



EMC Test Report

Report No.: HB-079E-0348/16

Product : Amp Chanderlier Large , Amp Chanderlier Small
Model/Type : See model list
Brand Name : Normann Copenhagen
Applicant : Normann Copenhagen Aps
Application No. : 2016102802
Date of Test : Nov. 09 to 10, 2016
Date of Issue : 24 Nov , 2016
Standards : EN 55015:2013
EN 61000-3-2:2014
EN 61000-3-3:2013
EN 61547:2009
EN 62493:2010

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1- GENERAL INFORMATION

1.1 Test Summary

Table 1:

Standard	Test Items	Status	Result
EN 55015	Disturbance Voltage at Mains Terminals (9kHz to 30MHz)	<input checked="" type="checkbox"/>	Pass
	Radiated Electromagnetic Disturbance (9kHz to 30MHz)	<input checked="" type="checkbox"/>	Pass
	Radiated Disturbances (30MHz to 300MHz)	<input checked="" type="checkbox"/>	Pass

Note: ☒ Indicates that the test is applicable, ☐ Indicates that the test is not applicable

Table 2:

Standard	Test Items	Status	Result
EN 62493	Disturbance Voltage at Mains Terminals (20kHz to 30MHz)	<input checked="" type="checkbox"/>	Pass
	Radiated Electromagnetic Disturbance (10kHz to 30MHz)	<input checked="" type="checkbox"/>	Pass
	Radiated Disturbances (30MHz to 300MHz)	<input checked="" type="checkbox"/>	Pass
	Induced Current Density	<input checked="" type="checkbox"/>	Pass

Note: ☒ Indicates that the test is applicable, ☐ Indicates that the test is not applicable

Table 3:

Standard	Test Items	Status	Result
EN 61000-3-2	Harmonic Current Test	<input checked="" type="checkbox"/>	Pass
EN 61000-3-3	Voltage Fluctuations and Flicker Test	<input checked="" type="checkbox"/>	Pass

Note: ☒ Indicates that the test is applicable, ☐ Indicates that the test is not applicable

Table 4

Standard	Test Items	Status	Result
EN 61547:	Test items as below listed	<input checked="" type="checkbox"/>	Pass
EN 61000-4-2	Electrostatic discharge Immunity	<input checked="" type="checkbox"/>	Pass
EN 61000-4-3	Radiated Susceptibility (80MHz to 1GHz)	<input checked="" type="checkbox"/>	Pass
EN 61000-4-4	Electrical Fast Transient/Burst Immunity	<input checked="" type="checkbox"/>	Pass
EN 61000-4-5	Surge Immunity	<input checked="" type="checkbox"/>	Pass
EN 61000-4-6	Conducted Susceptibility (150kHz to 80MHz)	<input checked="" type="checkbox"/>	Pass
EN 61000-4-8	Power Frequency Magnetic Field Immunity (50/60Hz)	<input checked="" type="checkbox"/>	Pass
EN 61000-4-11	Voltage Dips, Short Interruptions Immunity	<input checked="" type="checkbox"/>	Pass

Note: ☒ Indicates that the test is applicable, ☐ Indicates that the test is not applicable

Tested By: Chun Liu /

Date: 24 Nov, 2016

Checked By: Lechun Guan /

Date: 24 Nov, 2016

Approved By: Zhaofu Peng/

Date: 24 Nov, 2016



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1.2 Product Description for Equipment under Test (EUT)

Client Information

Applicant: Normann Copenhagen Aps
Address of applicant: Østerbrogade 70, 2100 Copenhagen, Denmark

General Description of E.U.T

EUT Name: LED Fixed Luminaires
Trade Mark: NORMANN COPENHAGEN
EUT Model No.: 502080
Supplementary Models: 502079, 502081, 502076, 502077, 502078
Power Supply: ☒ 100-240V~, 50/60Hz
☐ Power by AC/DC adaptor

Remark:

1. The products are LED fixed luminaires, IP20, Class II, suitable for indoor used only.
2. All models have similar construction, only difference with appearance, number of lampholders, power and model of LED driver. Full tests were performed on 502080.

Model list:

No.	Model	Power	LED driver
1	502079	35×Max.0.4W	K14-16V1330
2	502080		Input: 100-240V, 50/60Hz,
3	502081		Output: DC12V, max.1330mA
4	502076	15×Max.0.4W	K22-12V1000
5	502077		Input: 100-240V, 50/60Hz,
6	502078		Output: DC12V, 1000mA

1.3 Test Standards

The following Declaration of Conformity report of EUT is prepared in accordance with

EN 55015:2013

EN 61000-3-2:2014

EN 61000-3-3:2013

EN 61547:2009

EN 62493:2010

The objective of the manufacturer is to demonstrate compliance with the described standards above.

1.4 Test Methodology

All measurements contained in this report were conducted with CISPR 16-1-1: 2006, Radio disturbance and immunity measuring apparatus – Measuring apparatus, and CISPR 16-2-3: 2010, Method of measurement of disturbances and immunity.

2- SYSTEM TEST CONFIGURATION

2.1 Justification

The system was configured for testing in a typical fashion (as normally used by a typical user).

2.2 Equipment Modifications

The EUT tested was not modified by LTS.

2.3 Basic Configuration of Test System

Emission: The equipment under test (EUT) was configured to measure its highest possible radiation level. The test modes were adapted accordingly in reference to the Operating Instructions.

Immunity: The equipment under test (EUT) was configured to the representative operating mode and conditions.



EUT

2.4 General Description of Test Auxiliary

None

EUT Description:	Manufacturer	Model No.	Certificate
/	/	/	/

3- DISTURBANCE VOLTAGE AT MAINS TERMINALS

3.1 Measurement Uncertainty

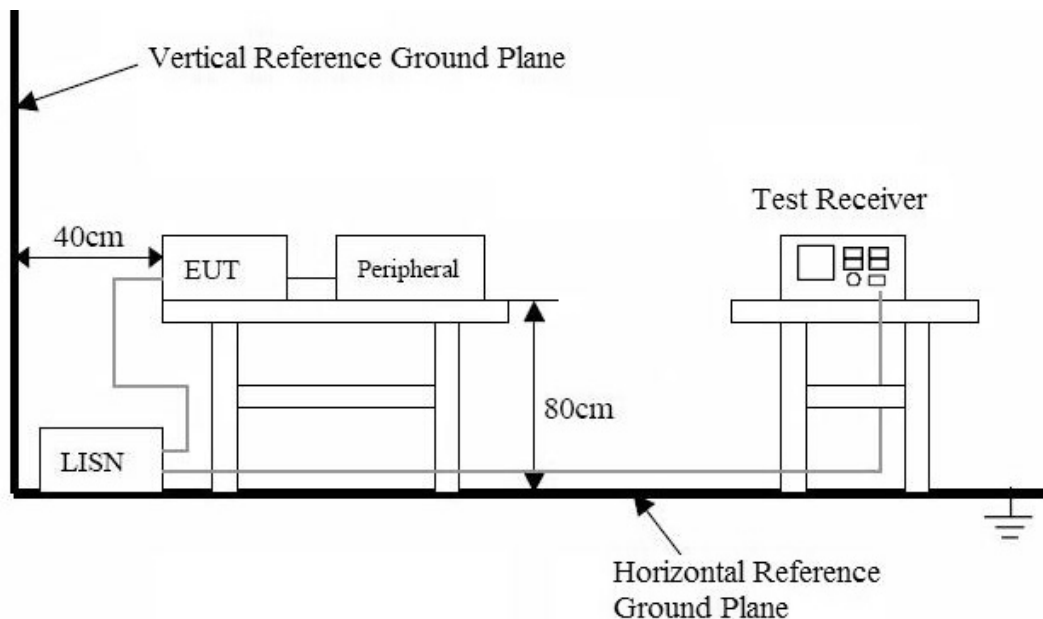
All measurements involve certain levels of uncertainties, especially in field of EMC. The factors contributing to uncertainties are spectrum analyzer, cable loss, and LISN. The Treatment of Uncertainty in EMC Measurements, the best estimate of the uncertainty of any conducted emissions measurement is 2.9 dB.

3.2 Limit of Disturbance Voltage at Mains Terminals

Frequency Range (MHz)	Quasi-Peak (dB μ V)	Average (dB μ V)
9kHz ~ 50kHz	110	-----
50kHz ~ 150kHz	90 ~ 80*	-----
150kHz ~ 0.5MHz	66 ~ 56*	56 ~ 46*
0.5MHz ~ 5.0MHz	56	46
5.0MHz ~ 30MHz	60	50

NOTE 1: The tighter limit shall apply at the edge between two frequency bands.
NOTE 2: The limits decrease linearly with the logarithm of the frequency in the range 50kHz to150 kHz and 150 kHz to 0.5 MHz.

3.3 EUT Setup



The setup of EUT is according with CISPR 16-1-1: 2006, CISPR 16-2-3: 2010 measurement procedure. The specification used was the EN 55015 limits.

The EUT was placed center and the back edge of the test table.


The cables were draped along the test table and bundled to 30-40cm in the middle.

The spacing between the peripherals was 10 cm.

Maximum emission emitted from EUT was determined by manipulating the EUT, support equipment, interconnecting cables and varying the mode of operation and the levels in the final

result of the test were recorded with the EUT running in the operating mode that maximum emission was emitted.

3.4 Test Equipment List and Details

Equipment	Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due Date
EMI Test Receiver		ESCI	100943	2015-12-16	2016-12-15
L.I.S.N.		ENV216	101047	2015-12-16	2016-12-15
RF Cable		RG 223/U	/	2015-12-16	2016-12-15

3.5 Instrument Setup

The test receiver was set with the following configurations:

Test Receiver Setting:

Frequency Range..... 9 kHz to 30 MHz
 Detector..... Peak & Quasi-Peak & Average
 Sweep Speed..... Auto
 IF Band Width..... 200Hz / 9kHz

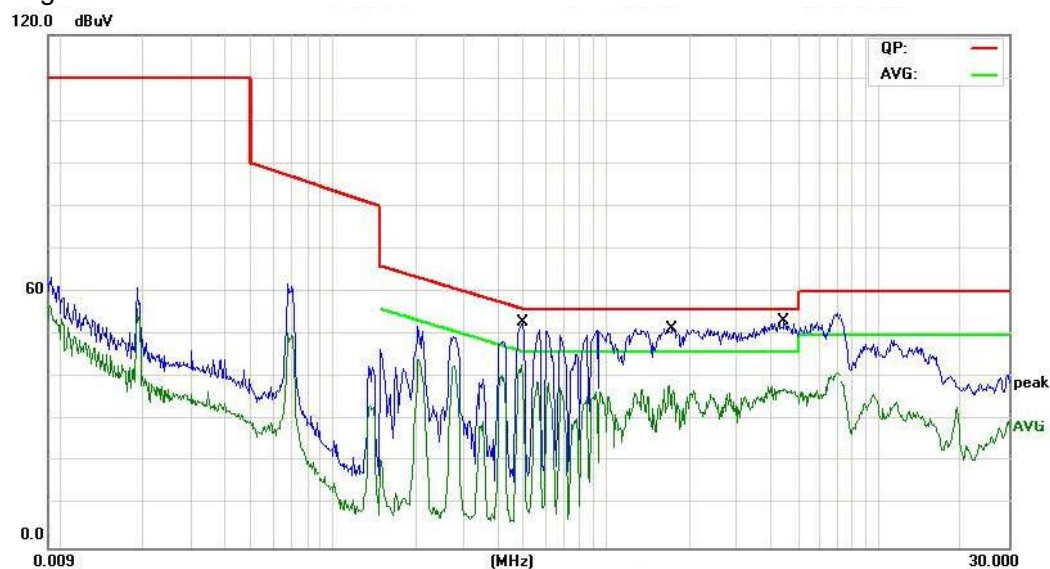
3.6 Test Procedure

1. During the conducted emission test, the EUT power cord was connected to the auxiliary outlet of the first Artificial Mains.
2. Maximizing procedure was performed on the six (6) highest emissions to ensure EUT compliance using all installation combination.
3. All data was recorded in the peak detection mode. Quasi-peak and Average readings were only performed when an emission was found to be marginal (within -10 dBµV of specification limits). Quasi-peak readings are distinguished with a "QP". Average readings are distinguished with a "AVG".

3.7 Test Data

Temperature:	22~25 (°C)
Humidity:	45~50 (%RH)
Barometric Pressure:	950~1000 (mbar)
Operating Mode:	On
Test Specification:	AC 24V/50Hz
Date of Test:	09 Nov. 2016
Test Result:	Pass

Comment: Live Line
Level dBμV
Peak & Average Scan



Site EMC Testing Room

Phase: L1

Temperature: 23

Limit: (CE)EN55015_QP

Power: AC 230V/50Hz

Humidity: 46 %

EUT:

M/N: 502080

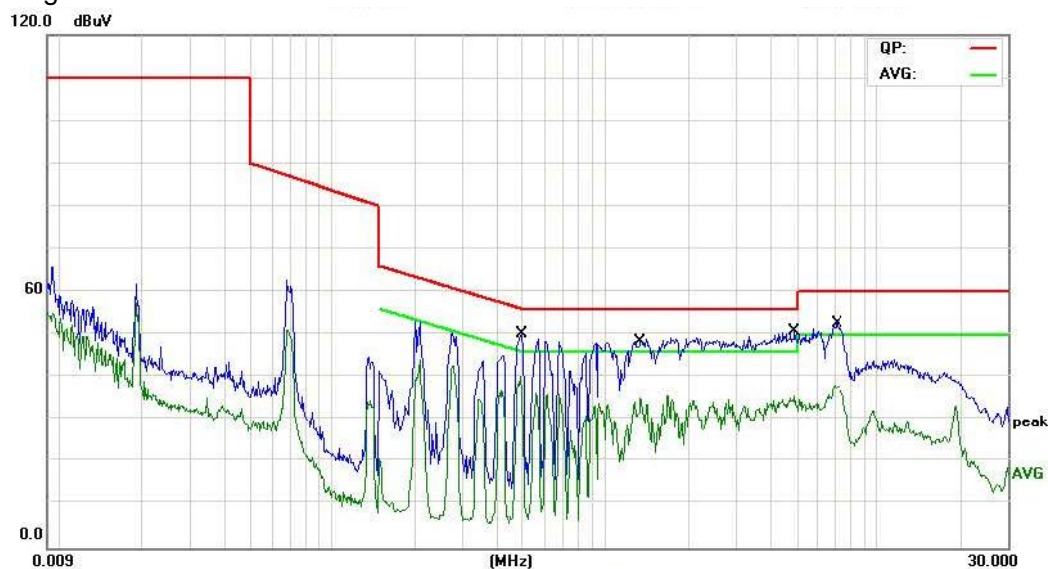
Mode: Fixed luminaire

Note:

No.	Mk.	Freq. MHz	Reading Level dBμV	Correct Factor dB	Measure- ment dBμV	Limit dBμV	Over dB	Detector	Comment
1	*	0.4980	17.83	34.00	51.83	56.03	-4.20	QP	
2		0.4980	5.30	34.00	39.30	46.03	-6.73	AVG	
3		1.7540	15.51	34.02	49.53	56.00	-6.47	QP	
4		1.7540	1.13	34.02	35.15	46.00	-10.85	AVG	
5		4.4860	15.13	34.05	49.18	56.00	-6.82	QP	
6		4.4860	2.46	34.05	36.51	46.00	-9.49	AVG	

Remark: data mark with “*” comes nearest to limit.

Comment: Neutral Line
Level dB μ V
Peak & Average Scan



Site EMC Testing Room

Phase: N

Temperature: 23

Limit: (CE)EN55015_QP

Power: AC 230V/50Hz

Humidity: 46 %

EUT:

MN: 502080

Mode: Fixed luminaire

Note:

No.	Mk.	Freq. MHz	Reading Level dB μ V	Correct Factor dB	Measure- ment dB μ V	Limit dB μ V	Over dB	Detector	Comment
1	*	0.4980	15.24	34.00	49.24	56.03	-6.79	QP	
2		0.4980	2.43	34.00	36.43	46.03	-9.60	AVG	
3		1.3500	13.53	34.01	47.54	56.00	-8.46	QP	
4		1.3500	1.16	34.01	35.17	46.00	-10.83	AVG	
5		4.9260	12.57	34.06	46.63	56.00	-9.37	QP	
6		4.9260	-1.09	34.06	32.97	46.00	-13.03	AVG	
7		7.1100	13.47	34.07	47.54	60.00	-12.46	QP	
8		7.1100	2.87	34.07	36.94	50.00	-13.06	AVG	

Remark: data mark with "*" comes nearest to limit.

4- RADIATED ELECTROMEGNETIC DISTURBANCE

4.1 Measurement Uncertainty

All measurements involve certain levels of uncertainties, especially in field of EMC. The factors contributing to uncertainties are test receiver, cable loss, antenna factor calibration, measurement distance variation, site imperfections, mismatch (average), and system repeatability. The treatment of uncertainty in EMC Measurements, the best estimate of the uncertainty of any conducted emissions measurement is $\pm 3.6\text{dB}$.

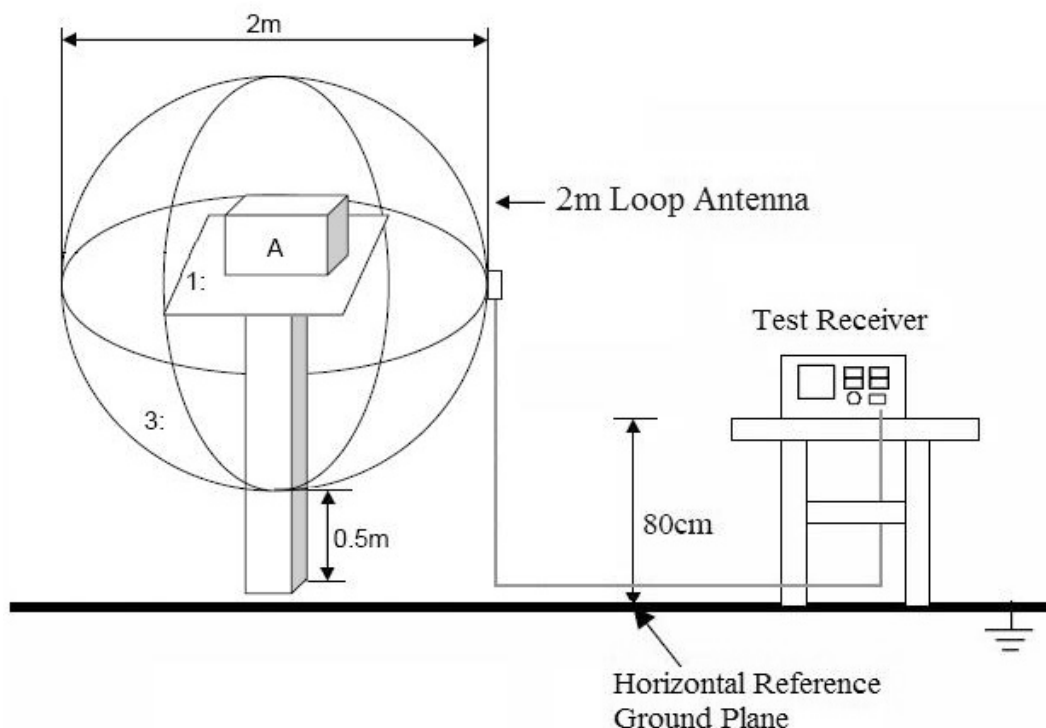
4.2 Limit of Radiated Electromagnetic Disturbance

Frequency Range	Limits Frequency for loop diameter (dB μ A)
	2m
9kHz ~ 70kHz	88
70kHz ~ 150kHz	88 ~ 58*
150kHz ~ 3.0MHz	58 ~ 26*
3.0MHz ~ 30MHz	22


NOTE 1: The tighter limit shall apply at the edge between two frequency bands.

NOTE 2: Distance refers to the distance in meters between the test instrument antenna and the closest point of any part of the E.U.T.

4.3 EUT Setup



4.4 Test Equipment List and Details

Equipment	Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due Date
2m Loop Antenna			N/A	2015-12-16	2016-12-15
EMI Test Receiver			100943	2015-12-16	2016-12-15
RF Cable			/	2015-12-16	2016-12-15

4.5 Instrument Setup

The test receiver was set with the following configurations:

Test Receiver Setting:

Frequency Range.....9 kHz to 30 MHz
 Detector.....Peak & Quasi-Peak & Average
 Sweep Speed.....Auto
 IF Band Width.....200Hz / 9kHz

4.6 Test Procedure

1. The EUT is placed on a wood table in the center of a loop antenna and the onerous position is considered. The induced current in the loop antenna is measured by means of a current probe and the test receiver. Three field components are checked by means of a coaxial switch.
2. The frequency range from 9 kHz to 30MHz is investigated. Maximizing procedure was performed on the six (6) highest emissions to ensure EUT compliance using all installation combination.
3. All data was recorded in the peak detection mode. Quasi-peak readings were only performed when an emission was found to be marginal (within -10 dBµV of specification limits). Quasi-peak readings are distinguished with a "QP".

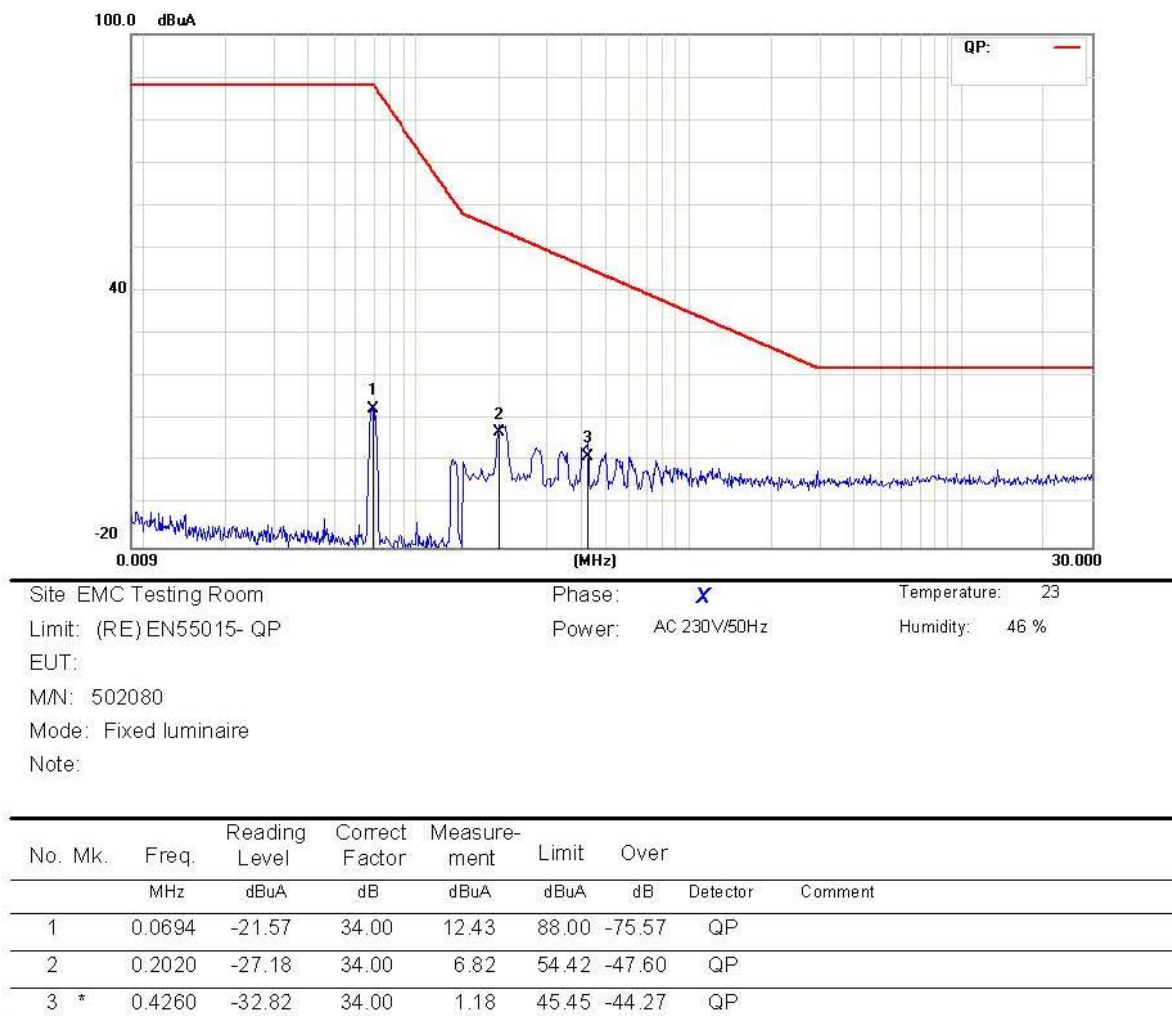
4.7 Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain from the Amplitude reading. The basic equation is as follows:
 Corr. Ampl. = Indicated Reading + Antenna Factor + Cable Factor

4.8 Test Data

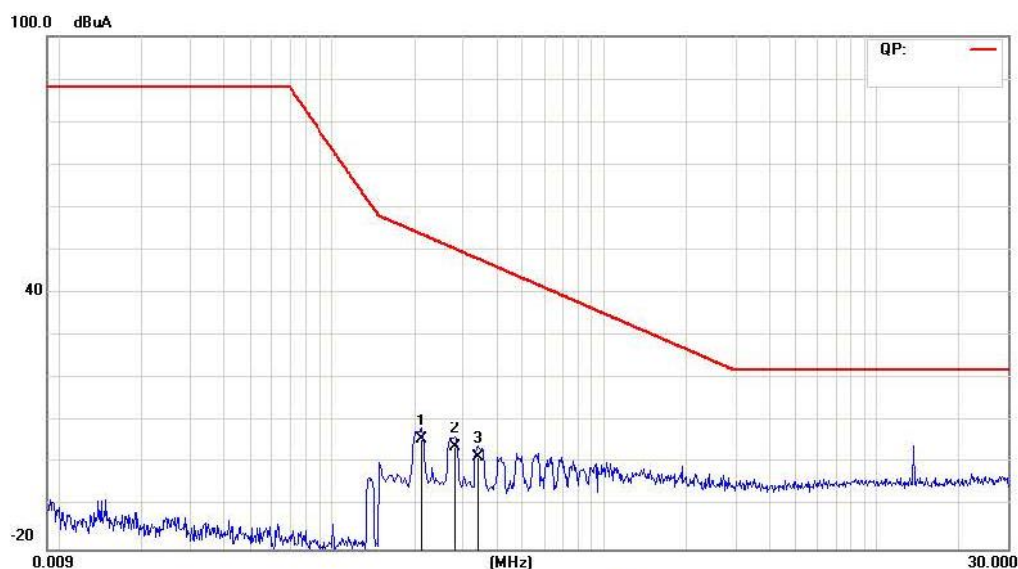
Temperature:	22~25 (℃)
Humidity:	45~50 (%RH)
Barometric Pressure:	950~1000 (mbar)
Operating Mode:	On
Test Specification:	AC 230V/50Hz
Start of Test:	09 Nov, 2016
Test Result:	Pass

Comment: Polarization: X
Level dBμA
Peak Scan



Remark: data mark with '*' comes nearest to limit.

Comment: Polarization: Y
Level dBμA
Peak Scan



Site: EMC Testing Room
Limit: (RE) EN55015- QP
EUT:
MN: 502080
Mode: Fixed luminaire
Note:

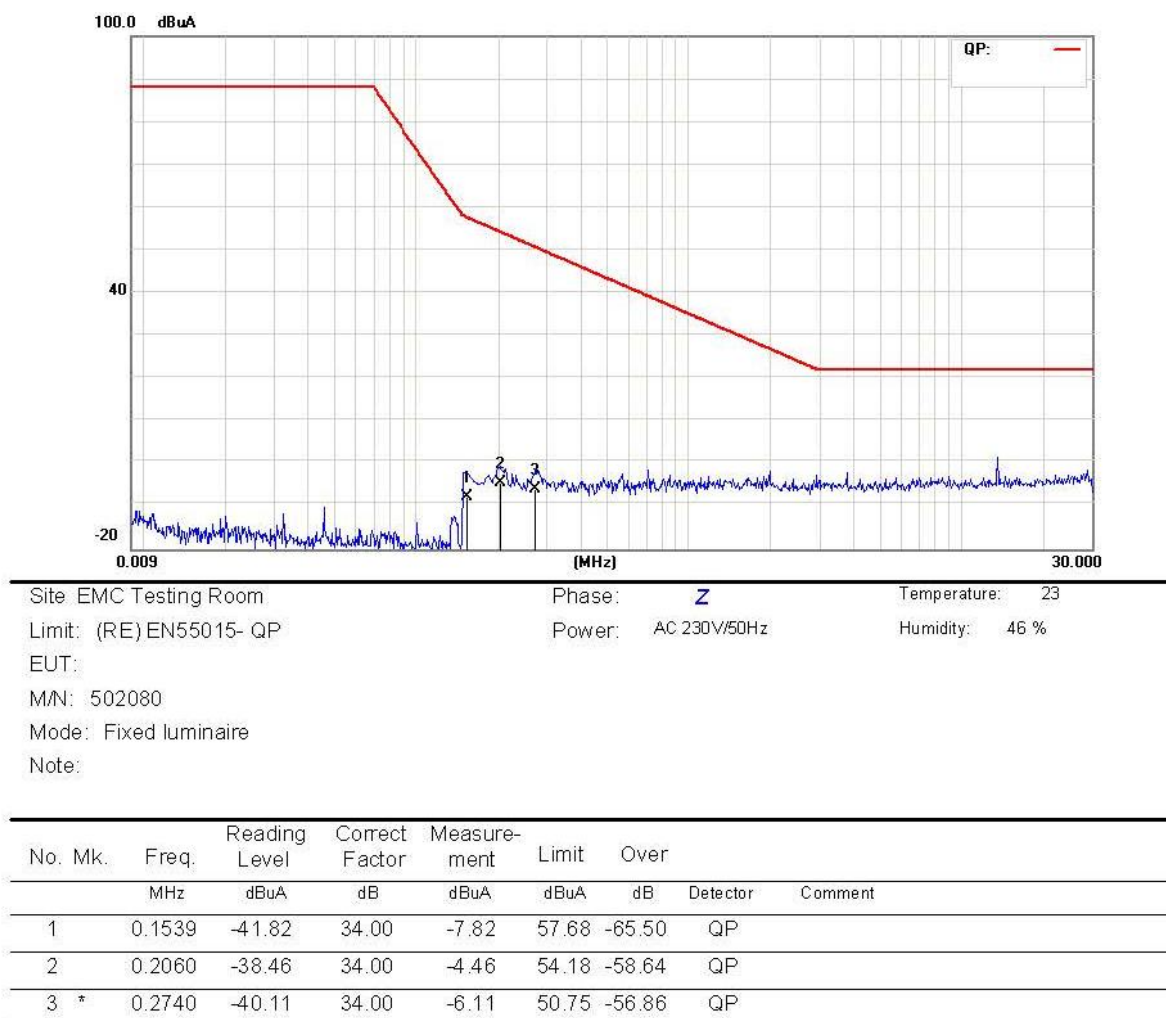
Phase: Y
Power: AC 230V/50Hz

Temperature: 23
Humidity: 46 %

No.	Mk.	Freq. MHz	Reading Level dBμA	Correct Factor dB	Measure- ment dBμA	Limit dBμA	Over dB	Detector	Comment
1		0.2140	-28.41	34.00	5.59	53.72	-48.13	QP	
2		0.2819	-30.15	34.00	3.85	50.41	-46.56	QP	
3	*	0.3460	-32.51	34.00	1.49	47.95	-46.46	QP	

Remark: data mark with "*" comes nearest to limit.

Comment: Polarization: Z
Level dBμA
Peak Scan



Remark: data mark with “*” comes nearest to limit.

5- RADIATED DISTURBANCES

5.1 Measurement Uncertainty

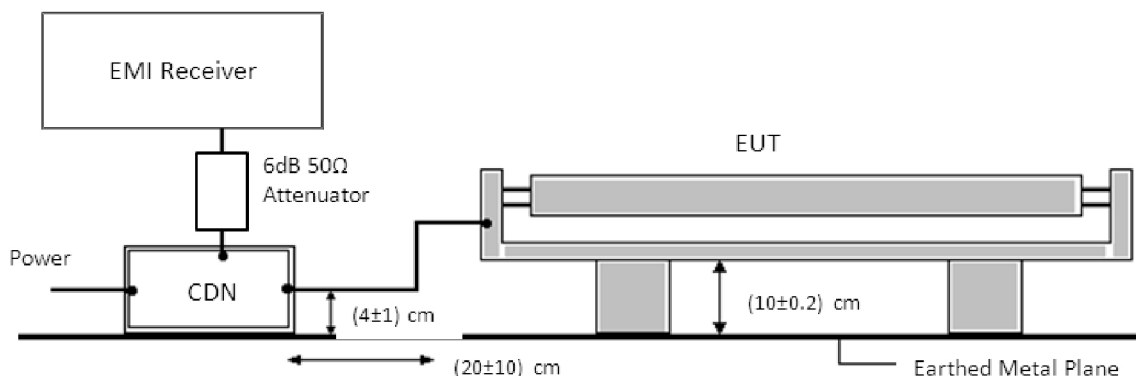
All measurements involve certain levels of uncertainties, especially in field of EMC. The factors contributing to uncertainties are spectrum analyzer, cable loss, measurement distance variation, site imperfections, mismatch (average), and system repeatability. The Treatment of Uncertainty in EMC Measurements, the best estimate of the uncertainty of a radiation emissions measurement is 3.6dB.

5.2 Limit of Radiated Disturbances

Frequency (MHz)	Quasi-Peak (dB μ V)
30 ~ 100	64 ~ 54
100 ~ 230	54
230 ~ 300	61

NOTE 1 The lower limit shall apply at the transition frequency.
NOTE 2 Additional provisions may be required for cases where interference occurs.

5.3 EUT Setup



The radiated emission tests were performed in the open area 3-meter test site, using the setup accordance with the CISPR 16-1-1: 2006, CISPR 16-2-3: 2010. The specification used was EN 55015 limits.

The EUT was placed on the center of the test table.

Maximum emission emitted from EUT was determined by manipulating the EUT, support equipment, interconnecting cables and varying the mode of operation and the levels in the final result of the test were recorded with the EUT running in the operating mode that maximum emission was emitted.

5.4 Test Equipment List and Details

Equipment	Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due Date
EMI Test Receiver				2015-12-16	2016-12-15
Coupling Decoupling Network				2015-12-16	2016-12-15
RF Cable				2015-12-16	2016-12-15

5.5 Test Receiver Setup

The test receiver was set with the following configurations:

Test Receiver Setting:

Detector.....Peak & Quasi-Peak
IF Band Width.....120kHz
Frequency Range.....30MHz to 300MHz

5.6 Test Procedure

1. The test is conducted in a shielding room, by means of CDN method. EUT is placed upon a wood board 10cm above the ground reference plane. Cable length between CDN and EUT is 20cm \pm 10cm.
2. All data was recorded in the peak detection mode. Quasi-peak readings performed only when an emission was found to be marginal (within -10 dB μ V of specification limits), and are distinguished with a "QP" in the data table.

5.7 Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated by adding the CDN Factor and Cable Factor, and subtracting the Amplifier Gain from the Amplitude reading. The basic equation is as follows:

Corr. Ampl. = Indicated Reading + CDN Factor + Cable Factor

The "Margin" column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of 7dB μ V means the emission is 7dB μ V below the maximum limit. The equation for margin calculation is as follows:

Margin = Limit – Corr. Ampl.

5.8 Test Data

Temperature:	22~25 (°C)
Humidity:	45~50 (%RH)
Barometric Pressure:	950~1000 (mbar)
Operating Mode:	On
Test Specification:	AC 230V/50Hz
Start of Test:	08 Oct, 2016
Test Result:	Pass

Level dBμV

Peak Scan



Site: EMC Testing Room

Phase:

Temperature: 23

Limit: (RE) EN55015-CDN-QP

Power: AC 230V/50Hz

Humidity: 46 %

EUT:

MN: 502080

Mode: Fixed luminaire

Note:

No.	Mk.	Freq. MHz	Reading Level dBμV	Correct Factor dB	Measure- ment dBμV	Limit dBμV	Over dB	Detector	Comment
1	*	77.8000	31.98	17.47	49.45	56.09	-6.64	QP	
2		85.7200	30.56	17.65	48.21	55.28	-7.07	QP	

Remark: data mark with "*" comes nearest to limit.

6– HARMONIC CURRENT TEST (EN 61000-3-2)

Accordance with EN 61000-3-2, there is no Harmonics limit applied to this LED lighting device without discharge lamp and rated power of the LED lighting device if less than 25W.

Remark:

For LED lighting equipment with an active input power equal to or less than 25 W, ECANB interpretation that:

There are 2 possible ways ahead:

1. LED equipment with an active input power equal to or less than 25 W cannot be considered discharge lighting equipment'. Therefore there are no harmonic limits for LED equipment below 25 W.

2. LED lighting equipment can be regarded as a discharge lamp when it comes to selecting the limits in sub-clause 7.3 in the standard. That would mean that LED lighting equipment with an active input power equal to or less than 25 W shall fulfil the limits in table 3, column 2 or the waveform requirement in sub-clause 7.3.b. Consequently, LED lighting equipment with an active input power more than 25 W shall fulfil the limits in table 2.

ECANB considers option 1 the correct option but ECANB Members should be aware that IEC 77A may in future adopt option 2. (ECANB (07) 024 Version 1)

Required by the applicant and the manufacturer, Harmonics Current Emission test is not application.

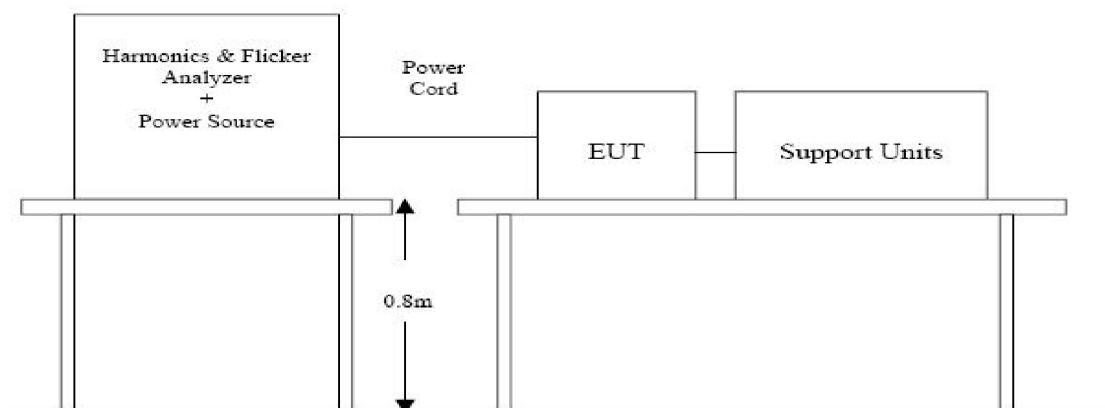
7 – VOLTAGE FLUCTUATIONS AND FLICKER TEST (EN 61000-3-3)

7.1 Application and Limit of Voltage Fluctuations and Flicker Test

Compliance to these standards ensures that tested equipment will not generate flickers and voltage change at levels that cause unacceptable degradation of the main environment. This directly contributes to meeting compatibility levels established in other EMC standards, which defines compatibility levels for low-frequency conducted disturbances in low-voltage supply systems.

Test Item	Limit	Remark
Pst	1.0	Pst means short-term flicker indicator.
Plt	0.65	Plt means long-term flicker indicator.
Tdt (ms)	500	Tdt means maximum time that dt exceeds 3 %.
dmax (%)	4%	dmax means maximum relative voltage change.
dc (%)	3.3%	dc means relative steady-state voltage change

7.2 Block Diagram of Test Setup:



7.3 Test Equipment List and Details

Equipment	Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due Date
Harmonic and Flicker Analyzer				2015-12-16	2016-12-15
AC Power Source				2015-12-16	2016-12-15

7.4 Test Procedure:

1. The test voltage was maintained within $\pm 2\%$ of the nominal value. The frequency was $50\text{Hz} \pm 0.5\%$.
2. The voltage fluctuations and flicker were measured at the supply terminals of EUT.
3. There is no testing required if the device does not generate any significant voltage fluctuation or flicker. A short time measurement confirmed the assumption that this is the fact. The details in the test module are representing the results of the short time measurement.

7.5 Test Result

Basic Standard:	EN/IEC 61000-3-3 Flicker
Short time (Pst)	10 min
Observation time	10 min (1 Flicker measurement)
Temperature:	22~25 (°C)
Humidity:	45~50 (%RH)
Barometric Pressure:	950~1000 (mbar)
Operating Mode:	On
Test Specification:	AC 230V/50Hz
Start of Test:	10 Nov, 2016
Test Result:	Pass

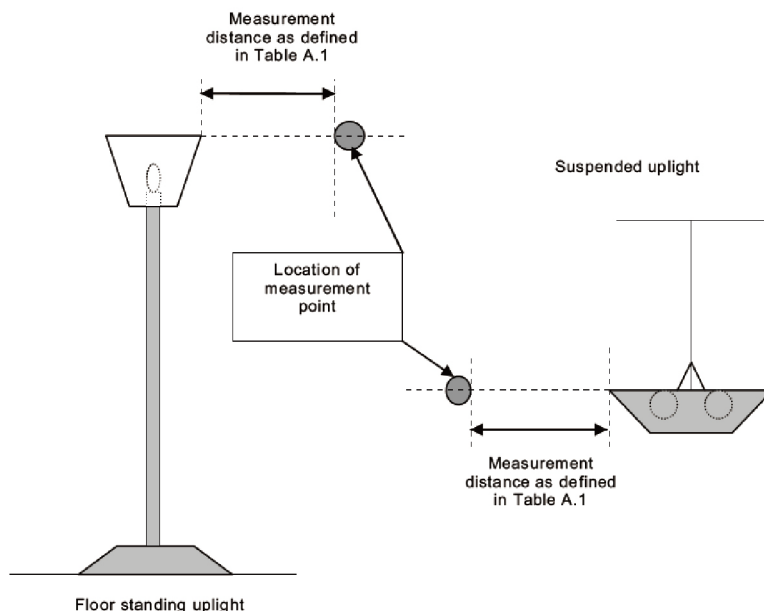
Maximum Flicker results			
Test Item	EUT values	Limit	Result
Pst	0.084	1.00	PASS
dc [%]	0.000	3.30	PASS
dmax [%]	0.000	4.00	PASS
dt [s]	0.000	0.50	PASS

8-ELECTROMAGNETIC FIELD TEST

8.1 Application of Electromagnetic Field

Compliance to these standards ensures that the exposure level of electromagnetic field generated by lighting equipment is acceptable. The EUT should primarily comply with tests in clause 3 to 5 of this report and fulfill the requirement of this clause in addition.

8.2 Block Diagram of Test Setup:



8.3 Test Equipment List and Details

Equipment	Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due Date
EMI Test Receiver			100943	2015-12-16	2016-12-15
Van Der Hoofden Test Head			000WX20608	2015-12-16	2016-12-15

8.4 Test Procedure:

1. The test is carried out in a shielding room. The EUT is placed on the insulated table and no conductive plane or object or human being was closer to lighting equipment than 0.8m.
2. The VDH test-head is adjusted to the same height of the test point and located at 0.5m away from it.

8.5 Test Result

Temperature:	22~25 (°)
Humidity:	45~50 (%RH)
Barometric Pressure:	950~1000 (mbar)
Operating Mode:	On
Test Specification:	AC 240V/50Hz
Start of Test:	10 Nov, 2016
Test Result:	Pass

Model/Type	Test point	Distance	Factor (F)	Limit
502080	Around the lamp	0.5m	F=0.0244	0.85

9- IMMUNITY TEST DESCRIPTION

9.1 General Description

Product Standard	EN 61547	
Basic Standard, Specification, and Performance Criterion required	EN 61000-4-2	Electrostatic Discharge – ESD: 8kV air discharge, 4kV Contact discharge, Performance Criterion B
	EN 61000-4-3	Radio-Frequency Electromagnetic Field Susceptibility Test – RS: 80 ~ 1000 MHz, 3V/m, 80% AM (1kHz), Performance Criterion A
	EN 61000-4-4	Electrical Fast Transient/Burst - EFT, AC Port: 1kV, DC port: 0.5kV, Performance Criterion B
	EN 61000-4-5	Surge Immunity Test: 1.2/50 μ s Open Circuit Voltage, 8 /20 μ s Short Circuit Current, AC Port: line to line 0.5 kV, Performance Criterion C
	EN 61000-4-6	Conducted Radio Frequency Disturbances Test – CS: 0.15 ~ 80 MHz, 3Vrms, 80% AM, 1kHz, Performance Criterion A
	EN 61000-4-11	1) 0% residual for 0.5 cycle, Performance Criterion B 2) 70% residual for 10 cycles, Performance Criterion C

9.2 The phenomena allowed during and after test in each criterion are clearly stated in the following table

Performance criteria		
Criteria	During test	After test
A	No change of the luminous intensity shall be observed and the regulating control, if any, shall operate during the test as intended.	No change of the luminous intensity shall be observed and the regulating control, if any, shall operate during the test as intended.
B	The luminous intensity may change to any value.	The luminous intensity shall be restored to its initial value within 1 min. Regulating controls need not function during the test, but after the test, the mode of the control shall be the same as before the test provided that during the test no mode changing commands were given
C	Any change of the luminous intensity is allowed and the lamp(s) may be extinguished.	Within 30 min, all functions shall return to normal, if necessary by temporary interruption of the mains supply and/or operating the regulating control.
Additional requirement for lighting equipment incorporating a starting device: After the test, the lighting equipment is switched off. After half an hour, it is switched on again. The lighting equipment shall start and operate as intended.		

9.3 Deviations from the standard

No deviations from EN 61547 were made when performing the tests described in this report.

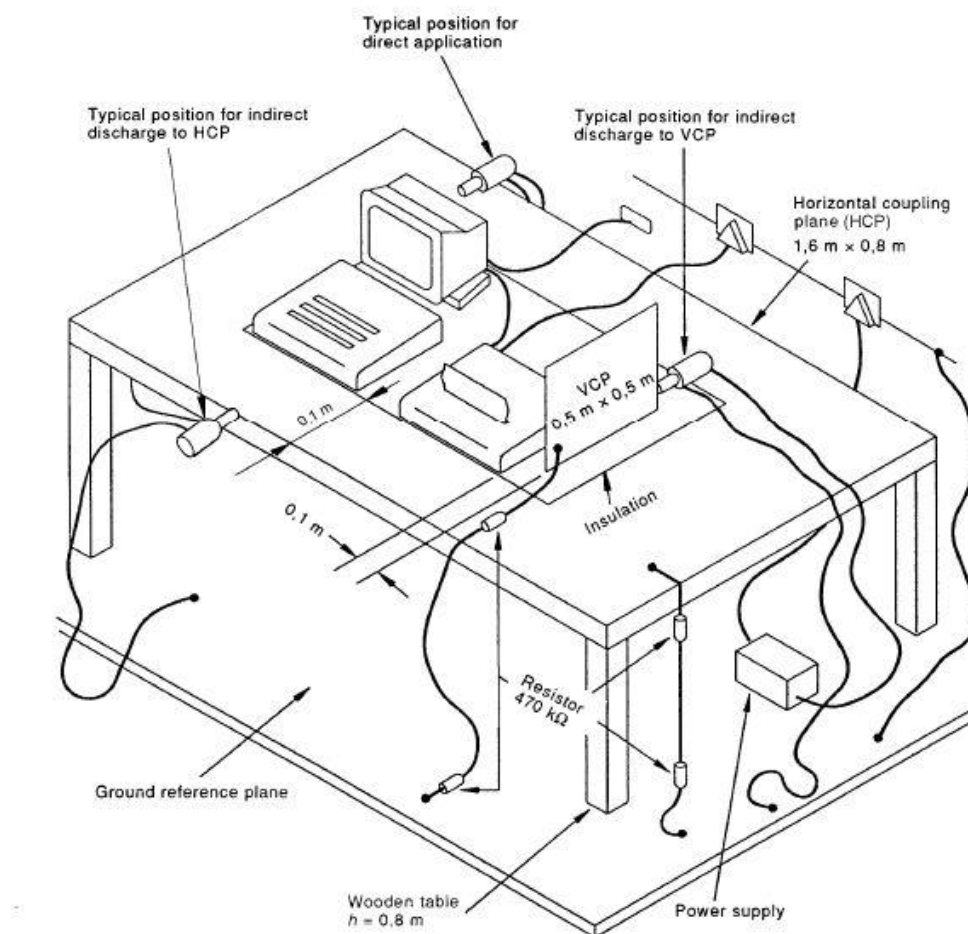
10- IMMUNITY TEST RESULTS

10.1 Electrostatic Discharge Immunity Test (EN 61000-4-2)

10.1.1 Test Specification

Basic Standard:	EN 61000-4-2
Test Level:	$\pm 2, 4, 8$ kV (Air Discharge) ± 4 kV (Contact Discharge) ± 4 kV (Indirect Contact HCP) ± 4 kV (Indirect Contact VCP)
Temperature:	22~25 (°C)
Humidity:	45~50 (%RH)
Barometric Pressure:	950~1000 (mbar)
Operating Mode:	On
Test Specification:	AC 230V/50Hz
Start of Test:	10 Nov, 2016

10.1.2 Test Setup



10.1.3 Test Equipment List and Details

Equipment	Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due Date
Electrostatic Generator			SF002900	2015-12-16	2016-12-15

10.1.4 Test Procedure

1. Electrostatic discharges were applied only to those points and surfaces of the EUT that are accessible to users during normal operation.
2. The test was performed with at least ten single discharges on the pre-selected points in the most sensitive polarity.
3. The time interval between two successive single discharges was at least 1 second.
4. The ESD generator was held perpendicularly to the surface to which the discharge was applied and the return cable was at least 0.2 meters from the EUT.
5. Contact discharges were applied to the non-insulating coating, with the pointed tip of the generator penetrating the coating and contacting the conducting substrate.
6. Air discharges were applied with the round discharge tip of the discharge electrode approaching the EUT as fast as possible (without causing mechanical damage) to touch the EUT. After each discharge, the ESD generator was removed from the EUT and re-triggered for a new single discharge. The test was repeated until all discharges were complete.
7. At least ten single discharges (in the most sensitive polarity) were applied to the Horizontal Coupling Plane at points on each side of the EUT. The ESD generator was positioned horizontally at a distance of 0.1 meters from the EUT with the discharge electrode touching the HCP.
8. At least ten single discharges (in the most sensitive polarity) were applied to the center of one vertical edge of the Vertical Coupling Plane in sufficiently different positions that the four faces of the EUT were completely illuminated. The VCP (dimensions 0.5m x 0.5m) was placed vertically to and 0.1 meters from the EUT.

10.1.5 Performance Criterion Required & Test Result

Table 1: Electrostatic Discharge Immunity (Air Discharge)

Test Level			Test Points	Observation Performance	Criterion Required
±2 kV	±4kV	±8kV			
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/> Gap	A	B
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/> Insulated crust	A	B
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/> Other Points	A	B

Table 2: Electrostatic Discharge Immunity (Direct Contact)

Test Level			Test Points	Observation Performance	Criterion Required
±2 kV	±4kV	±8kV			
<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/> Metal	A	B
<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/> Other Points	A	B

Table 3: Electrostatic Discharge Immunity (Indirect Contact HCP)

Test Level			Test Points	Observation Performance	Criterion Required
±2 kV	±4kV	±8kV			
<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Front Side	A	B
<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Back Side	A	B
<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Left Side	A	B
<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Right Side	A	B

Table 4: Electrostatic Discharge Immunity (Indirect Contact VCP)

Test Level			Test Points	Observation Performance	Criterion Required
±2 kV	±4kV	±8kV			
<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Front Side	A	B
<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Back Side	A	B
<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Left Side	A	B
<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Right Side	A	B

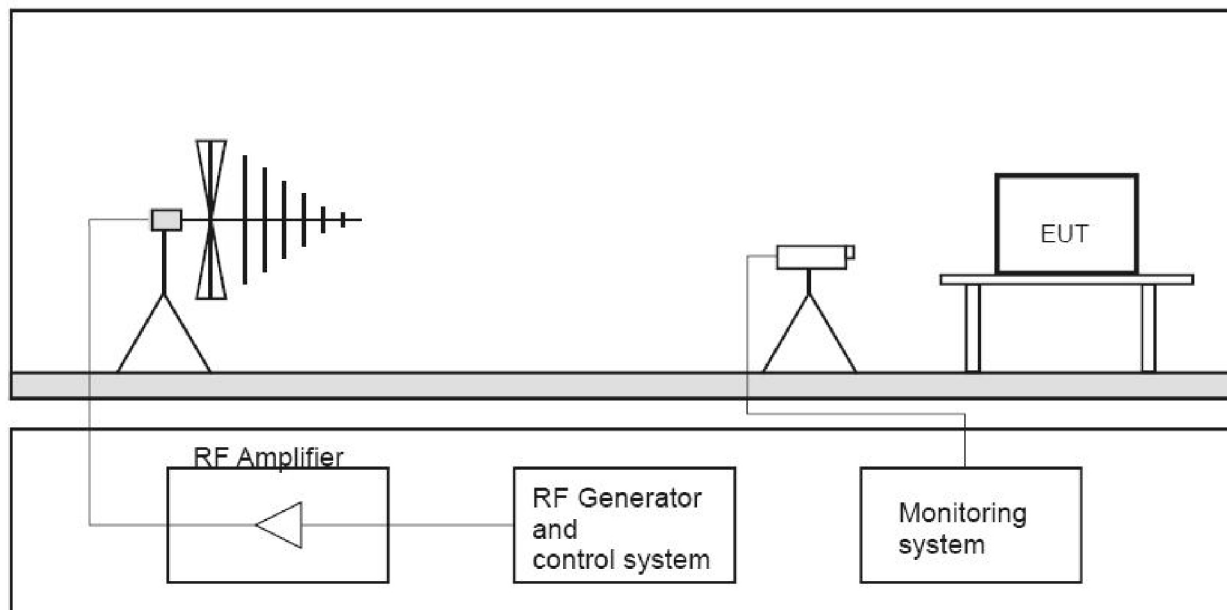
Test Result: Pass

10.2 Radiated Susceptibility Test (EN 61000-4-3)

10.2.1 Test Specification

Basic Standard:	EN 61000-4-3
Frequency Range:	80~1000MHz (MHz)
Modulation:	Amplitude 80%, 1kHz sinewave
Test Level:	3V/m
Temperature:	23 (°)
Humidity:	46 (%RH)
Barometric Pressure:	950~1000 (mbar)
Operating Mode:	On
Test Specification:	AC 230V/50Hz
Start of Test:	10 Nov, 2016
Test Result:	Pass

10.2.2 Test Setup



10.2.3 Test Equipment List and Details

Equipment	Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due Date
3m Chamber& Accessory Equipment				2016-07-08	2017-07-07
ESG Vector signal generators				2016-03-06	2017-03-05
Power Amplifier				2016-07-05	2017-07-04
TRILOG Broadband Antenna				2016-07-05	2017-07-04

Spectrum analyzer	Agilent	E4440A	MY46185649	2016-07-05	2017-07-04
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10.2.4 Test Procedure

1. The testing was performed in a fully-anechoic chamber.
2. The frequency range is swept from 80 MHz to 1000 MHz, with the signal 80% amplitude modulated with a 1kHz sine wave.
3. The dwell time at each frequency shall not be less than the time necessary for the EUT to be exercised and to respond, but shall in no case be less than 0,5s.
4. The field strength level was 3V/m.
5. The test was performed with the EUT exposed to both vertically and horizontally polarized fields on each of the four sides.

10.2.5 Performance Criterion Required & Test Result

Frequency Band (MHz)	Test Level	Test Points	Observation Performance	Criterion Required
80-1000	3V/m	Front Side	A	A
80-1000	3V/m	Rear Side	A	A
80-1000	3V/m	Left Side	A	A
80-1000	3V/m	Right Side	A	A

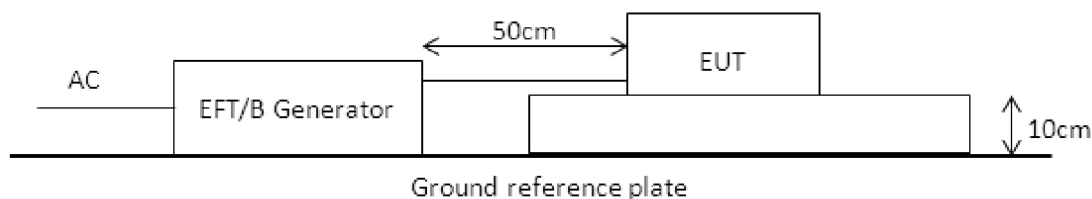
Test Result: Pass

10.3 Electrical Fast Transient/Burst Immunity Test (EN 61000-4-4)

10.3.1 Test Specification

Basic Standard :	EN 61000-4-4
Test Level:	± 1 kV for AC power ports, ± 0.5 kV for DC output port (If applicable)
Impulse Frequency:	5kHz
Impulse Wave-shape:	5/50ns
Burst Duration:	15ms
Burst Period:	300ms
Test Duration:	2 min.
Temperature:	22~25 (\boxtimes)
Humidity:	45~50 (%RH)
Barometric Pressure:	950~1000 (mbar)
Operating Mode:	On
Test Specification:	AC 230V/50Hz
Start of Test:	10 Nov, 2016

10.3.2 Test Setup



10.3.3 Test Equipment List and Details

Equipment	Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due Date
Electrical Fast Transient Generator			EC0461221	2015-12-16	2016-12-15
Capacitive Coupling Clamp			EC0441348	2015-12-16	2016-12-15

10.3.4 Test Procedure

- Both positive and negative polarity discharges were applied.
- The length of the "hot wire" from the coaxial output of the EFT generator to the terminals on the EUT should be 0.5m.

10.3.5 Performance Criterion Required & Test Result

Voltage	Test Points	Observation Performance	Criterion Required
±1kV	L	A	B
±1kV	N	A	B
±1kV	Earth	/	B
±1kV	L+N	A	B
±1kV	L + Earth	/	B
±1kV	N + Earth	/	B
±1kV	L + N + Earth	/	B
±0.5kV	DC output	A	B

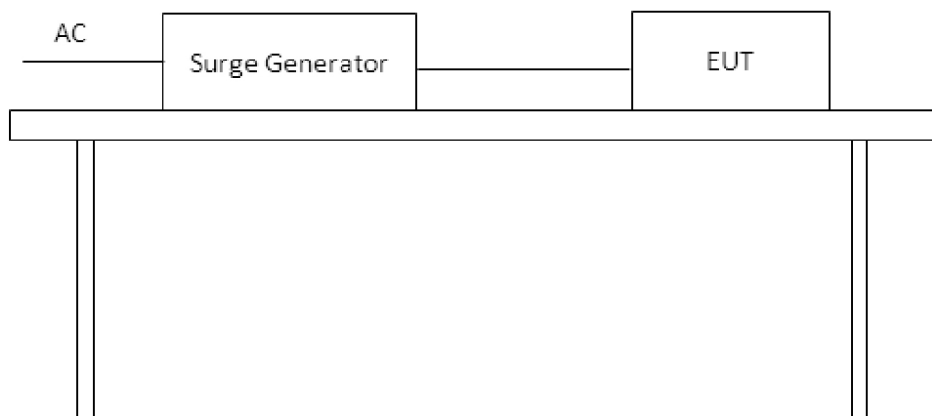
Test Result: Pass

10.4 Surge Immunity Test (EN 61000-4-5)

10.4.1 Test Specification

Basic Standard :	EN 61000-4-5
Test Level:	$\pm 0.5\text{kV}$ (Line to Line) for AC power ports
Wave-Shape:	1.2/50 μs Open Circuit Voltage
Generator Impedance:	42 ohm between signal line and ground 2 ohm between networks
Phase Angle:	90°, 270°
Pulse Repetition Rate:	1 time / min
Number of Tests:	5 positive at 90° and 5 negative at 270°
Temperature:	22~25 (\boxtimes)
Humidity:	45~55 (%RH)
Barometric Pressure:	950~1000 (mbar)
Operating Mode:	On
Test Specification:	AC 230V/50Hz
Start of Test:	10 Nov, 2016

10.4.2 Test Setup



10.4.3 Test Equipment List and Details

Equipment	Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due Date
Surge Generator				2015-12-16	2016-12-15

10.4.4 Test Procedure

1. For EUT power supply:

The surge is applied to the EUT power supply terminals via the capacitive coupling network. Decoupling networks are required in order to avoid possible adverse effects on equipment not under test that may be powered by the same lines, and to provide sufficient decoupling impedance to the surge wave. The power cord between the EUT and the CDN was shorter than 2 meters in length.

2. For test applied to unshielded unsymmetrically operated interconnection lines of EUT: (If applicable)

The surge was applied to the lines via the capacitive coupling. The coupling / decoupling networks didn't influence the specified functional conditions of the EUT. The interconnection line between the EUT and the coupling/decoupling networks was shorter than 2 meters in length.

10.4.5 Performance Criterion Required & Test Result

Voltage	Test Points	Observation Performance	Criterion Required
$\pm 0.5\text{kV}$	L-N	A	C
$\pm 1\text{kV}$	L-N	/	/
	L-PE	/	/
	N-PE	/	/
$\pm 2\text{kV}$	L-PE	/	/
	N-PE	/	/

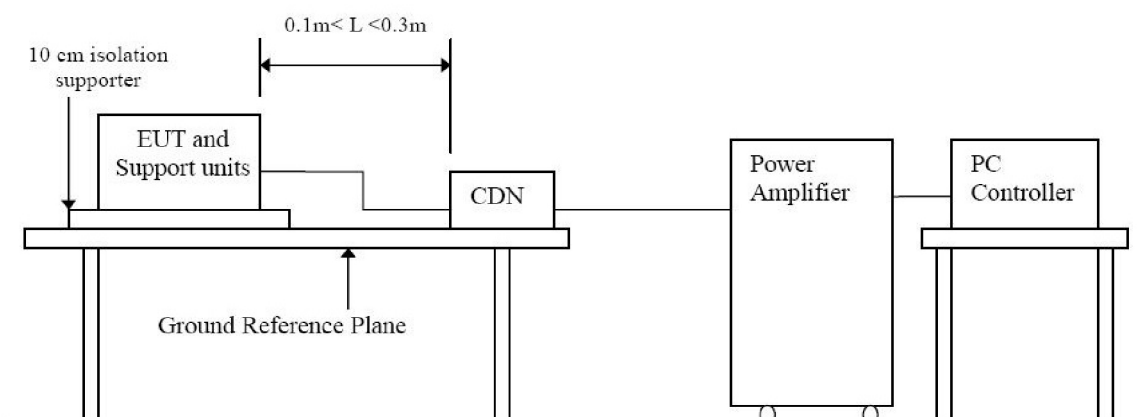
Test Result: Pass

10.5 Conducted Susceptibility Test (EN 61000-4-6)

10.5.1 Test Specification

Basic Standard:	EN 61000-4-6
Test Level:	3Vr.m.s
Frequency Range:	0.15~80MHz (MHz)
Modulation:	Amplitude 80%, 1kHz sinewave
Frequency Step:	1 % of preceding frequency value
Temperature:	22~25 (°)
Humidity:	45~50 (%RH)
Barometric Pressure:	950~1000 (mbar)
Operating Mode:	On
Test Specification:	AC 230V/50Hz
Start of Test:	10 Nov, 2016

10.5.2 Test Setup



10.5.3 Test Equipment List and Details

Equipment	Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due Date
RF POWER AMPLIFIER				2016-4-25	2017-4-24
CDN				2016-4-25	2017-4-24
6DB Attenuator				2016-4-25	2017-4-24
EM Injection clamp				2016-4-25	2017-4-24

10.5.4 Test Procedure

1. The test was performed with the test generator connected to each of the coupling and decoupling devices in turn, while the other non-excited RF input ports of the coupling devices are terminated by a 50-ohm load resistor.
2. The frequency range was swept from 150 kHz to 80 MHz, using the signal level established during the setting process and with a disturbance signal of 80 % amplitude. The signal was modulated with a 1 kHz sine wave, pausing to adjust the RF signal level or the switch

coupling devices as necessary. The sweep rate was 1.5×10^{-3} decades/s. Where the frequency range is swept incrementally, the step size was 1 % of preceding frequency value from 150 kHz to 80 MHz.

3. The dwell time at each frequency was less than the time necessary for the EUT to be exercised, and able to respond. Sensitive frequencies such as clock frequency(ies) and harmonics or frequencies of dominant interest, was analyzed separately.
4. Attempts were made to fully exercise the EUT during testing, and to fully interrogate all exercise modes selected for susceptibility.

10.5.5 Performance Criterion Required & Test Result

Frequency Band (MHz)	Voltage (V_{rms})	Test Points	Observation Performance	Criterion Required
0.15-80	3	L-N	A	A

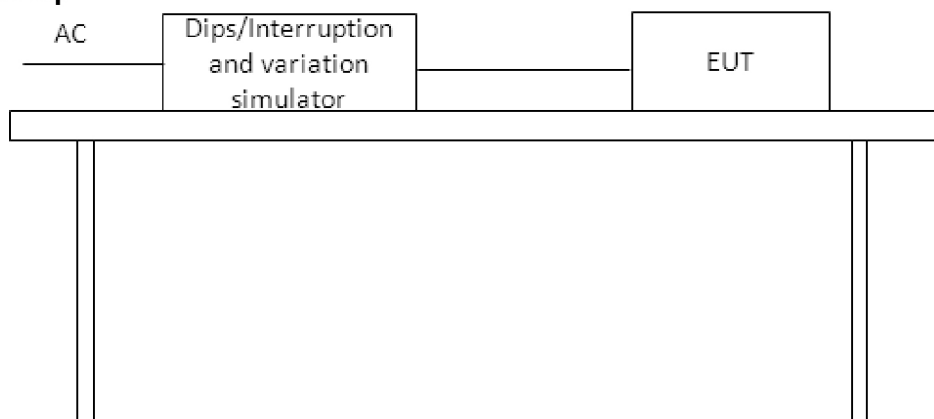
Test Result: Pass

10.6 Voltage Dips, Short Interruptions Immunity Tests (EN 61000-4-11)

10.6.1 Test Specification

Basic Standard:	EN 61000-4-11
Test Level:	0% residual voltage for 0.5 cycle 70% residual voltage for 10 cycles
Interval between event:	10 seconds
Phase Angle:	0°/180°
Test cycle:	3 times
Temperature:	22~25 (°)
Humidity:	45~50(%RH)
Barometric Pressure:	950~1000 (mbar)
Operating Mode:	On
Test Specification:	AC 230V/50Hz
Start of Test:	10 Nov, 2016

10.6.2 Test Setup



10.6.3 Test Equipment List and Details

Equipment	Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due Date
Voltage Dips and Interruptions Generator				2015-12-16	2016-12-15

10.6.4 Test Procedure


The EUT was tested for each selected combination of test levels and duration with a sequence of 3 dips/interruptions with intervals of 10s (between each test event). Each representative mode of operation shall be tested. Abrupt changes in supply voltage shall occur at zero crossings of the voltage waveform.

10.6.5 Performance Criterion Required & Test Result

Voltage (% Residual)	Duration (Period)	Observation Performance	Criterion Required
0	0.5	A	B
70	10	A	C

Test Result: Pass

APPENDIX A - EUT PHOTOGRAPHS

<p>EUT view</p> <p>Whole view</p> <p><input type="checkbox"/> Front</p> <p><input type="checkbox"/> Rear</p> <p><input type="checkbox"/> Right Side</p> <p><input type="checkbox"/> Left Side</p> <p><input checked="" type="checkbox"/> Top</p> <p><input type="checkbox"/> Bottom</p> <p><input type="checkbox"/> Internal</p>	
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<p>EUT view</p> <p>Internal view</p> <p><input type="checkbox"/> Front</p> <p><input type="checkbox"/> Rear</p> <p><input type="checkbox"/> Right Side</p> <p><input type="checkbox"/> Left Side</p> <p><input type="checkbox"/> Top</p> <p><input type="checkbox"/> Bottom</p> <p><input checked="" type="checkbox"/> Internal</p>	
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APPENDIX B - TEST SETUP PHOTOGRAPHS

Conducted Emission



Radiated Electromagnetic Disturbance



Radiated Disturbances



Harmonic Current & Voltage Fluctuations and Flicker Test (EN61000-3-2/3)



Electromagnetic field Test Setup



Electrostatic Discharge Immunity Test (EN 61000-4-2)



Electrical Fast Transient/Burst Immunity Test For AC (EN 61000-4-4)



Electrical Fast Transient/Burst Immunity Test For DC (EN 61000-4-4)



Surge Immunity Test (EN 61000-4-5)



Voltage Dips, Short Interruptions Immunity Test (EN 61000-4-11)



---- End of Report ----