report candela distribution, calculated lumen output, voltage (V), current (A) and power (W).

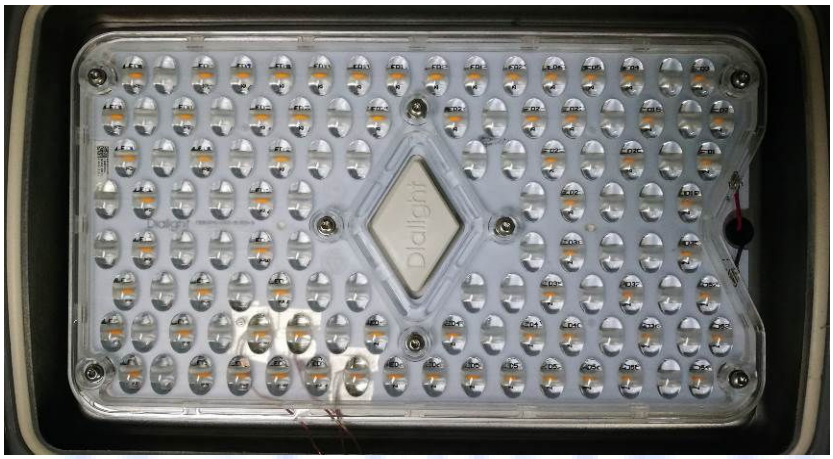
Sphere Spectroradiometric measurement:

Measure sphere photometry and input electrical parameters and report the total flux output (lumens), Correlated Color Temperature (CCT), Color Rendering Index (CRI), Chromaticity Coordinates (x,y), Spectral Power Distribution (SPD), voltage (V), current (A) and power (W).

Additional information:

IN-SITU Temperature Measurement Testing (ISTMT) as below:





Thermocouple location on the product (S/N: 21AMB0004)

S/N: 21AMB0004		
LED No.	**Temperature measured**	**Temperature corrected at 25°C**
Point 1	35.74°C	35.78°C
Point 2	35.76°C	35.80°C
Point 3	35.82°C	35.86°C
Ambient Temperature	24.96°C	25°C
Remark: The highest in-situ measured temperature of LED is 35.86°C. The temperature measurement point measured according to the LED datasheet provided by applicant		

TEST PROCEDURES AND CONDITIONS:

Goniometry measurement:

- The test procedure will follow SOP 107-106-001
- Electrical conditions and physical orientation were set as required by the lamp manufacturer or the customer.
- Ambient temperature was controlled at 25+/-1 degree Celsius and measured at the approximate height of the sample mounted on the Goniometer equipment.
- Calibration was based on National Institute of Standards and Technology certified total luminous flux standard and maintained by a set of incandescent reflector working standard lamps.
- Lamps were stabilized per LM-79 requirements.
- Type C Goniometer was used to measure intensity at each angle of distribution.
- Burn time during testing for each lamp: 0 Hours
- Stabilization time during testing for each lamp: 0.75 Hours

Sphere Spectroradiometry measurement:

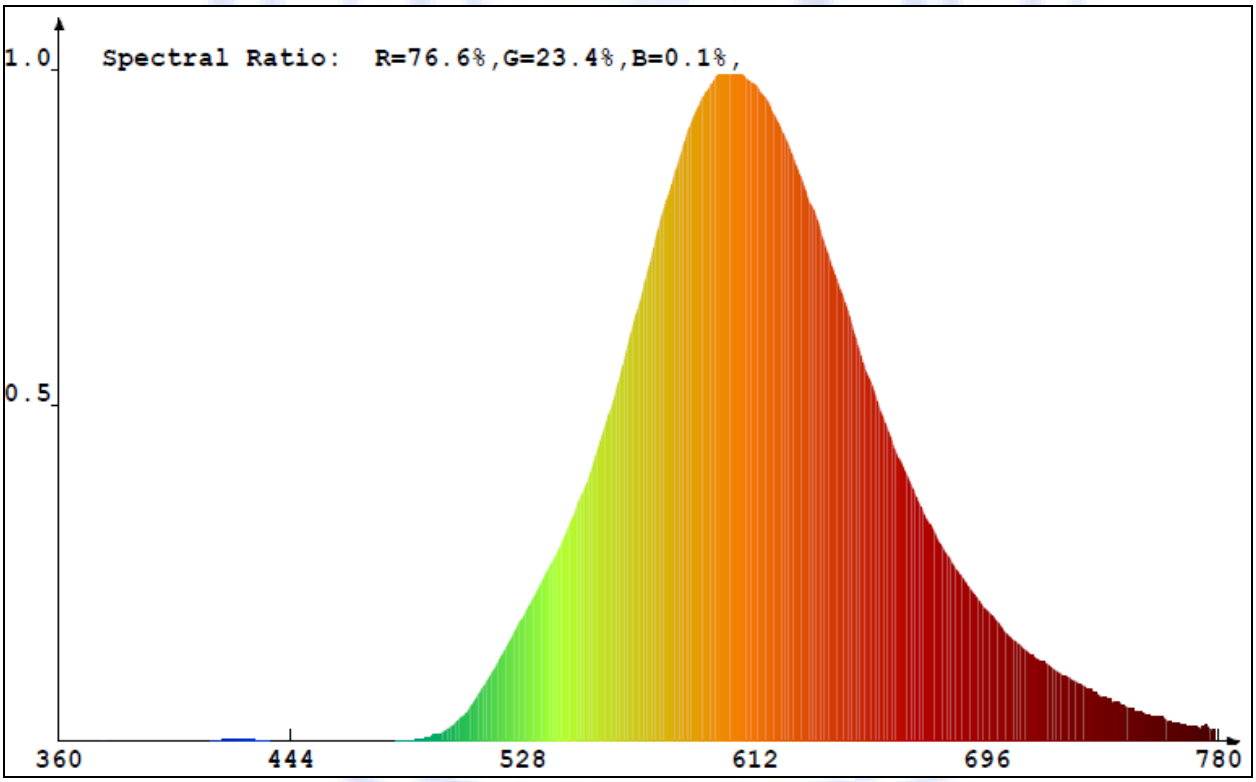
- The test procedure will follow SOP 107-106-001
- Electrical conditions and physical orientation were set as required by the lamp manufacturer or the customer.
- Ambient temperature was controlled at 25+/-1 degree Celsius and measured inside of the sphere, shielded from direct radiation of the lamp.
- Calibration was based on National Institute of Standards and Technology certified total spectral flux standard and maintained by a set of incandescent working standard lamps.
- Lamps were stabilized per LM-79 requirements.
- CCD Spectroradiometer attached to a 2.0 meter sphere painted with high reflectance paint was used to measure correlated colour temperature, chromaticity coordinated, colour rendering index, total luminous flux, and spectral power distribution. Sphere measurement was set up in 4π geometry and used continuous self-absorption correction.
- Burn time during testing for each lamp: 0 Hours
- Stabilization time during testing for each lamp: 0.75 Hours
- Spatial correction factor applied to lamp measurement: 1

SPHERE SPECTRORADIOMETRY TEST DATA:

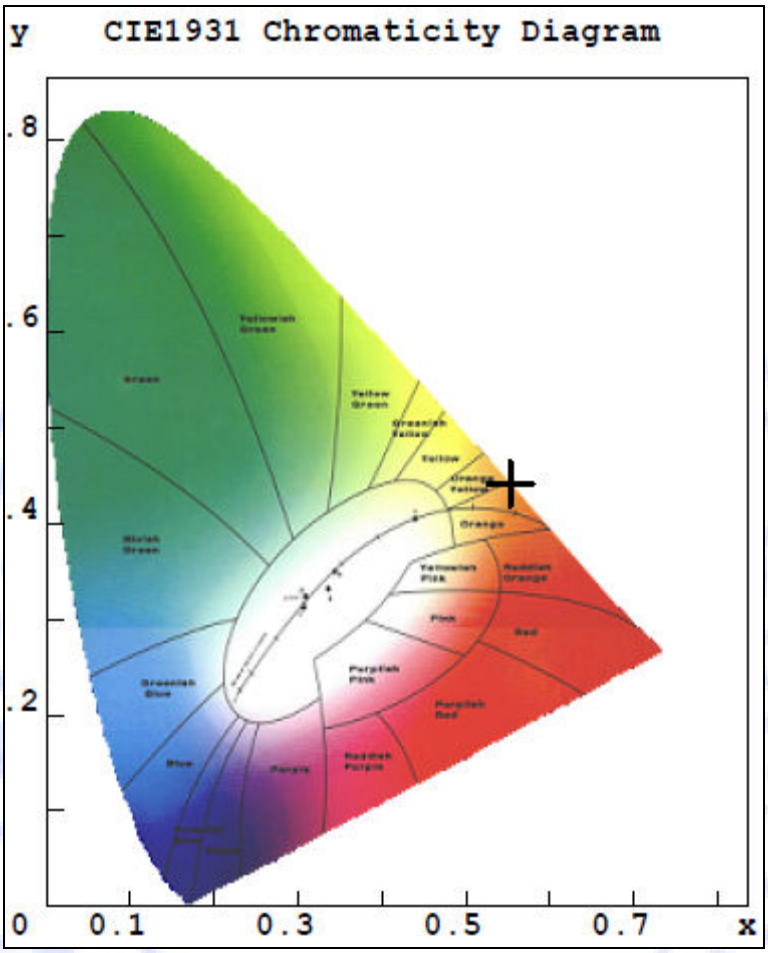
Main (nm)	Peak (nm)	Color Temp (K)	CIE-X	CIE-Y	Lumen (lm)	Efficacy	Power (W)	Vf (V)	I (A)	Ra	PF
586.8	603.28	1960	0.5533	0.4417	2155.80	91.27	23.62	240.26	0.102	57.7	0.964

R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14	R15
53	72	84	46	49	62	71	26	0	41	29	20	54	91	45

SPECTRAL POWER DISTRIBUTION:



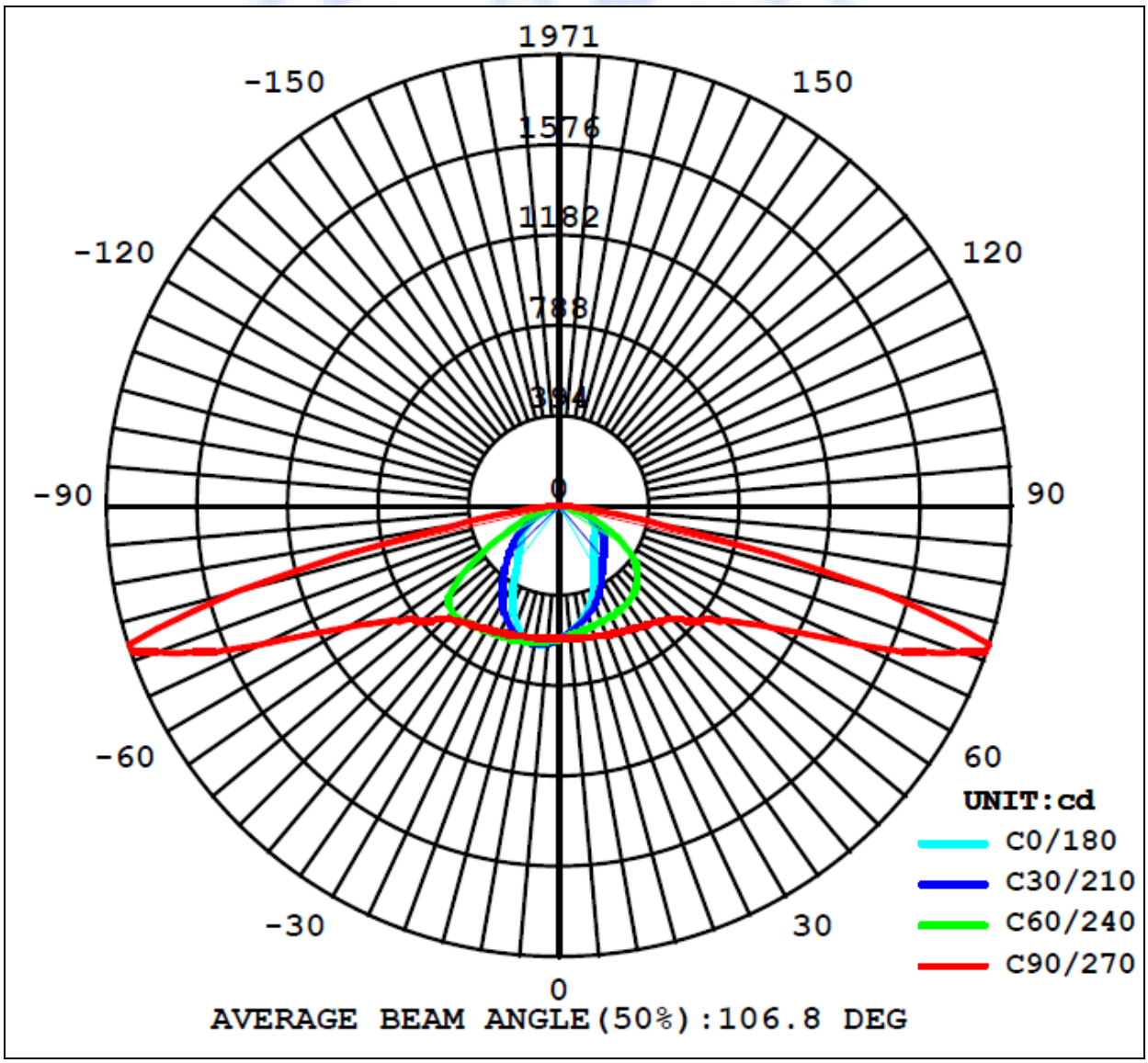
CIE CHROMATICITY DIAGRAM:



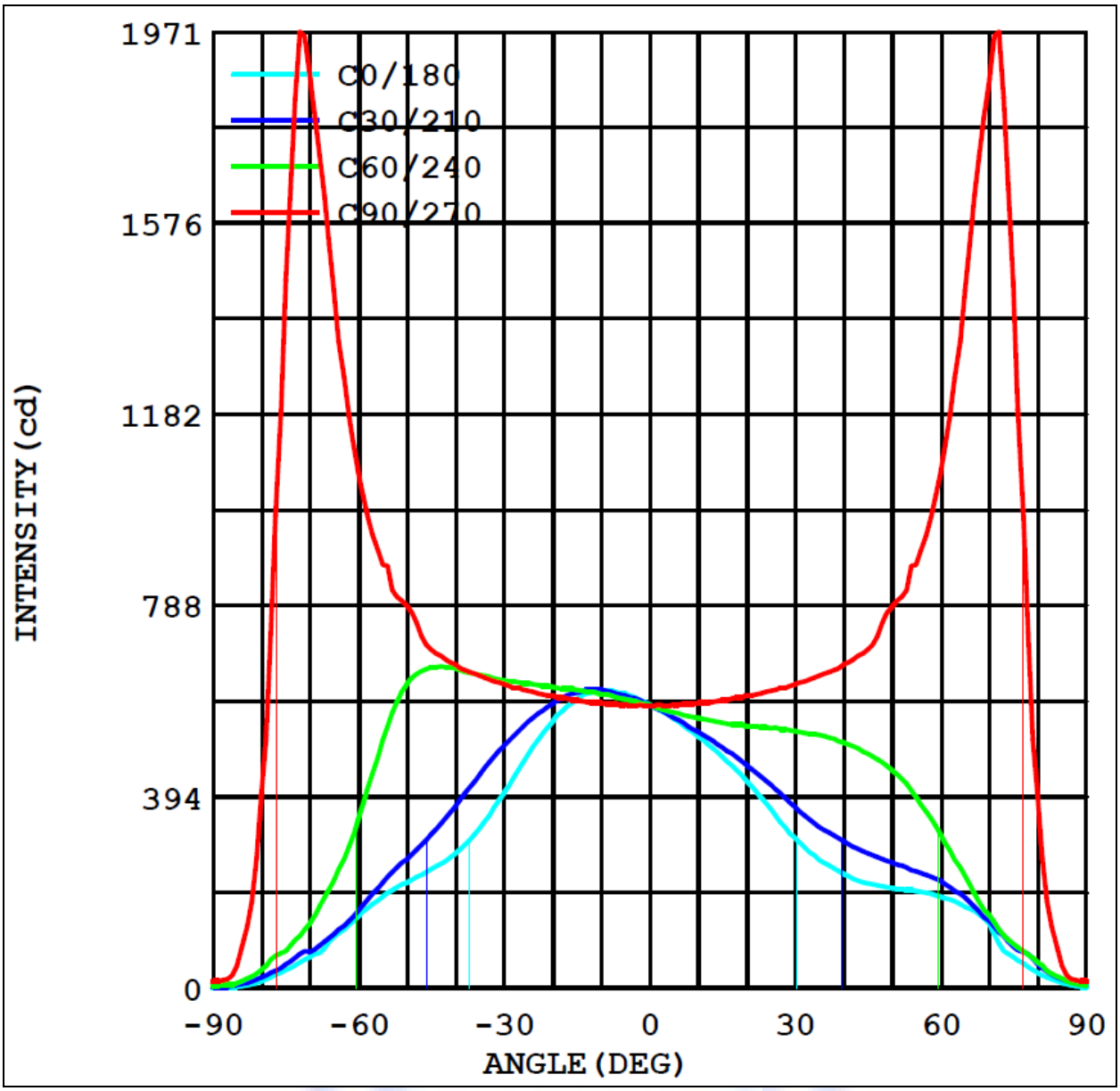
GONIOMETRIC TEST DATA:

Luminous Flux (lm)	**:**	2145.2	**Power (W)**	**:**	24.12
Efficiency (lm/W)	**:**	88.9	**Voltage (V)**	**:**	240.3
Imax (cd)	**:**	1971	**Current (A)**	**:**	0.105
Maximum (C, γ)	**:**	(90,72.0)	**Power Factor (PF)**	**:**	0.956

LUMINOUS INTENSITY DISTRIBUTION (POLAR) DIAGRAM



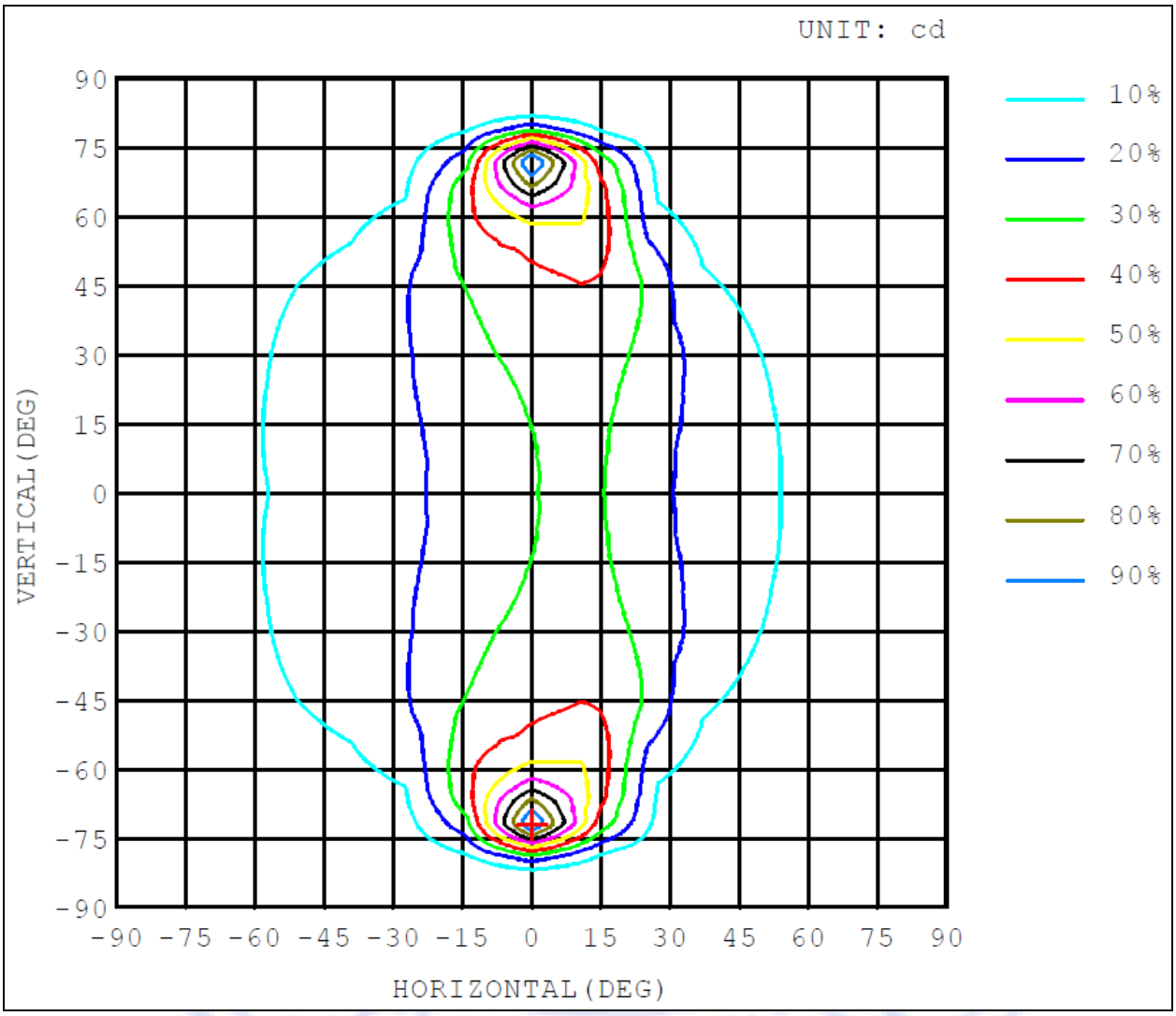
LUMINOUS INTENSITY DISTRIBUTION DIAGRAM



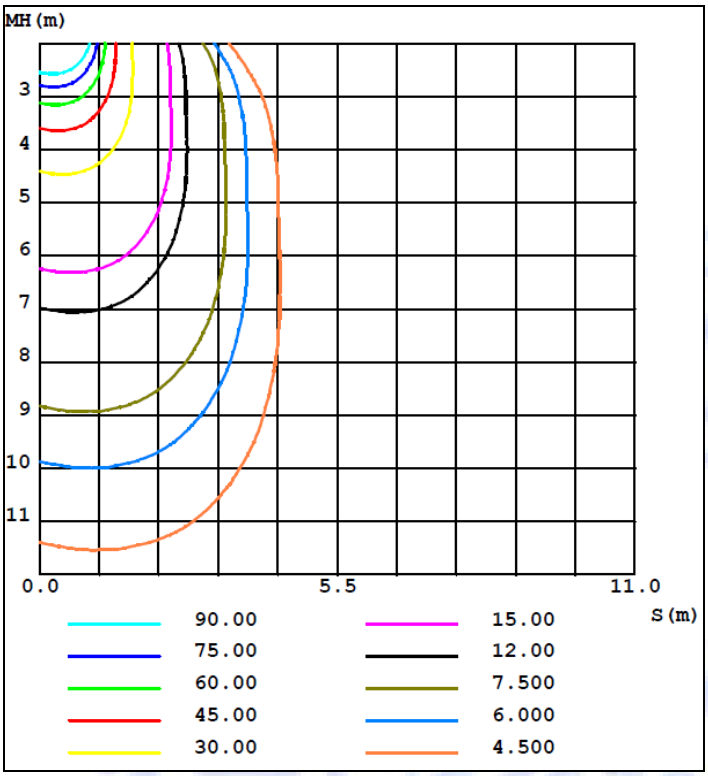
ZONAL FLUX TABLE

γ	C0	C45	C90	C135	C180	C225	C270	C315	γ	φ Zone	φ Total
5	606	599.6	582.8	559.9	555.5	559.9	582.8	599.6	**0-5**	13.91	13.91
10	612.6	611.1	586.6	539.5	518.6	539.5	586.6	611.1	**5-10**	41.37	55.28
15	595.8	614.5	592.3	518.6	476.7	518.6	592.3	614.5	**10-15**	67.7	122.9
20	548.8	609	602.3	496.2	426.4	496.2	602.3	609	**15-20**	91.82	214.8
25	480.5	595.6	612.4	475.8	368.3	475.8	612.4	595.6	**20-25**	112.8	327.6
30	402.8	575.8	625.9	448.6	308.5	448.6	625.9	575.8	**25-30**	130	457.7
35	329.2	548.1	643.5	414.6	264.9	414.6	643.5	548.1	**30-35**	144.2	601.9
40	277.2	498.6	666.2	379.5	235.2	379.5	666.2	498.6	**35-40**	156.2	758.1
45	244.9	423.1	697.9	341.9	215.9	341.9	697.9	423.1	**40-45**	167	925.2
50	217.5	332.5	786.2	304.1	206.4	304.1	786.2	332.5	**45-50**	178.2	1103
55	189.4	247.5	872.2	266.1	200.3	266.1	872.2	247.5	**50-55**	186.5	1290
60	148.4	176.9	1062	226.4	187.8	226.4	1062	176.9	**55-60**	188.6	1479
65	104.9	122.6	1437	177.3	167.8	177.3	1437	122.6	**60-65**	188.4	1667
70	64.76	91.4	1872	123	131.6	123	1872	91.4	**65-70**	189	1856
75	37.15	54.89	1458	83.08	65.15	83.08	1458	54.89	**70-75**	166.4	2022
80	14.58	22.78	397	52.48	31.86	52.48	397	22.78	**75-80**	84.03	2107
85	3.204	5.292	44.56	15.66	11.52	15.66	44.56	5.292	**80-85**	23.34	2130
90	1.656	1.908	13.78	2.844	2.484	2.844	13.78	1.908	**85-90**	4.315	2134
95	1.44	1.116	8.532	1.404	1.584	1.404	8.532	1.116	**90-95**	1.898	2136
100	1.296	0.756	6.516	0.864	1.368	0.864	6.516	0.756	**95-100**	1.258	2137
105	1.224	0.72	5.472	0.648	1.26	0.648	5.472	0.72	**100-105**	0.989	2138
110	1.188	0.684	4.536	0.576	1.188	0.576	4.536	0.684	**105-110**	0.87	2139
115	1.188	0.792	3.996	0.612	1.152	0.612	3.996	0.792	**110-115**	0.789	2140
120	1.152	0.9	3.564	0.684	1.152	0.684	3.564	0.9	**115-120**	0.736	2141
125	1.152	0.936	3.204	0.72	1.152	0.72	3.204	0.936	**120-125**	0.68	2141
130	1.152	1.044	2.808	0.828	1.116	0.828	2.808	1.044	**125-130**	0.617	2142
135	1.152	1.08	2.484	0.936	1.188	0.936	2.484	1.08	**130-135**	0.56	2143
140	1.152	1.188	2.268	1.044	1.224	1.044	2.268	1.188	**135-140**	0.508	2143
145	1.224	1.224	2.124	1.116	1.332	1.116	2.124	1.224	**140-145**	0.461	2144
150	1.26	1.296	2.052	1.188	1.332	1.188	2.052	1.296	**145-150**	0.414	2144
155	1.26	1.296	1.944	1.26	1.44	1.26	1.944	1.296	**150-155**	0.363	2144
160	1.368	1.368	1.908	1.332	1.476	1.332	1.908	1.368	**155-160**	0.309	2145
165	1.44	1.404	1.908	1.44	1.62	1.44	1.908	1.404	**160-165**	0.25	2145
170	1.512	1.44	1.872	1.476	1.584	1.476	1.872	1.44	**165-170**	0.185	2145
175	1.548	1.476	1.836	1.512	1.692	1.512	1.836	1.476	**170-175**	0.114	2145
180	1.62	1.512	1.836	1.62	1.692	1.62	1.836	1.512	**175-180**	0.039	2145
DEG	**LUMINOUS INTENSITY: cd**									**UNIT: lm**	

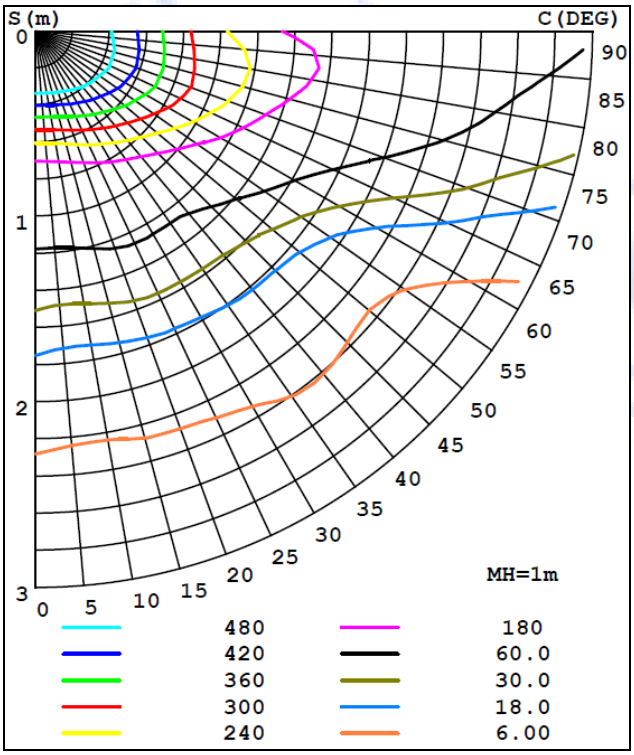
ISONCANDELA DIAGRAM



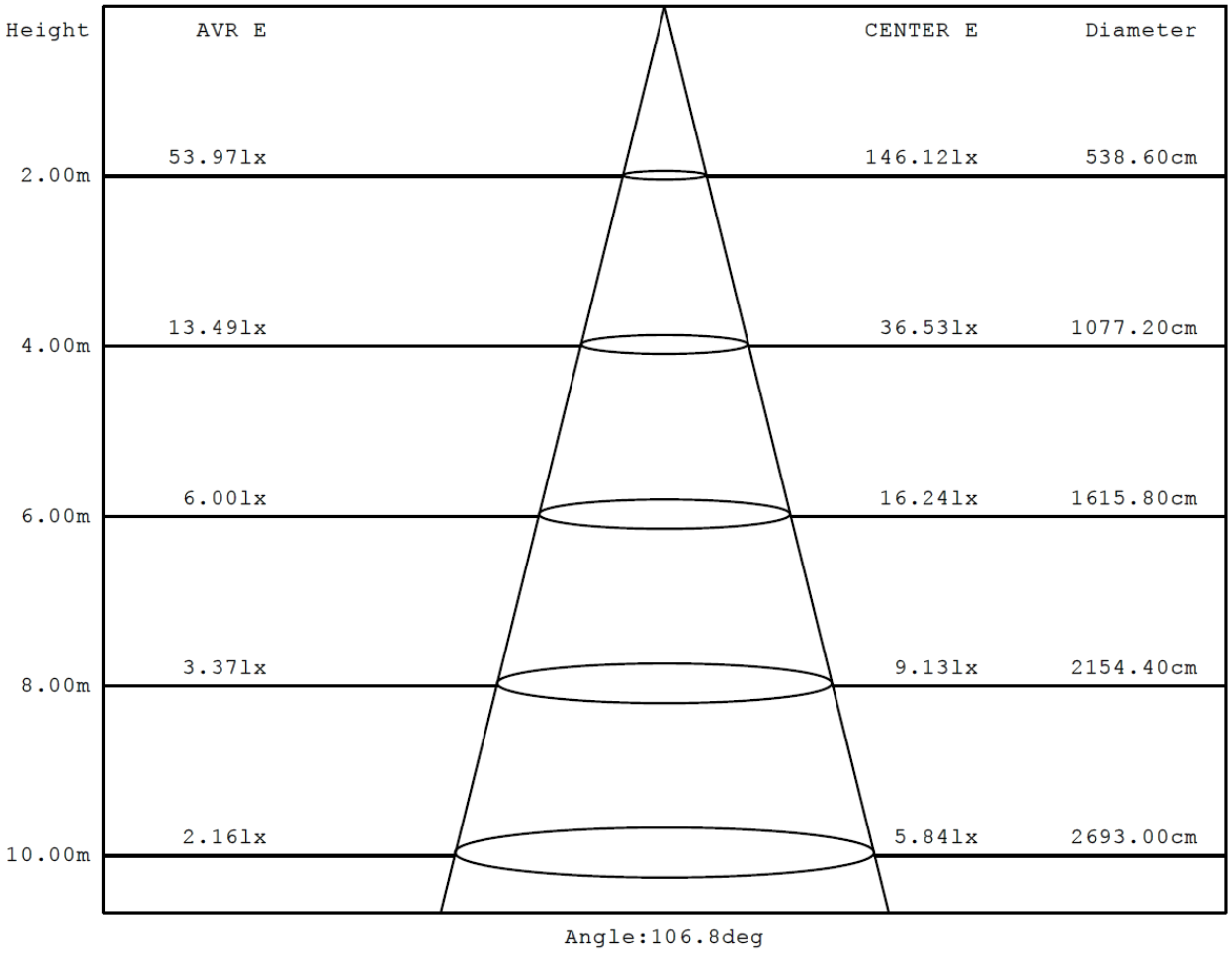
C0 PLANE ISOLUX DIAGRAM (UNIT: 1x)



PLANAR ISOLUX DIAGRAM (UNIT: 1x)



ILLUMINANCE AT A DISTANCE



LUMINOUS DISTRIBUTION INTENSITY DATA

Gamma\C	0DEG	15DEG	30DEG	45DEG	60DEG	75DEG	90DEG	105DEG	120DEG	135DEG
0.0DEG	584.4	584.1	584.2	583.4	583.2	582.5	582.2	580.9	582.4	583.2
5.0DEG	606	604.5	602.4	599.6	595.4	590.1	582.8	575.6	568.1	559.9
10.0DEG	612.6	612.7	613.7	611.1	605.6	597.9	586.6	571.7	557.2	539.5
15.0DEG	595.8	598.8	609.6	614.5	613.6	606.7	592.3	571.7	546.6	518.6
20.0DEG	548.8	557.6	586	609	620.7	617.6	602.3	575.2	539.7	496.2
25.0DEG	480.5	499	548.5	595.6	627.2	629.1	612.4	581.3	535.6	475.8
30.0DEG	402.8	427.3	499.9	575.8	633.6	645	625.9	588.8	530.1	448.6
35.0DEG	329.2	359.2	440.6	548.1	644.9	666	643.5	600.5	521.7	414.6
40.0DEG	277.2	301.7	375	498.6	658.6	700.5	666.2	617.3	505.4	379.5
45.0DEG	244.9	264.2	316.2	423.1	661.1	764.7	697.9	643.6	483.2	341.9
50.0DEG	217.5	234.6	266.8	332.5	627.2	870.7	786.2	697.2	448.3	304.1
55.0DEG	189.4	195.2	218.7	247.5	512.1	945.5	872.2	730.7	394.1	266.1
60.0DEG	148.4	146	160.1	176.9	349.4	974.3	1062	765.3	317.4	226.4
65.0DEG	104.9	99	111.8	122.6	221.8	934.5	1437	749.5	230.4	177.3
70.0DEG	64.76	63.03	74.8	91.4	135.3	813	1872	620.3	150.5	123
75.0DEG	37.15	33.51	48.88	54.89	76.31	538.6	1458	377.8	91.08	83.08
80.0DEG	14.58	12.88	22.32	22.78	37.29	154.8	397	121.1	54.14	52.48
85.0DEG	3.204	2.304	5.94	5.292	10.4	19.76	44.56	27.53	19.9	15.66
90.0DEG	1.656	0.468	2.664	1.908	5.184	6.912	13.78	5.724	5.508	2.844
95.0DEG	1.44	0.324	1.872	1.116	3.528	4.14	8.532	3.528	3.672	1.404
100.0DEG	1.296	0.36	1.548	0.756	2.664	3.204	6.516	2.412	2.592	0.864
105.0DEG	1.224	0.396	1.368	0.72	2.34	2.88	5.472	1.944	2.016	0.648
110.0DEG	1.188	0.504	1.296	0.684	2.268	2.664	4.536	1.836	1.8	0.576
115.0DEG	1.188	0.576	1.26	0.792	2.232	2.556	3.996	1.8	1.728	0.612
120.0DEG	1.152	0.612	1.26	0.9	2.196	2.484	3.564	1.692	1.656	0.684
125.0DEG	1.152	0.684	1.296	0.936	2.052	2.232	3.204	1.584	1.656	0.72
130.0DEG	1.152	0.72	1.296	1.044	1.98	1.944	2.808	1.44	1.62	0.828
135.0DEG	1.152	0.828	1.332	1.08	1.872	1.656	2.484	1.44	1.656	0.936
140.0DEG	1.152	0.864	1.332	1.188	1.836	1.584	2.268	1.44	1.62	1.044
145.0DEG	1.224	0.972	1.404	1.224	1.8	1.512	2.124	1.44	1.62	1.116
150.0DEG	1.26	1.008	1.404	1.296	1.764	1.512	2.052	1.476	1.656	1.188
155.0DEG	1.26	1.08	1.44	1.296	1.728	1.476	1.944	1.476	1.656	1.26
160.0DEG	1.368	1.152	1.512	1.368	1.728	1.476	1.908	1.476	1.692	1.332
165.0DEG	1.44	1.26	1.512	1.404	1.692	1.512	1.908	1.512	1.692	1.44
170.0DEG	1.512	1.368	1.584	1.44	1.692	1.548	1.872	1.548	1.692	1.476
175.0DEG	1.548	1.404	1.62	1.476	1.728	1.548	1.836	1.584	1.764	1.512
180.0DEG	1.62	1.512	1.656	1.512	1.656	1.584	1.836	1.62	1.692	1.62

Gamma\C	150DEG	165DEG	180DEG
0.0DEG	583.7	584.4	584.7
5.0DEG	557.4	553.9	555.5
10.0DEG	527.3	518	518.6
15.0DEG	495.8	477.3	476.7
20.0DEG	459	428	426.4
25.0DEG	418.3	374.4	368.3
30.0DEG	373.5	317.6	308.5
35.0DEG	332.7	275.8	264.9
40.0DEG	302.2	247.9	235.2
45.0DEG	278	228	215.9
50.0DEG	258.1	218	206.4
55.0DEG	240.4	211.6	200.3
60.0DEG	221.1	199.5	187.8
65.0DEG	186.1	172.9	167.8
70.0DEG	137.4	132.7	131.6
75.0DEG	86.94	67.86	65.15
80.0DEG	49.64	31.6	31.86
85.0DEG	19.26	11.08	11.52
90.0DEG	5.004	1.656	2.484
95.0DEG	2.376	0.36	1.584
100.0DEG	1.728	0.288	1.368
105.0DEG	1.404	0.324	1.26
110.0DEG	1.296	0.396	1.188
115.0DEG	1.224	0.468	1.152
120.0DEG	1.224	0.504	1.152
125.0DEG	1.188	0.612	1.152
130.0DEG	1.188	0.72	1.116
135.0DEG	1.26	0.792	1.188
140.0DEG	1.296	0.864	1.224
145.0DEG	1.332	0.972	1.332
150.0DEG	1.404	1.044	1.332
155.0DEG	1.476	1.152	1.44
160.0DEG	1.512	1.26	1.476
165.0DEG	1.584	1.368	1.62
170.0DEG	1.692	1.44	1.584
175.0DEG	1.692	1.548	1.692
180.0DEG	1.692	1.548	1.692

Machine Specification

MEASUREMENT ITEMS			
Photometry Measurement		**Electrical Measurement**	
Description	**Unit**	**Description**	**Unit**
Wavelength	nm	Voltage	V
Luminous flux	lm	Current	A
Chromaticity	-	Power Factor	pf
Correlated Colour Temperature	K		
Rendering Index	-		
Luminous Intensity	cd		
Illuminance	lux		
Luminous flux	lm		

CCD SPECTRORADIOMETER SPECIFICATIONS	
Photodetector	Class 1
Spectral Range	200nm ~ 780nm
Spectral Resolution	±2nm
Reproducibility	±5nm
Accuracy of Chromaticity Coordinate (Δx, Δy)	±0.003
Correlated Colour Temperature Range	1500 ~ 25000K
CCT Accuracy	±0.5%
Accuracy of Rendering Index	±(0.5%+0.5)

GONIOMETER SPECIFICATIONS	
Photometric accuracy	Class 1
C-plane Axis (C1)	± 360º
Gamma Axis (γ1)	± 180º
Angle Accuracy	0.01º
Test range of illuminance	0.001Lx to 100,000Lx
Test range of light intensity	1cd to 10^7cd
Testing accuracy	3% (Under Standard Lamp); Stray Light: less than 0.2%
Electric meter accuracy	class 0.5

PROGRAMMABLE AC POWER SUPPLY	
LSP-500VAR / LSP-500VA	500VA, 300V Programmable AC Power Supply
Output Voltage Range	0 – 300 V RMS
Output Voltage Stability	≤ 0.2% / ≤ 0.5%
Output Voltage Frequency	45 – 65 Hz / 45 – 70 Hz
Output Frequency Stability	≤ 0.03% / 0.1%
Maximum Output Power	500VA
Harmonic Distortion	≤ 2% the resistive load is fully loaded

PROGRAMMABLE DC POWER SUPPLY						
SOURCE SPECIFICATIONS				**MEASUREMENT SPECIFICATIONS**		
VOLTAGE PROGRAMMING ACCURACY				**VOLTAGE MEASUREMENT ACCURACY**		
Range	Resolution	Accuracy at 23ºC±2ºC ±(% of reading + Volts)		Range	Resolution	Accuracy at 23ºC±2ºC ±(% of reading + Volts)
60V	1mV	0.05% + 10 mV		60 V	10 mV	0.1% + 10 mV
CURRENT PROGRAMMING ACCURACY				**CURRENT MEASUREMENT ACCURACY**		
Range	Resolution	Accuracy at 23ºC±2ºC ±(% of reading + Volts)		Range	Resolution	Accuracy at 23ºC±2ºC ±(% of reading + Volts)
1500 mA	0.1 mA	0.3% + 5 mA		1500 mA	1 mA	0.3% + 3 mA

This test is accredited under the laboratory's ISO/IEC 17025 accreditation issued by ANSI National Accreditation Board/ANAB. Refer to certificate and scope of accreditation AT1511.

Test Conducted by

Approved Signatory

…… ……

Nur Awanis Binti Abdul Razak
Project Engineer

See Keat Siang
Technical Manager

APPENDIX 1:
Test Product Information:

21AMB0004

Sample Log Code of DUT: DUT 4/4
***This sample log code is identified by QAV Technologies.**