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	:	21AMB0002
Test Prime	:	Nur Awanis Binti Abdul Razak
Receive Date	:	24th February 2021
Perform Date	:	25th February 2021
Report Number	:	QAV-0221-0187
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 **21AMB0002** 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:

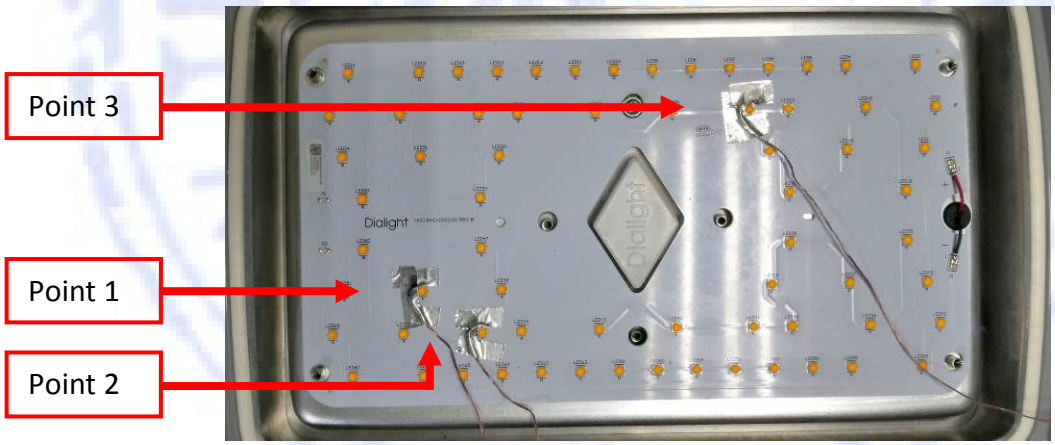
Measure distribution photometry and input electrical parameters and report candela distribution, calculated lumen output, voltage (V), current (A) and power (W).

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: 21AMB0002)

S/N: 21AMB0002		
LED No.	**Temperature measured**	**Temperature corrected at 25°C**
Point 1	37.30°C	36.34°C
Point 2	37.54°C	36.58°C
Point 3	37.53°C	36.57°C
Ambient Temperature	25.96°C	25°C
Remark: The highest in-situ measured temperature of LED is 36.58°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:

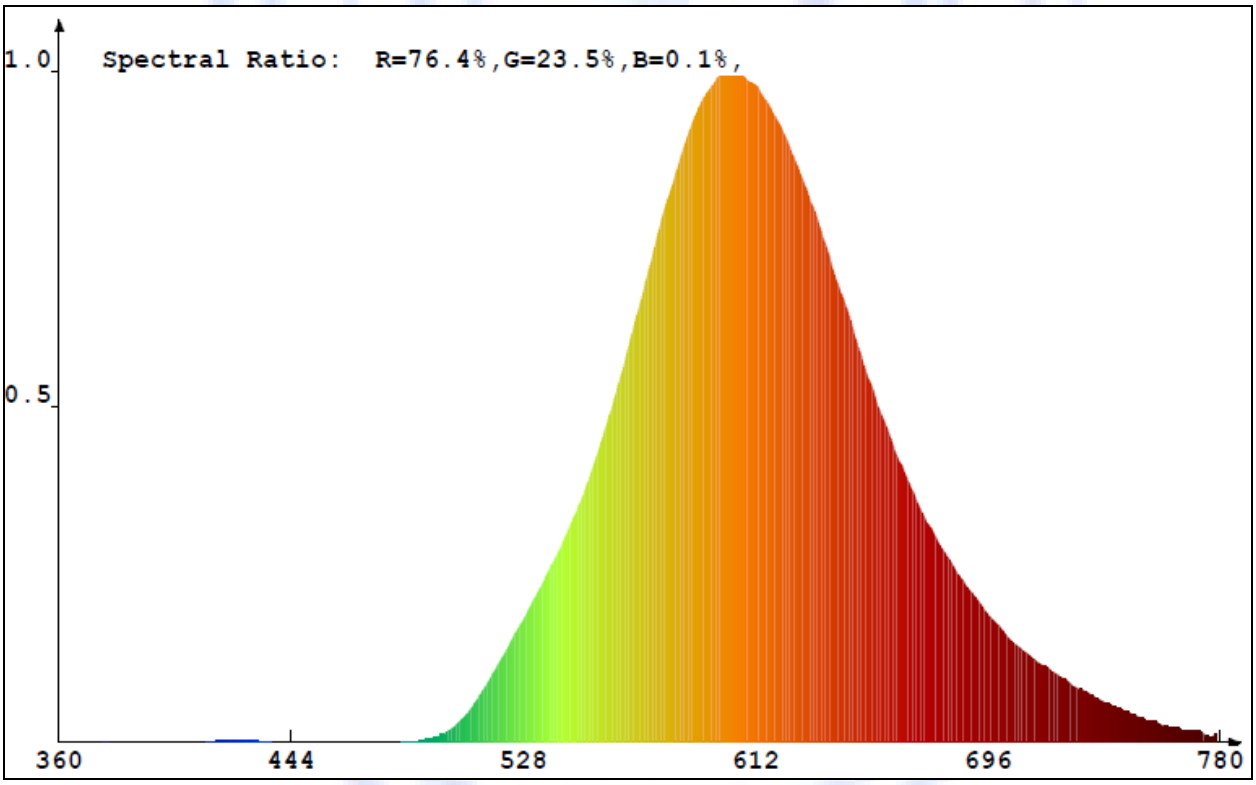
- The test procedure will follow SOP 107-106-001
- Electrical conditions and physical orientation were set as required by the lamp manufacturer or the customer.
- Ambient temperature was controlled at 25+/-1 degree Celsius and measured inside of the sphere, shielded from direct radiation of the lamp.
- 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:

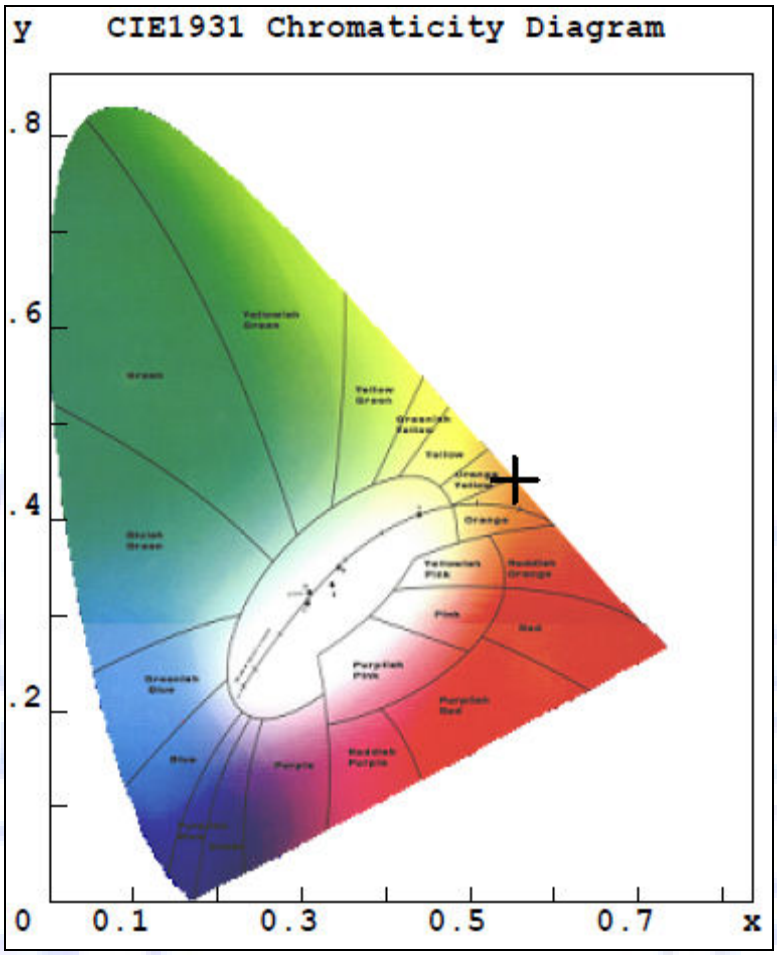
Main (nm)	Peak (nm)	Color Temp (K)	CIE-X	CIE-Y	Lumen (lm)	Efficacy	Power (W)	Vf (V)	I (A)	Ra	PF
586.8	603.24	1960	0.5533	0.4418	2290.21	95.11	24.08	240.16	0.104	57.7	0.964

R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14	R15
53	72	83	45	48	62	72	26	0	41	28	19	54	91	45

SPECTRAL POWER DISTRIBUTION:



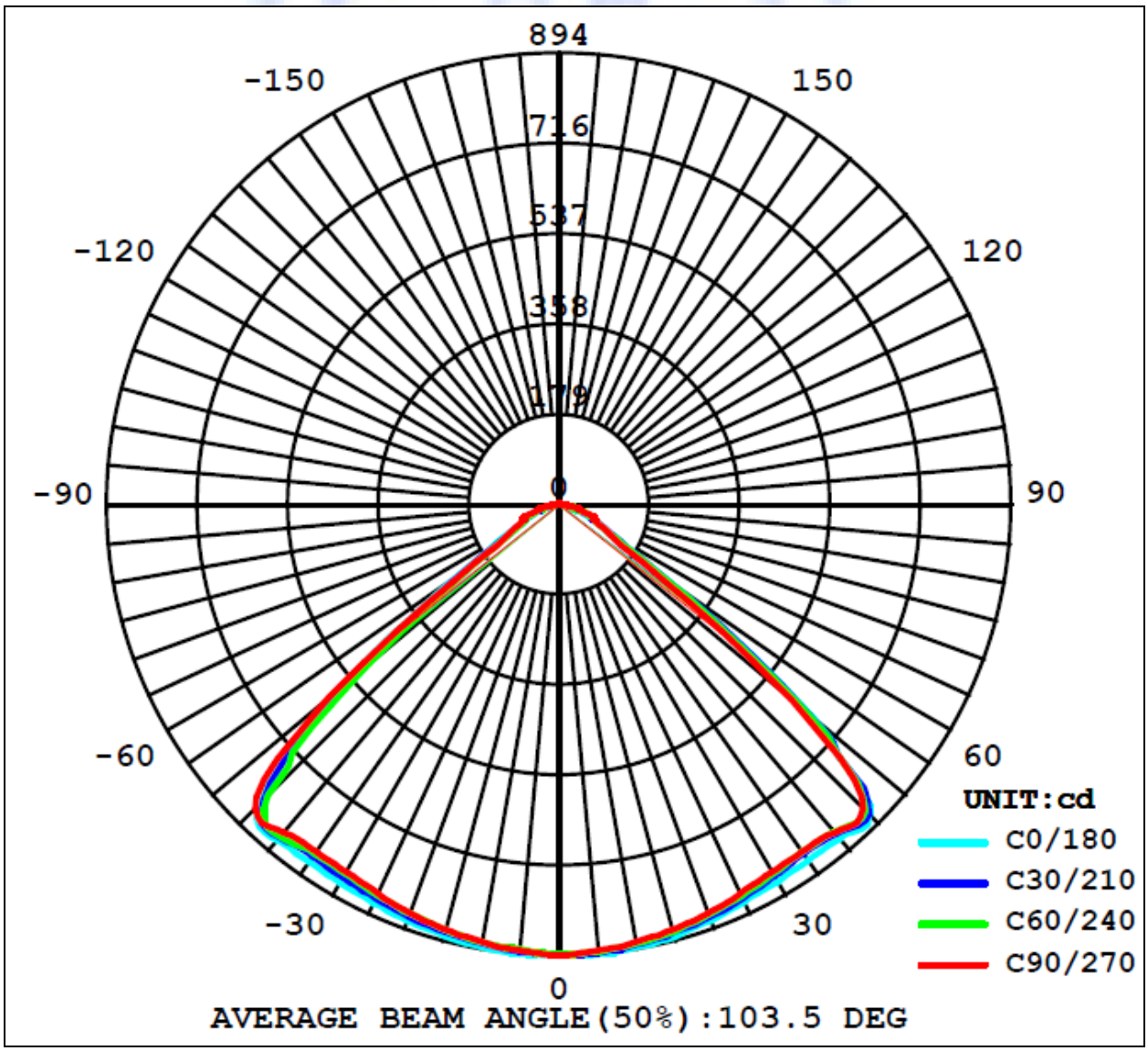
CIE CHROMATICITY DIAGRAM:



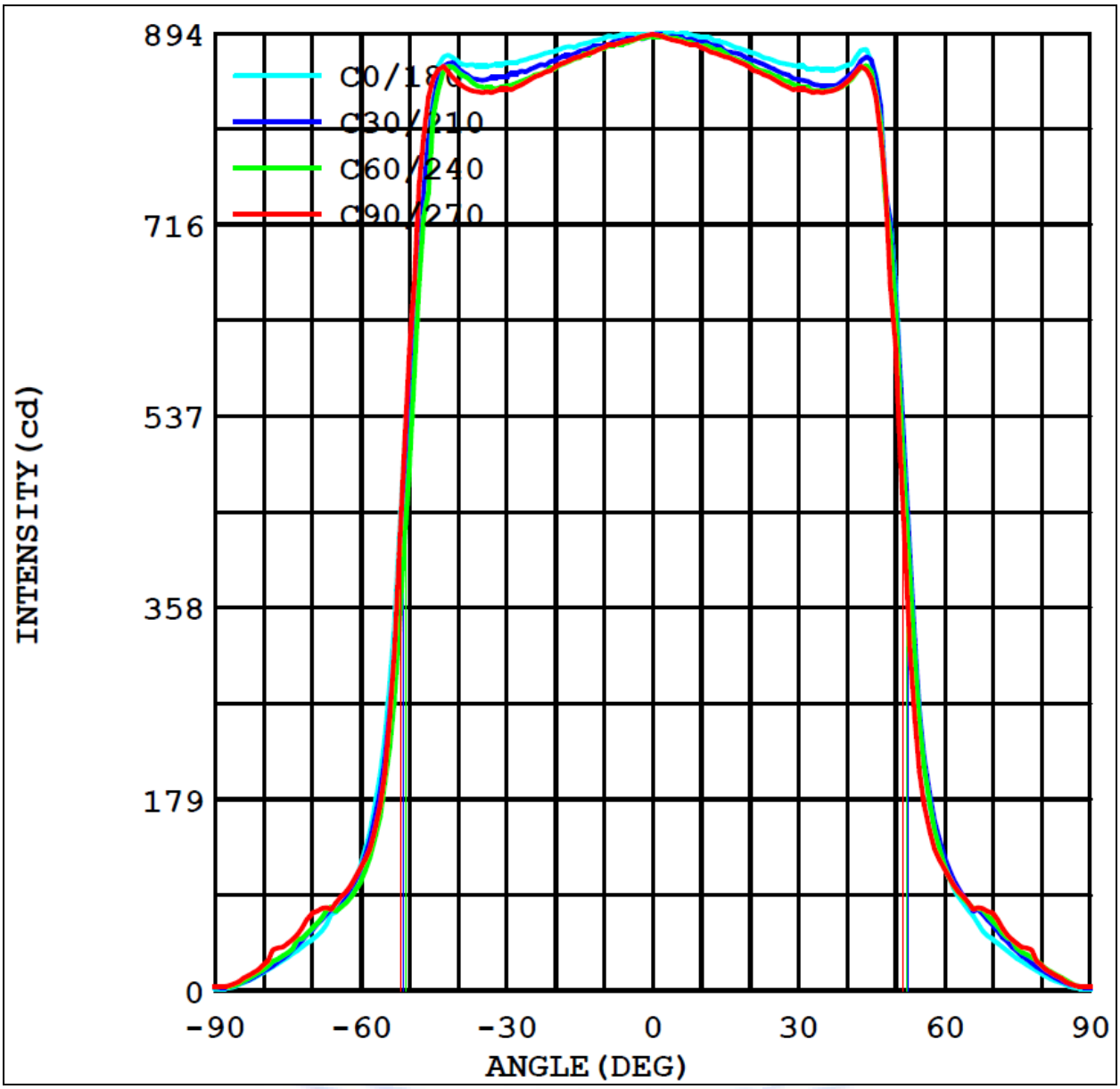
GONIOMETRIC TEST DATA:

Luminous Flux (lm)	**:**	2245.3	**Power (W)**	**:**	24.61
Efficiency (lm/W)	**:**	91.2	**Voltage (V)**	**:**	240.3
Imax (cd)	**:**	895	**Current (A)**	**:**	0.107
Maximum (C, γ)	**:**	(180,0.0)	**Power Factor (PF)**	**:**	0.957

LUMINOUS INTENSITY DISTRIBUTION (POLAR) DIAGRAM



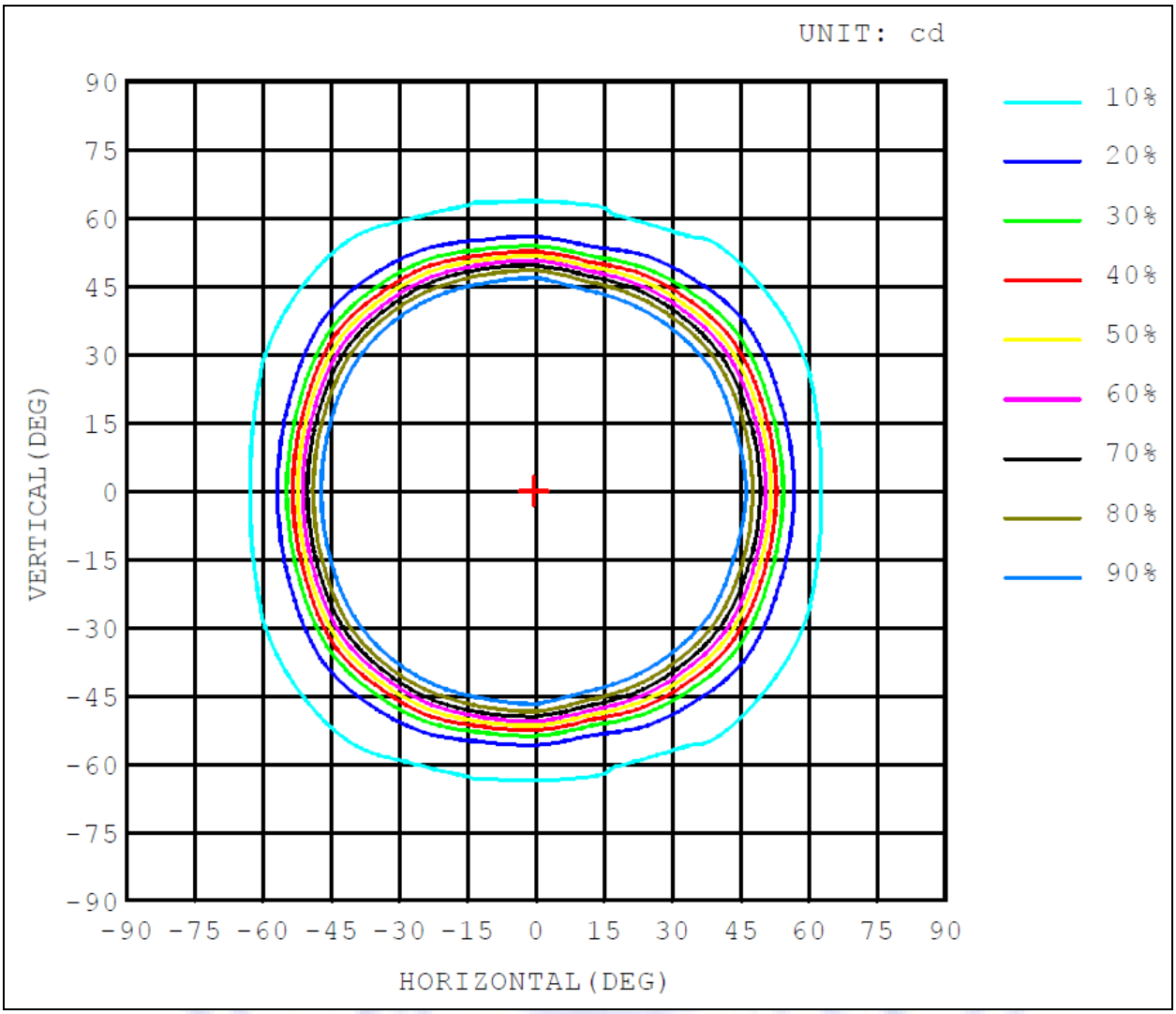
LUMINOUS INTENSITY DISTRIBUTION DIAGRAM



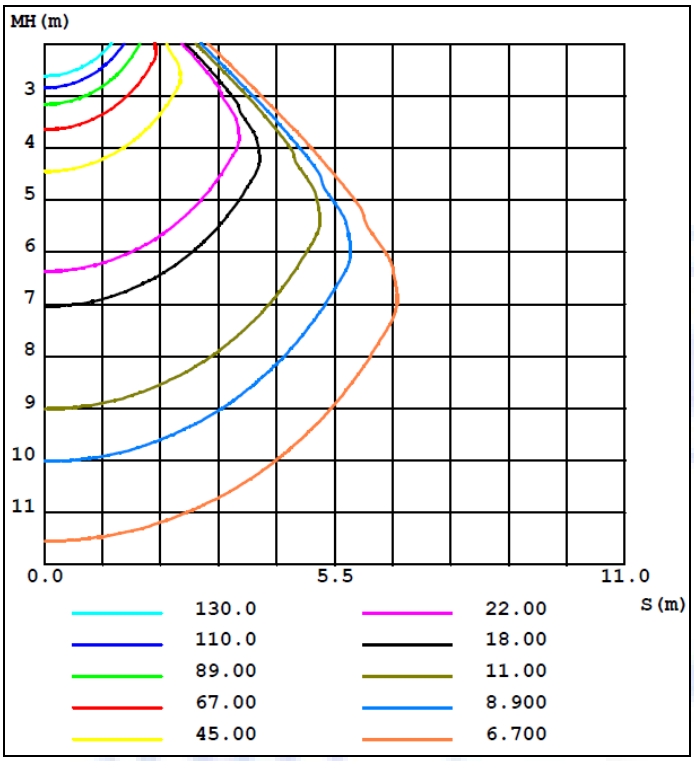
ZONAL FLUX TABLE

γ	C0	C45	C90	C135	C180	C225	C270	C315	γ	φ Zone	φ Total
5	892.2	888.2	886.6	889	893.1	889	886.6	888.2	**0-5**	21.27	21.27
10	889.5	882.6	880.5	884.3	890.1	884.3	880.5	882.6	**5-10**	63.37	84.65
15	883.4	875.1	872.1	876.5	885.4	876.5	872.1	875.1	**10-15**	104.3	189
20	877.4	865.4	862.3	867.8	876.2	867.8	862.3	865.4	**15-20**	143.5	332.5
25	870.9	855.9	850.6	857.3	868.6	857.3	850.6	855.9	**20-25**	180.7	513.3
30	866.6	849.9	842	846.7	863.4	846.7	842	849.9	**25-30**	215.8	729.1
35	863.5	847.7	838.5	842.8	860	842.8	838.5	847.7	**30-35**	249.4	978.5
40	867.5	860.2	848.3	846.7	864.1	846.7	848.3	860.2	**35-40**	283.2	1262
45	842.2	810.2	851.8	863.7	866.9	863.7	851.8	810.2	**40-45**	317.3	1579
50	584.9	485.5	599.5	618.3	654.7	618.3	599.5	485.5	**45-50**	294.6	1874
55	237.6	189.4	204.4	235.7	259.1	235.7	204.4	189.4	**50-55**	162.9	2037
60	116.5	106.2	114.8	121.2	118.1	121.2	114.8	106.2	**55-60**	71.12	2108
65	73.11	76.89	82.4	85.06	75.05	85.06	82.4	76.89	**60-65**	45.69	2154
70	47.59	52.05	72.61	56.08	47.7	56.08	72.61	52.05	**65-70**	34.74	2188
75	31.17	33.69	43.95	36.68	30.31	36.68	43.95	33.69	**70-75**	23.98	2212
80	17.13	16.45	24.3	19.11	16.02	19.11	24.3	16.45	**75-80**	14.49	2227
85	5.508	4.32	8.784	6.264	5.328	6.264	8.784	4.32	**80-85**	6.571	2233
90	1.944	1.476	3.78	1.584	1.908	1.584	3.78	1.476	**85-90**	1.865	2235
95	1.656	0.864	2.808	0.936	1.62	0.936	2.808	0.864	**90-95**	1.002	2236
100	1.476	0.612	2.196	0.648	1.476	0.648	2.196	0.612	**95-100**	0.742	2237
105	1.368	0.612	1.8	0.612	1.332	0.612	1.8	0.612	**100-105**	0.608	2238
110	1.332	0.612	1.584	0.576	1.296	0.576	1.584	0.612	**105-110**	0.543	2238
115	1.296	0.684	1.512	0.648	1.296	0.648	1.512	0.684	**110-115**	0.515	2239
120	1.404	0.9	1.584	0.828	1.404	0.828	1.584	0.9	**115-120**	0.533	2239
125	1.656	1.188	1.764	1.044	1.62	1.044	1.764	1.188	**120-125**	0.594	2240
130	1.872	1.404	1.944	1.332	1.8	1.332	1.944	1.404	**125-130**	0.662	2241
135	2.052	1.692	2.088	1.584	1.98	1.584	2.088	1.692	**130-135**	0.701	2241
140	2.16	1.836	2.268	1.8	2.124	1.8	2.268	1.836	**135-140**	0.71	2242
145	2.304	2.052	2.376	1.944	2.268	1.944	2.376	2.052	**140-145**	0.694	2243
150	2.412	2.16	2.484	2.088	2.412	2.088	2.484	2.16	**145-150**	0.657	2243
155	2.484	2.232	2.556	2.16	2.484	2.16	2.556	2.232	**150-155**	0.589	2244
160	2.484	2.268	2.592	2.232	2.448	2.232	2.592	2.268	**155-160**	0.496	2244
165	2.484	2.268	2.556	2.268	2.484	2.268	2.556	2.268	**160-165**	0.393	2245
170	2.52	2.304	2.556	2.34	2.52	2.34	2.556	2.304	**165-170**	0.285	2245
175	2.52	2.34	2.556	2.34	2.484	2.34	2.556	2.34	**170-175**	0.173	2245
180	2.52	2.376	2.484	2.376	2.484	2.376	2.484	2.376	**175-180**	0.058	2245
DEG	**LUMINOUS INTENSITY: cd**									**UNIT: lm**	

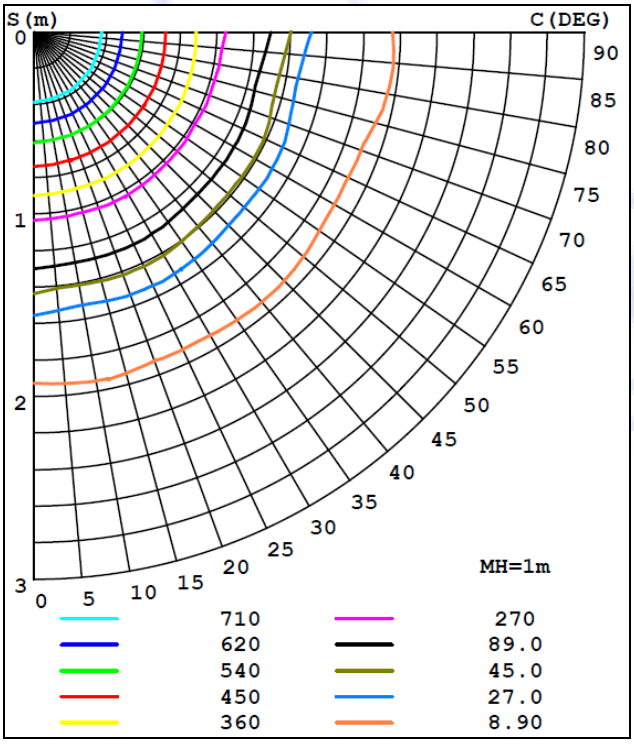
ISONCANDELA DIAGRAM



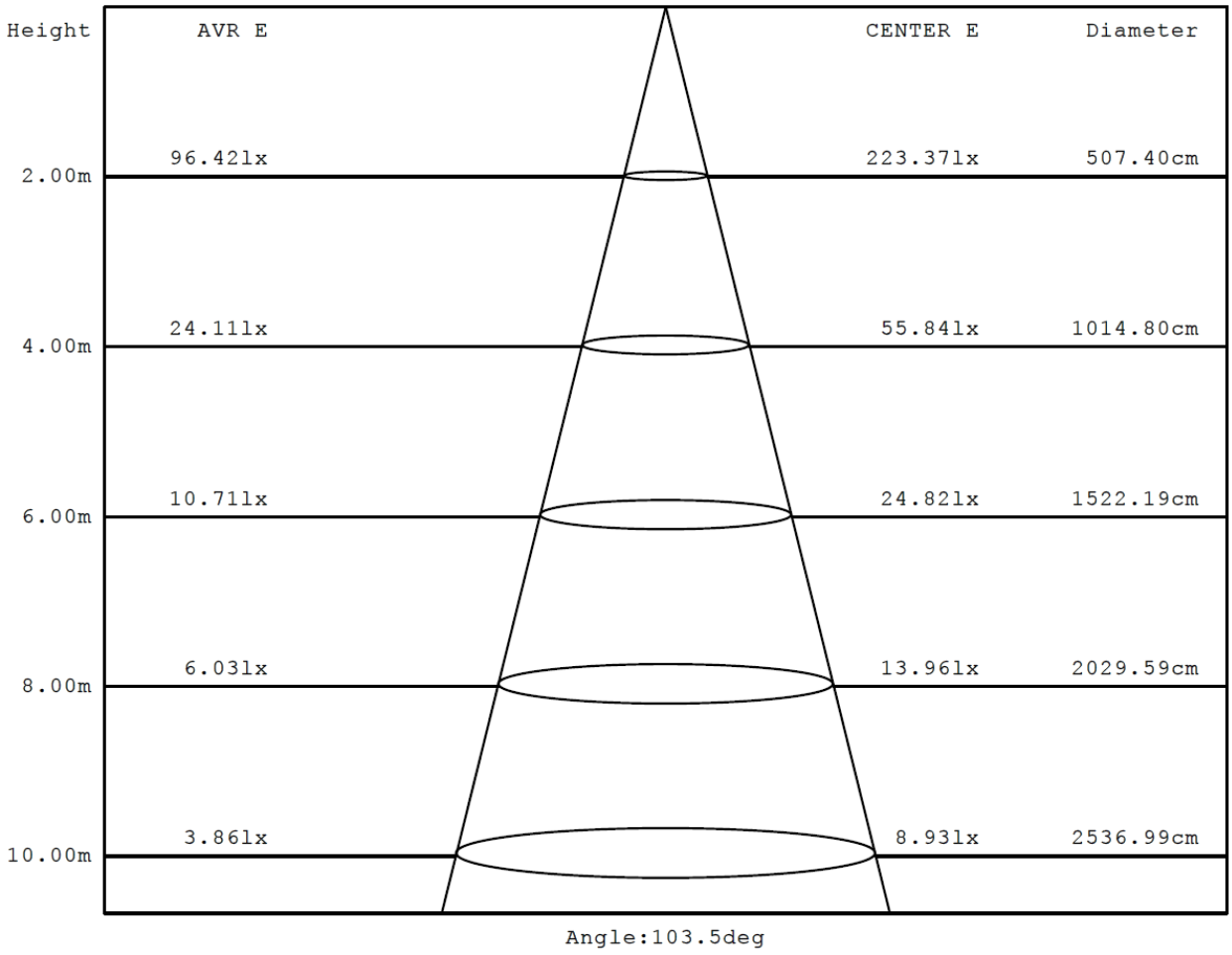
C0 PLANE ISOLUX DIAGRAM (UNIT: 1x)



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	893.4	891.6	892.5	892.1	891.6	890.1	892.7	892.1	893.3	893.6
5.0DEG	892.2	889.3	888.7	888.2	884.9	884.9	886.6	887.2	888.7	889
10.0DEG	889.5	884.8	882.2	882.6	880.2	878.2	880.5	882.2	881.8	884.3
15.0DEG	883.4	878.5	877.4	875.1	871.5	868.6	872.1	873	875.9	876.5
20.0DEG	877.4	872.7	868.7	865.4	861.4	857.6	862.3	861.1	864.9	867.8
25.0DEG	870.9	864.3	860.8	855.9	852.4	847.5	850.6	850.3	854.5	857.3
30.0DEG	866.6	855.1	853.9	849.9	844.8	840	842	840.9	844.8	846.7
35.0DEG	863.5	854.1	850.4	847.7	844.2	841.3	838.5	836.4	840	842.8
40.0DEG	867.5	861.7	861.1	860.2	858.2	854.4	848.3	846.1	847.1	846.7
45.0DEG	842.2	817.8	827.5	810.2	815.8	811.9	851.8	856.1	858	863.7
50.0DEG	584.9	538.9	538.2	485.5	491.7	468.7	599.5	602.5	635	618.3
55.0DEG	237.6	212.5	217.2	189.4	195.2	162.7	204.4	210.3	249.4	235.7
60.0DEG	116.5	109.5	112.8	106.2	101.3	98.78	114.8	109.9	118.1	121.2
65.0DEG	73.11	76.35	74.37	76.89	74.12	80.09	82.4	88.81	81.25	85.06
70.0DEG	47.59	47.48	56.41	52.05	58.03	62.63	72.61	64.47	64.76	56.08
75.0DEG	31.17	28.29	34.23	33.69	35.2	33.08	43.95	38.34	39.95	36.68
80.0DEG	17.13	13.42	17.82	16.45	20.05	17.92	24.3	21.27	24.33	19.11
85.0DEG	5.508	3.6	6.336	4.32	6.66	3.564	8.784	6.984	9.792	6.264
90.0DEG	1.944	0.648	2.592	1.476	3.312	1.944	3.78	2.124	3.528	1.584
95.0DEG	1.656	0.36	1.872	0.864	2.412	1.26	2.808	1.404	2.592	0.936
100.0DEG	1.476	0.396	1.62	0.612	1.872	0.9	2.196	0.972	1.98	0.648
105.0DEG	1.368	0.468	1.404	0.612	1.62	0.72	1.8	0.792	1.656	0.612
110.0DEG	1.332	0.54	1.296	0.612	1.476	0.72	1.584	0.72	1.512	0.576
115.0DEG	1.296	0.576	1.332	0.684	1.44	0.756	1.512	0.756	1.44	0.648
120.0DEG	1.404	0.828	1.476	0.9	1.584	0.972	1.584	0.9	1.512	0.828
125.0DEG	1.656	1.08	1.692	1.188	1.764	1.224	1.764	1.152	1.692	1.044
130.0DEG	1.872	1.368	1.908	1.404	1.944	1.44	1.944	1.44	1.872	1.332
135.0DEG	2.052	1.584	2.088	1.692	2.088	1.656	2.088	1.62	2.016	1.584
140.0DEG	2.16	1.836	2.232	1.836	2.268	1.836	2.268	1.8	2.196	1.8
145.0DEG	2.304	1.944	2.34	2.052	2.376	2.052	2.376	1.98	2.34	1.944
150.0DEG	2.412	2.124	2.448	2.16	2.52	2.196	2.484	2.16	2.484	2.088
155.0DEG	2.484	2.16	2.484	2.232	2.52	2.232	2.556	2.232	2.484	2.16
160.0DEG	2.484	2.196	2.52	2.268	2.52	2.268	2.592	2.232	2.484	2.232
165.0DEG	2.484	2.268	2.52	2.268	2.52	2.268	2.556	2.268	2.52	2.268
170.0DEG	2.52	2.304	2.52	2.304	2.556	2.34	2.556	2.34	2.52	2.34
175.0DEG	2.52	2.304	2.556	2.34	2.52	2.34	2.556	2.34	2.52	2.34
180.0DEG	2.52	2.34	2.484	2.376	2.484	2.34	2.484	2.34	2.484	2.376

Gamma\C	150DEG	165DEG	180DEG
0.0DEG	893.3	892.2	895.1
5.0DEG	890.6	890.8	893.1
10.0DEG	885.4	886.7	890.1
15.0DEG	877.4	879.7	885.4
20.0DEG	869.6	870.5	876.2
25.0DEG	860.5	862	868.6
30.0DEG	851.2	853.9	863.4
35.0DEG	844.3	847.8	860
40.0DEG	852.9	851.6	864.1
45.0DEG	869.3	860.6	866.9
50.0DEG	648.1	632.2	654.7
55.0DEG	259.5	238.2	259.1
60.0DEG	126.1	117	118.1
65.0DEG	80.92	81.57	75.05
70.0DEG	60.62	49.5	47.7
75.0DEG	37	29.19	30.31
80.0DEG	19.83	13.89	16.02
85.0DEG	7.56	4.212	5.328
90.0DEG	2.772	0.684	1.908
95.0DEG	1.908	0.396	1.62
100.0DEG	1.62	0.396	1.476
105.0DEG	1.404	0.396	1.332
110.0DEG	1.368	0.468	1.296
115.0DEG	1.332	0.576	1.296
120.0DEG	1.404	0.756	1.404
125.0DEG	1.584	1.044	1.62
130.0DEG	1.8	1.296	1.8
135.0DEG	2.016	1.548	1.98
140.0DEG	2.124	1.728	2.124
145.0DEG	2.268	1.908	2.268
150.0DEG	2.412	2.088	2.412
155.0DEG	2.448	2.16	2.484
160.0DEG	2.484	2.196	2.448
165.0DEG	2.484	2.232	2.484
170.0DEG	2.484	2.268	2.52
175.0DEG	2.484	2.304	2.484
180.0DEG	2.484	2.34	2.484

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

Nur Awanis Binti Abdul Razak
Project Engineer

Approved Signatory

See Keat Siang
Technical Manager

APPENDIX 1:
Test Product Information:

21AMB0002

Sample Log Code of DUT: DUT 2/4
***This sample log code is identified by QAV Technologies.**