Certificate

Issue Date: December 13, 2017
Ref. Report No. ISL-17LE733MEE-MA

Product Name	:	THM 15/THM 20 Series
Model(s)	:	THM 15-2411WI; THM 20-2411WI (See next page model difference for details)
Trade Mark	:	TRACO POWER
Responsible Party	:	TRACO ELECTRONIC AG
Address	:	Sihlbruggstrasse 111 CH-6340 Baar Switzerland,
Manufacturer	:	TRACO ELECTRONIC AG
Address	:	Sihlbruggstrasse 111 CH-6340 Baar Switzerland

We, **International Standards Laboratory**, hereby certify that:

The device bearing the trade name and model specified above has been shown to comply with the applicable technical standards as indicated in the measurement report and was tested in accordance with the measurement procedures specified in EUROPEAN COUNCIL DIRECTIVE 93/42/EEC. The device was passed the test performed according to :

Standards:

EN 55011:2009+ A1:2010, CISPR11:2009+A1:2010: Class B: Industrial, scientific and medical equipment Radio frequency disturbance characteristics Limits and methods of measurement.
AS/NZS CISPR 11:2011: Class B: Industrial, scientific and medical equipment– Radio-frequency disturbance characteristics-Limits and methods of measurement
EN 60601-1-2:2015: Medical electrical equipment – Part 1-2: General requirements for basic safety and essential performance – Collateral Standard: Electromagnetic disturbances – Requirements and tests.

I attest to the accuracy of data and all measurements reported herein were performed by me or were made under my supervision and are correct to the best of my knowledge and belief. I assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them.

International Standards Laboratory

Bert Chen / Director

☐ **Hsi-Chih LAB**:
No. 65, Gu Dai Keng Street, Hsi-Chih Dist.,
New Taipei City 221, Taiwan
Tel: 886-2-2646-2550; Fax: 886-2-2646-4641

☒ **Lung-Tan LAB**:
No. 120, Lane 180, Hsin Ho Rd., Lung-Tan Dist.,
Tao Yuan City 325, Taiwan
Tel: 886-3-407-1718; Fax: 886-3-407-1738

Model Number	Input Range	Output Voltage	Output Current @Full Load
	VDC	VDC	mA
THM 15-1211	9 ~ 18	5	3000
THM 15-1212	9 ~ 18	12	1250
THM 15-1213	9 ~ 18	15	1000
THM 15-1215	9 ~ 18	24	625
THM 15-1221	9 ~ 18	±5	±1500
THM 15-1222	9 ~ 18	±12	±625
THM 15-1223	9 ~ 18	±15	±500
THM 15-2411	18 ~ 36	5	3000
THM 15-2412	18 ~ 36	12	1250
THM 15-2413	18 ~ 36	15	1000
THM 15-2415	18 ~ 36	24	625
THM 15-2421	18 ~ 36	±5	±1500
THM 15-2422	18 ~ 36	±12	±625
THM 15-2423	18 ~ 36	±15	±500
THM 15-4811	36 ~ 75	5	3000
THM 15-4812	36 ~ 75	12	1250
THM 15-4813	36 ~ 75	15	1000
THM 15-4815	36 ~ 75	24	625
THM 15-4821	36 ~ 75	±5	±1500
THM 15-4822	36 ~ 75	±12	±625
THM 15-4823	36 ~ 75	±15	±500
THM 15-2411WI	9 ~ 36	5	3000
THM 15-2412WI	9 ~ 36	12	1250
THM 15-2413WI	9 ~ 36	15	1000
THM 15-2415WI	9 ~ 36	24	625
THM 15-2421WI	9 ~ 36	±5	±1500
THM 15-2422WI	9 ~ 36	±12	±625
THM 15-2423WI	9 ~ 36	±15	±500
THM 15-4811WI	18 ~ 75	5	3000
THM 15-4812WI	18 ~ 75	12	1250
THM 15-4813WI	18 ~ 75	15	1000
THM 15-4815WI	18 ~ 75	24	625
THM 15-4821WI	18 ~ 75	±5	±1500
THM 15-4822WI	18 ~ 75	±12	±625
THM 15-4823WI	18 ~ 75	±15	±500
THM 15-12S10	9 ~ 18	10	1500
THM 15-1214	9 ~ 18	18	833
THM 15-24S10	18 ~ 36	10	1500
THM 15-2414	18 ~ 36	18	833
THM 15-48S10	36 ~ 75	10	1500
THM 15-4814	36 ~ 75	18	833
THM 15-24S10WI	9 ~ 36	10	1500
THM 15-2414WI	9 ~ 36	18	833
THM 15-48S10WI	18 ~ 75	10	1500
THM 15-4814WI	18 ~ 75	18	833

Model Number	Input Range	Output Voltage	Output Current @Full Load
	VDC	VDC	mA
THM 20-1211	9 ~ 18	5	4000
THM 20-1212	9 ~ 18	12	1670
THM 20-1213	9 ~ 18	15	1330
THM 20-1215	9 ~ 18	24	833
THM 20-1221	9 ~ 18	±5	±2000
THM 20-1222	9 ~ 18	±12	±833
THM 20-1223	9 ~ 18	±15	±667
THM 20-2411	18 ~ 36	5	4000
THM 20-2412	18 ~ 36	12	1670
THM 20-2413	18 ~ 36	15	1330
THM 20-2415	18 ~ 36	24	833
THM 20-2421	18 ~ 36	±5	±2000
THM 20-2422	18 ~ 36	±12	±833
THM 20-2423	18 ~ 36	±15	±667
THM 20-4811	36 ~ 75	5	4000
THM 20-4812	36 ~ 75	12	1670
THM 20-4813	36 ~ 75	15	1330
THM 20-4815	36 ~ 75	24	833
THM 20-4821	36 ~ 75	±5	±2000
THM 20-4822	36 ~ 75	±12	±833
THM 20-4823	36 ~ 75	±15	±667
THM 20-2411WI	9 ~ 36	5	4000
THM 20-2412WI	9 ~ 36	12	1670
THM 20-2413WI	9 ~ 36	15	1330
THM 20-2415WI	9 ~ 36	24	833
THM 20-2421WI	9 ~ 36	±5	±2000
THM 20-2422WI	9 ~ 36	±12	±833
THM 20-2423WI	9 ~ 36	±15	±667
THM 20-4811WI	18 ~ 75	5	4000
THM 20-4812WI	18 ~ 75	12	1670
THM 20-4813WI	18 ~ 75	15	1330
THM 20-4815WI	18 ~ 75	24	833
THM 20-4821WI	18 ~ 75	±5	±2000
THM 20-4822WI	18 ~ 75	±12	±833
THM 20-4823WI	18 ~ 75	±15	±667
THM 20-12S10	9 ~ 18	10	2000
THM 20-1214	9 ~ 18	18	1110
THM 20-24S10	18 ~ 36	10	2000
THM 20-2414	18 ~ 36	18	1110
THM 20-48S10	36 ~ 75	10	2000
THM 20-4814	36 ~ 75	18	1110
THM 20-24S10WI	9 ~ 36	10	2000
THM 20-2414WI	9 ~ 36	18	1110
THM 20-48S10WI	18 ~ 75	10	2000
THM 20-4814WI	18 ~ 75	18	1110

CE MARK TECHNICAL FILE

AS/NZS EMC CONSTRUCTION FILE

of

Product Name

THM 15/THM 20 Series

Model

THM 15-2411WI; THM 20-2411WI (more serial models listed on1.2 of this test report)

Trade Mark

Contains:

1. Declaration of Conformity
2. EN55011/CISPR 11/ AS/NZS CISPR 11EMI test report
3. EN60601-1-2, EN61000-3-2, and EN61000-3-3 test report
4. Block Diagram and Schematics
5. Users' manual

Declaration of Conformity

Name of Responsible Party:	TRACO ELECTRONIC AG
Address of Responsible Party:	Sihlbruggstrasse 111 CH-6340 Baar Switzerland
Declares that product:	THM 15/THM 20 Series
Model:	THM 15-2411WI; THM 20-2411WI (more serial models listed on1.2 of this test report)
Trade Mark:	TRACO POWER
Manufacturer:	TRACO ELECTRONIC AG
Address:	Sihlbruggstrasse 111 CH-6340 Baar Switzerland

Conforms to the EMC Directive 93/42/EEC as attested by conformity with the following harmonized standards:

EN 55011:2009+ A1:2010, CISPR11:2009+A1:2010: Class B: Industrial, scientific and medical equipment Radio frequency disturbance characteristics Limits and methods of measurement.
AS/NZS CISPR 11:2011: Class B: Industrial, scientific and medical equipment– Radio-frequency disturbance characteristics-Limits and methods of measurement
EN 60601-1-2:2015: Medical electrical equipment – Part 1-2: General requirements for basic safety and essential performance – Collateral Standard: Electromagnetic disturbances – Requirements and tests.

Standard	Description	Results	Criteria
EN 61000-4-2:2009 IEC 61000-4-2:2008	Electrostatic Discharge	Pass	Compliance
EN 61000-4-3:2006+A1:2008 +A2:2010 IEC 61000-4-3:2006+A1:2007+A2:2010	Radio-Frequency, Electromagnetic Field	Pass	Compliance
EN 61000-4-4:2012 IEC 61000-4-4:2012	Electrical Fast Transient/Burst	Pass	Compliance
EN 61000-4-5:2014 IEC 61000-4-5:2014	Surge	Pass	Compliance
EN 61000-4-6:2014+AC:2015 IEC 61000-4-6:2013	Conductive Disturbance	Pass	Compliance
EN 61000-4-8:2010 IEC 61000-4-8:2009	Power Frequency Magnetic Field	Pass	Compliance

<to be continued>

We, TRACO ELECTRONIC AG, hereby declare that the equipment bearing the trade name and model number specified above was tested conforming to the applicable Rules under the most accurate measurement standards possible, and that all the necessary steps have been taken and are in force to assure that production units of the same equipment will continue to comply with the requirements.

TRACO ELECTRONIC AG

Date: December 13, 2017

Declaration of Conformity

Name of Responsible Party:	TRACO ELECTRONIC AG
Address of Responsible Party:	Sihlbruggstrasse 111 CH-6340 Baar Switzerland
Declares that product:	THM 15/THM 20 Series
Model:	THM 15-2411WI; THM 20-2411WI (more serial models listed on1.2 of this test report)
Trade Mark:	TRACO POWER
Manufacturer:	TRACO ELECTRONIC AG
Address:	Sihlbruggstrasse 111 CH-6340 Baar Switzerland

Conforms to the EMI part of RCM Mark requirements as attested by conformity with the following standards:

AS/NZS CISPR 11:2011: Class B: Industrial, scientific and medical equipment– Radio-frequency disturbance characteristics-Limits and methods of measurement

We, TRACO ELECTRONIC AG, hereby declare that the equipment bearing the trade name and model number specified above was tested conforming to the applicable Rules under the most accurate measurement standards possible, and that all the necessary steps have been taken and are in force to assure that production units of the same equipment will continue to comply with the requirements.

TRACO ELECTRONIC AG

Date: December 13, 2017

CE TEST REPORT

of

EN55011/CISPR11 Class B
EN60601-1-2 / IMMUNITY

Product : **THM 15/THM 20 Series**

Model(s): **THM 15-2411WI; THM 20-2411WI**

(more serial models listed on1.2 of this test report)

Trade Mark : TRACO POWER

Applicant: **TRACO ELECTRONIC AG**

Address: **Sihlbruggstrasse 111 CH-6340 Baar Switzerland**

Manufacturer: **TRACO ELECTRONIC AG**

Address: **Sihlbruggstrasse 111 CH-6340 Baar Switzerland**

Test Performed by:

International Standards Laboratory
<Lung-Tan LAB>
*Address:
No. 120, Lane 180, Hsin Ho Rd.,
Lung-Tan Dist., Tao Yuan City 325, Taiwan
*Tel: 886-3-407-1718; Fax: 886-3-407-1738

Report No.: **ISL-17LE733MEE-MA**
Issue Date : **December 13, 2017**

This report totally contains 58 pages including this cover page and contents page.

Contents of Report

1. General

1.1 Certification of Accuracy of Test Data

Standards:	Please refer to 1.2
Equipment Tested:	THM 15/THM 20 Series
Model:	THM 15-2411WI; THM 20-2411WI (more serial models listed on1.2 of this test report)
Trade Mark:	TRACO POWER
Applicant:	TRACO ELECTRONIC AG
Manufacturer:	TRACO ELECTRONIC AG
Sample received Date:	October 18, 2017
Final test Date:	EMI:refer to the date of test data EMS: November 23, 2017
Test Site:	International Standards Laboratory Chamber 12; Conduction 02; Immunity02
Test Distance:	10M (EMI test)
Temperature:	refer to each site test data
Humidity:	refer to each site test data
Atmospheric Pressure:	86 kPa to 106 kPa
Input power:	Conduction input power: DC 24V Radiation input power: DC 24V Immunity input power: DC 24V
Test Result:	**PASS**
Report Engineer:	Jayla Lu
Test Engineer:	Sawyer chiang Sawyer Chiang
Approved By:	Angus Chu Angus Chu / Director

1.2 Model Number Definition

There is more than one model number for this product, please refer the details listed below:

Model Number	Input Range	Output Voltage	Output Current @Full Load
	VDC	VDC	mA
THM 15-1211	9 ~ 18	5	3000
THM 15-1212	9 ~ 18	12	1250
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THM 15-1215	9 ~ 18	24	625
THM 15-1221	9 ~ 18	±5	±1500
THM 15-1222	9 ~ 18	±12	±625
THM 15-1223	9 ~ 18	±15	±500
THM 15-2411	18 ~ 36	5	3000
THM 15-2412	18 ~ 36	12	1250
THM 15-2413	18 ~ 36	15	1000
THM 15-2415	18 ~ 36	24	625
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THM 15-4813	36 ~ 75	15	1000
THM 15-4815	36 ~ 75	24	625
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THM 15-4822	36 ~ 75	±12	±625
THM 15-4823	36 ~ 75	±15	±500
THM 15-2411WI	9 ~ 36	5	3000
THM 15-2412WI	9 ~ 36	12	1250
THM 15-2413WI	9 ~ 36	15	1000
THM 15-2415WI	9 ~ 36	24	625
THM 15-2421WI	9 ~ 36	±5	±1500
THM 15-2422WI	9 ~ 36	±12	±625
THM 15-2423WI	9 ~ 36	±15	±500
THM 15-4811WI	18 ~ 75	5	3000
THM 15-4812WI	18 ~ 75	12	1250
THM 15-4813WI	18 ~ 75	15	1000
THM 15-4815WI	18 ~ 75	24	625
THM 15-4821WI	18 ~ 75	±5	±1500
THM 15-4822WI	18 ~ 75	±12	±625
THM 15-4823WI	18 ~ 75	±15	±500
THM 15-12S10	9 ~ 18	10	1500
THM 15-1214	9 ~ 18	18	833
THM 15-24S10	18 ~ 36	10	1500
THM 15-2414	18 ~ 36	18	833
THM 15-48S10	36 ~ 75	10	1500
THM 15-4814	36 ~ 75	18	833
THM 15-24S10WI	9 ~ 36	10	1500
THM 15-2414WI	9 ~ 36	18	833
THM 15-48S10WI	18 ~ 75	10	1500
THM 15-4814WI	18 ~ 75	18	833

Model Number	Input Range	Output Voltage	Output Current @Full Load
	VDC	VDC	mA
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THM 20-2412	18 ~ 36	12	1670
THM 20-2413	18 ~ 36	15	1330
THM 20-2415	18 ~ 36	24	833
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THM 20-4822WI	18 ~ 75	±12	±833
THM 20-4823WI	18 ~ 75	±15	±667
THM 20-12S10	9 ~ 18	10	2000
THM 20-1214	9 ~ 18	18	1110
THM 20-24S10	18 ~ 36	10	2000
THM 20-2414	18 ~ 36	18	1110
THM 20-48S10	36 ~ 75	10	2000
THM 20-4814	36 ~ 75	18	1110
THM 20-24S10WI	9 ~ 36	10	2000
THM 20-2414WI	9 ~ 36	18	1110
THM 20-48S10WI	18 ~ 75	10	2000
THM 20-4814WI	18 ~ 75	18	1110

1.3 Test Standards

The tests which this report describes were conducted by an independent electromagnetic compatibility consultant, International Standards Laboratory in accordance with the following

EN 55011:2009+ A1:2010, CISPR11:2009+A1:2010: Class B: Industrial, scientific and medical equipment Radio frequency disturbance characteristics Limits and methods of measurement.
AS/NZS CISPR 11:2011: Class B: Industrial, scientific and medical equipment– Radio-frequency disturbance characteristics-Limits and methods of measurement
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Standard	Description	Results	Criteria
EN 61000-4-2:2009 IEC 61000-4-2:2008	Electrostatic Discharge	Pass	Compliance
EN 61000-4-3:2006+A1:2008 +A2:2010 IEC 61000-4-3:2006+A1:2007+A2:2010	Radio-Frequency, Electromagnetic Field	Pass	Compliance
EN 61000-4-4:2012 IEC 61000-4-4:2012	Electrical Fast Transient/Burst	Pass	Compliance
EN 61000-4-5:2014 IEC 61000-4-5:2014	Surge	Pass	Compliance
EN 61000-4-6:2014+AC:2015 IEC 61000-4-6:2013	Conductive Disturbance	Pass	Compliance
EN 61000-4-8:2010 IEC 61000-4-8:2009	Power Frequency Magnetic Field	Pass	Compliance

1.3.1 Performance Criteria for Compliance EN 60601-1-2 (Annex I)

Examples of test failures:

- malfunction;
- non-operation when operation is required;
- unwanted operation when no operation is required;
- deviation from normal operation that poses an unacceptable RISK to the PATIENT or OPERATOR;
- component failures;
- change in programmable parameters;
- reset to factory defaults (MANUFACTURER's presets); – change of operating mode;
- a FALSE POSITIVE ALARM CONDITION;
- a FALSE NEGATIVE ALARM CONDITION (failure to alarm);
- cessation or interruption of any intended operation, even if accompanied by an ALARM SIGNAL;
- initiation of any unintended operation, including unintended or uncontrolled motion, even if accompanied by an ALARM SIGNAL;
- error of a displayed numerical value sufficiently large to affect diagnosis or treatment;
- noise on a waveform in which the noise would interfere with diagnosis, treatment or monitoring;
- artefact or distortion in an image in which the artefact would interfere with diagnosis, treatment or monitoring;
- failure of automatic diagnosis or treatment ME EQUIPMENT or ME SYSTEM to diagnose or treat, even if accompanied by an ALARM SIGNAL.

Example of performance during and after the applied testing stimulus required to pass the test:

- for a mammography system, the compression full release and associated command remains fully operational;
- for ULTRASOUND DIAGNOSTIC EQUIPMENT, the probe heating, dissipative power and temperature shall remain within specifications;
- safety-related functions perform as intended;
- false operation of alarms, "fail safe" modes and similar functions do not occur.
- NOTE This might require performing the test twice
- once to ensure the functions occur as expected and again to ensure they do not occur falsely.

Examples of acceptable degradation:

- an imaging system displays an image that could be altered, but in a way that would not affect the diagnosis or treatment;
- a heart rate monitor displays a heart rate that could be in error, but by an amount that is not clinically significant;
- a PATIENT monitor exhibits a small amount of noise or a transient on a waveform and the noise or transient would not affect diagnosis, treatment or monitoring.

Examples of ME EQUIPMENT and ME SYSTEMS with multiple functions:

- multi-parameter monitors;
- anaesthesia system with monitors; – ventilators with monitors;
- multiple instances of the same function (e.g. multiple invasive blood pressure sensors).

1.4 Description of EUT

EUT

Description	DC/DC Converter
Condition	Pre-Production
Model	THM 15-2411WI; THM 20-2411WI (more serial models listed on1.2 of this test report)
Serial Number	N/A
Highest working frequency:	285kHz
Environment	Professional healthcare facility environment
Classification of equipment	Group 1 equipment

The devices can be installed inside the EUT are listed below:

Model Name	NOM. Input VDC	Output Voltage VDC	Output Current mA
THM 15-2411WI	24	5	3000
THM 20-2411WI	24	5	4000

Test configuration:
For EMI test mode

Configuration	Model Name	NOM. Input VDC	Output Voltage VDC	Outpt Current mA	Class A test board	Class B test board
1	THM 20-2411WI	24	5	4000	Yes	No
2	THM 20-2411WI	24	5	4000	No	Yes

For EMS(Not Include Electrical Fast transients/burst immunity & Surge Immunity) test mode

Configuration	Model Name	NOM. Input VDC	Output Voltage VDC	Output Current mA	Class A test board	With 2pcs of aluminum electrolytic capacitor test board
1	THM 20-2411WI	24	5	4000	Yes	No

For Electrical Fast transients/burst immunity & Surge Immunity test mode

Configuration	Model Name	NOM. Input VDC	Output Voltage VDC	Output Current mA	Class A test board	With 2pcs of aluminum electrolytic capacitor test board
1	THM 20-2411WI	24	5	4000	No	Yes

EMI Noise Source:
Please refer to the technical documents.
EMI Solution:
Please refer to the technical documents.

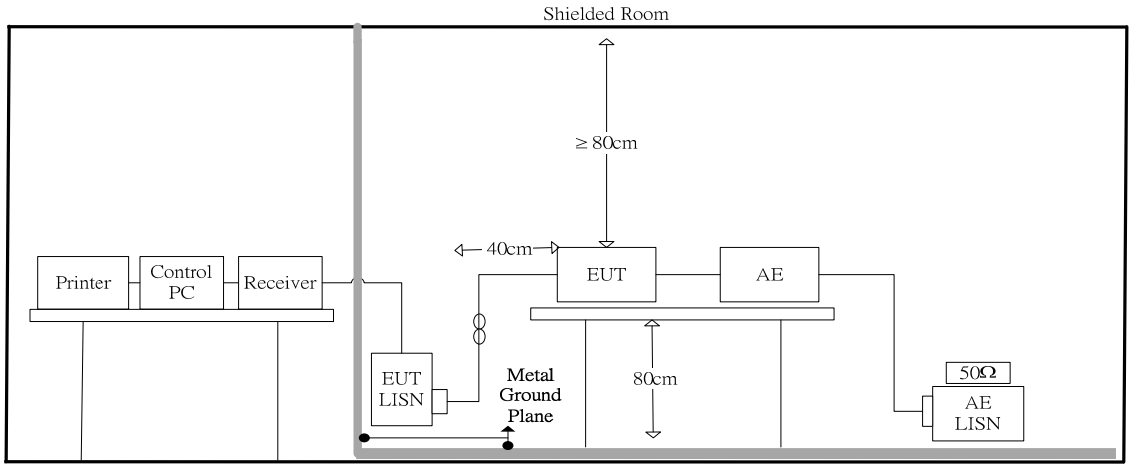
1.5 Description of Support Equipment

No	Unit	Model Serial No.	Brand	Power Cord	FCC ID
1	DC Power Source	GPD-4050D S/N: N/A	GW INSTEK	Non-shielded	FCC DOC
2	Dummy Load	N/A S/N: N/A	N/A	N/A	N/A

2. Power Main Port Conducted Emissions

2.1 Test Setup and Procedure

2.1.1 Test Setup



2.1.2 Test Procedure

The measurements were performed in a shielded room test site. The EUT was placed on non-conduction 1.0m x 1.5m table, which was 0.8 meters above an earth-grounded.

Power to the EUT was provided through the LISN which had the Impedance (50ohm/50uH) vs. Frequency Characteristic in accordance with the standard. Power to the LISNs was filtered to eliminate ambient signal interference and these filters were bonded to the ground plane. Peripheral equipment required to provide a functional system (support equipment) for EUT testing was powered from the second LISN through a ganged, metal power outlet box which was bonded to the ground plane at the LISN.

The interconnecting cables were arranged and moved to get the maximum measurement. Both the line of power cord, hot and neutral, were measured. All of the interfaces cables were manipulated according to EN 55011 requirements.

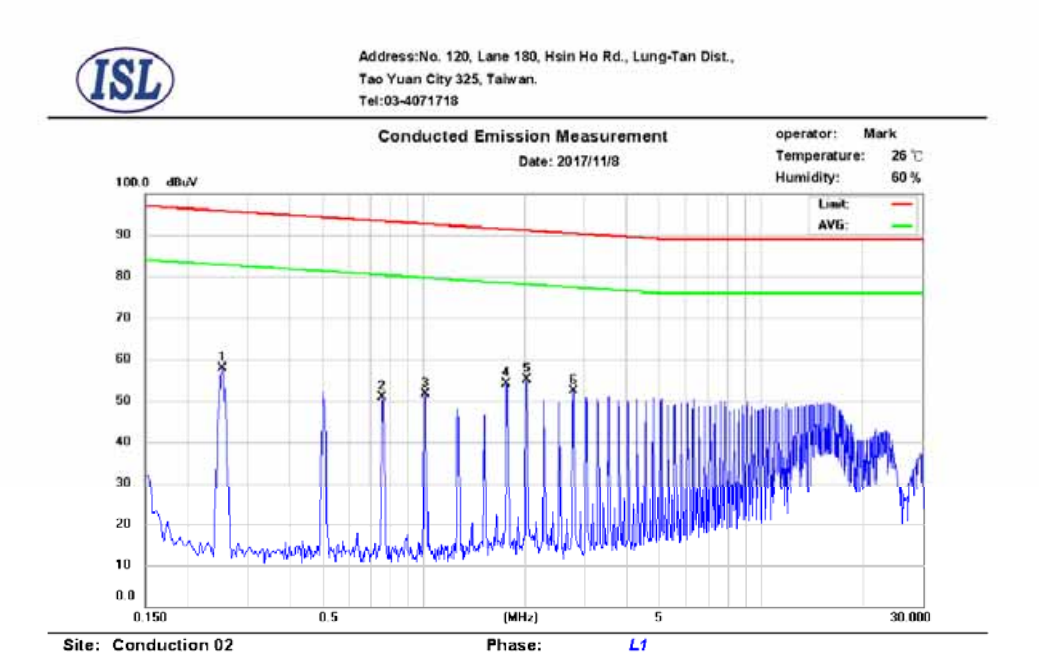
The highest emissions were analyzed in details by operating the spectrum analyzer in fixed tuned mode to determine the nature of the emissions and to provide information which could be useful in reducing their amplitude.

2.1.3 EMI Receiver/Spectrum Analyzer Configuration (for the frequencies tested)

Frequency Range:	150KHz--30MHz
Detector Function:	Quasi-Peak / Average Mode
Resolution Bandwidth:	9KHz

2.2 Conduction Test Data: Configuration 1

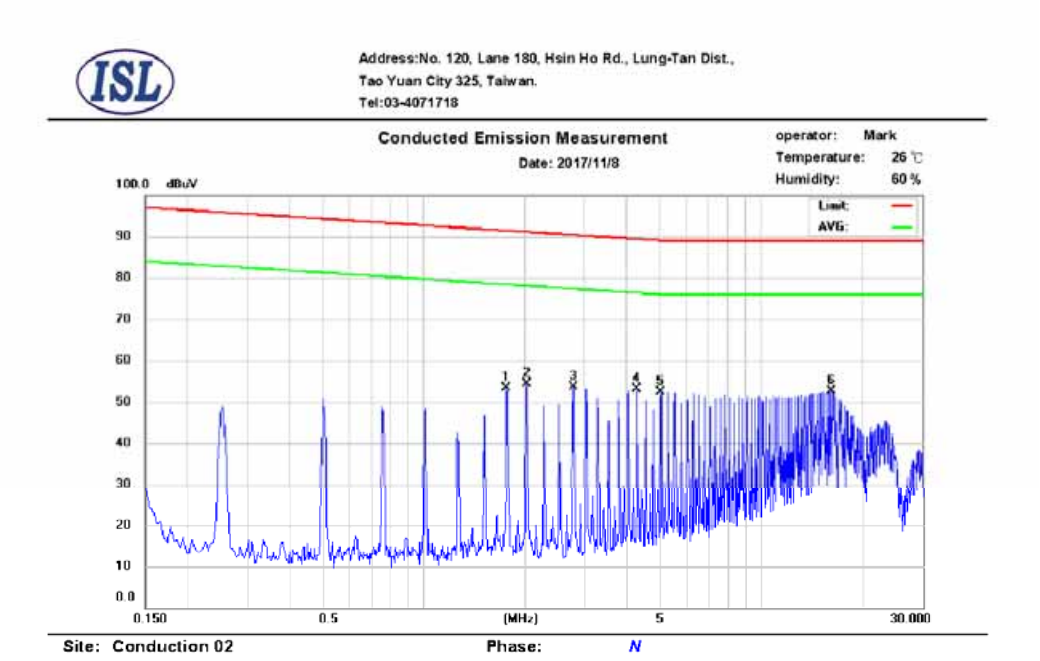
-Line



No.	Frequency (MHz)	QP_R (dBuV)	AVG_R (dBuV)	Correct Factor (dB)	QP Emission (dBuV)	QP Limit (dBuV)	QP Margin (dB)	AVG Emission (dBuV)	AVG Limit (dBuV)	AVG Margin (dB)
1	0.254	47.87	47.03	9.67	57.54	95.80	-38.26	56.70	82.80	-26.10
2	0.758	46.14	38.57	9.69	55.83	93.30	-37.47	48.26	80.30	-32.04
3	1.014	44.57	37.23	9.71	54.28	92.64	-38.36	46.94	79.64	-32.70
4	1.770	44.31	36.50	9.73	54.04	91.37	-37.33	46.23	78.37	-32.14
5	2.026	40.85	34.95	9.73	50.58	91.06	-40.48	44.68	78.06	-33.38
6	2.786	37.16	30.74	9.75	46.91	90.33	-43.42	40.49	77.33	-36.84

Note:
Margin = QP/AVG Emission - Limit
QP/AVG Emission = QP_R/AVG_R + Correct Factor
Correct Factor = LISN Loss + Cable Loss
A margin of -8dB means that the emission is 8dB below the limit
The frequency spectrum graph is for final peak graph, and the attached table is for QP/AVG test result.
If peak data can pass, it will be shown in "QP/AVG Correct" column, if not, QP/AVG data will instead.

- Neutral

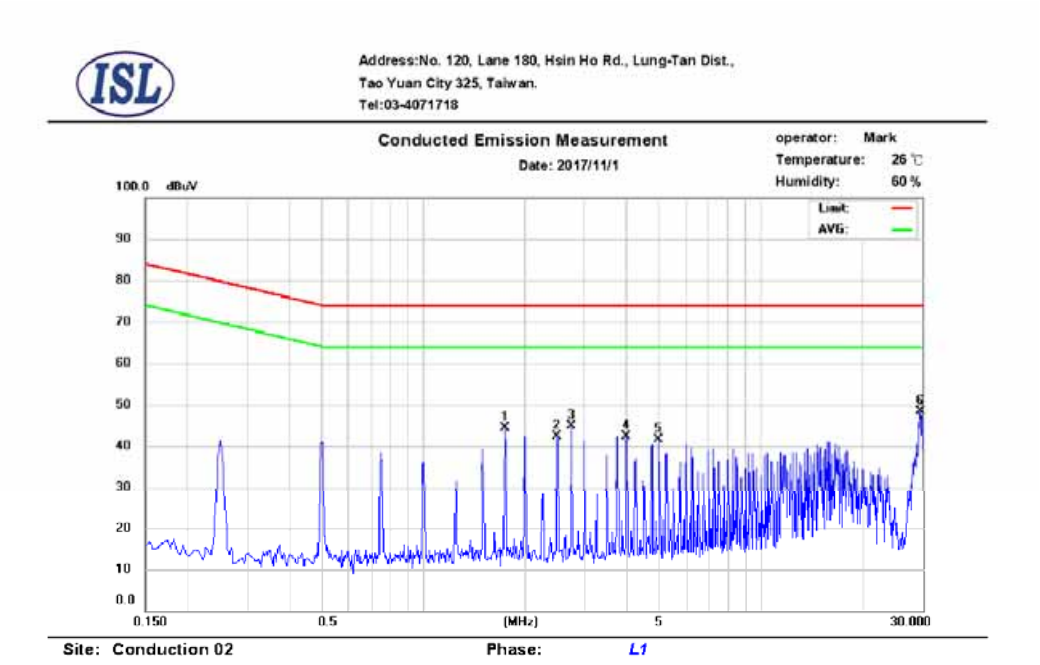


No.	Frequency (MHz)	QP_R (dBuV)	AVG_R (dBuV)	Correct Factor (dB)	QP Emission (dBuV)	QP Limit (dBuV)	QP Margin (dB)	AVG Emission (dBuV)	AVG Limit (dBuV)	AVG Margin (dB)
1	1.770	43.36	42.81	9.77	53.13	91.37	-38.24	52.58	78.37	-25.79
2	2.026	44.09	42.93	9.77	53.86	91.06	-37.20	52.70	78.06	-25.36
3	2.782	43.50	42.35	9.79	53.29	90.34	-37.05	52.14	77.34	-25.20
4	4.302	42.54	40.64	9.82	52.36	89.34	-36.98	50.46	76.34	-25.88
5	5.062	42.41	38.07	9.84	52.25	89.00	-36.75	47.91	76.00	-28.09
6	16.194	37.22	32.37	10.08	47.30	89.00	-41.70	42.45	76.00	-33.55

Note:
Margin = QP/AVG Emission - Limit
QP/AVG Emission = QP_R/AVG_R + Correct Factor
Correct Factor = LISN Loss + Cable Loss
A margin of -8dB means that the emission is 8dB below the limit
The frequency spectrum graph is for final peak graph, and the attached table is for QP/AVG test result.
If peak data can pass, it will be shown in "QP/AVG Correct" column, if not, QP/AVG data will instead.

2.3 Conduction Test Data: Configuration 2

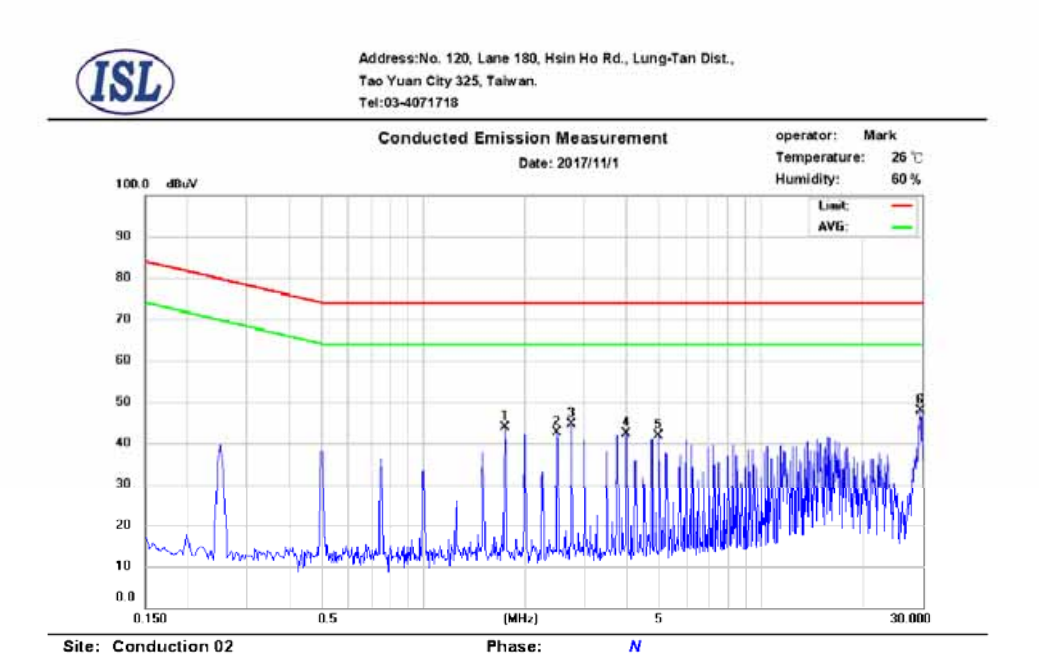
-Line



No.	Frequency (MHz)	QP_R (dBuV)	AVG_R (dBuV)	Correct Factor (dB)	QP Emission (dBuV)	QP Limit (dBuV)	QP Margin (dB)	AVG Emission (dBuV)	AVG Limit (dBuV)	AVG Margin (dB)
1	1.750	34.17	34.42	9.72	43.89	74.00	-30.11	44.14	64.00	-19.86
2	2.498	32.38	32.61	9.74	42.12	74.00	-31.88	42.35	64.00	-21.65
3	2.750	34.60	34.80	9.75	44.35	74.00	-29.65	44.55	64.00	-19.45
4	3.998	32.26	32.51	9.78	42.04	74.00	-31.96	42.29	64.00	-21.71
5	4.998	31.48	31.71	9.80	41.28	74.00	-32.72	41.51	64.00	-22.49
6	29.742	36.82	32.15	10.15	46.97	74.00	-27.03	42.30	64.00	-21.70

Note:
Margin = QP/AVG Emission - Limit
QP/AVG Emission = QP_R/AVG_R + Correct Factor
Correct Factor = LISN Loss + Cable Loss
A margin of -8dB means that the emission is 8dB below the limit
The frequency spectrum graph is for final peak graph, and the attached table is for QP/AVG test result.
If peak data can pass, it will be shown in "QP/AVG Correct" column, if not, QP/AVG data will instead.

- Neutral



No.	Frequency (MHz)	QP_R (dBuV)	AVG_R (dBuV)	Correct Factor (dB)	QP Emission (dBuV)	QP Limit (dBuV)	QP Margin (dB)	AVG Emission (dBuV)	AVG Limit (dBuV)	AVG Margin (dB)
1	1.750	33.50	33.78	9.76	43.26	74.00	-30.74	43.54	64.00	-20.46
2	2.498	32.52	32.75	9.78	42.30	74.00	-31.70	42.53	64.00	-21.47
3	2.750	34.54	34.71	9.79	44.33	74.00	-29.67	44.50	64.00	-19.50
4	3.998	32.09	32.34	9.82	41.91	74.00	-32.09	42.16	64.00	-21.84
5	4.998	31.69	31.88	9.84	41.53	74.00	-32.47	41.72	64.00	-22.28
6	29.734	36.47	34.97	10.25	46.72	74.00	-27.28	45.22	64.00	-18.78

Note:
Margin = QP/AVG Emission - Limit
QP/AVG Emission = QP_R/AVG_R + Correct Factor
Correct Factor = LISN Loss + Cable Loss
A margin of -8dB means that the emission is 8dB below the limit
The frequency spectrum graph is for final peak graph, and the attached table is for QP/AVG test result.
If peak data can pass, it will be shown in "QP/AVG Correct" column, if not, QP/AVG data will instead.

2.4 Test Setup Photo

Configuration 1

Front View

Back View

Configuration 2

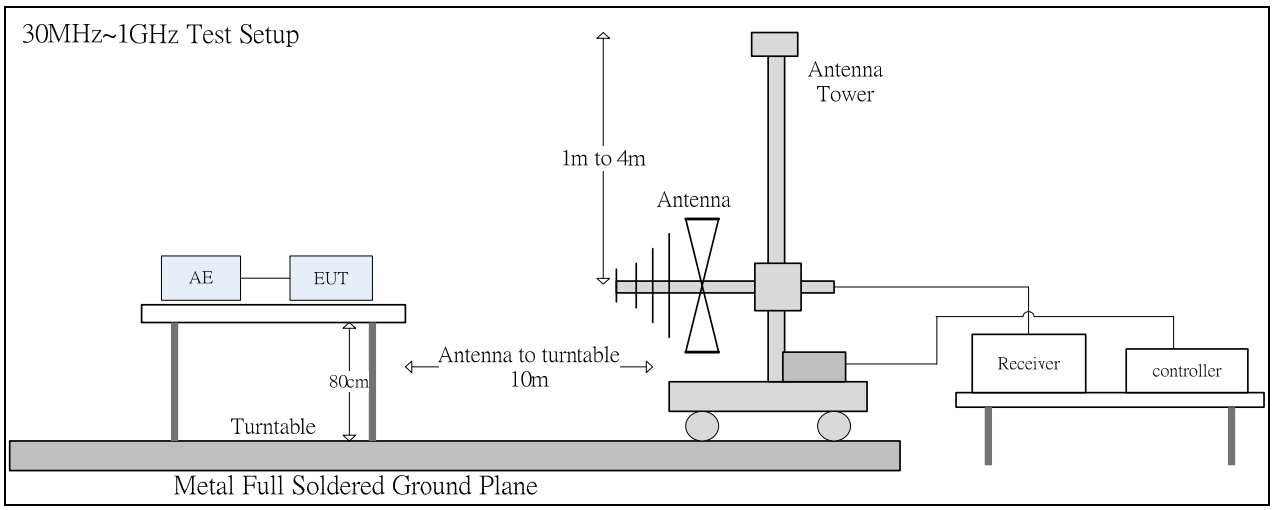
Front View

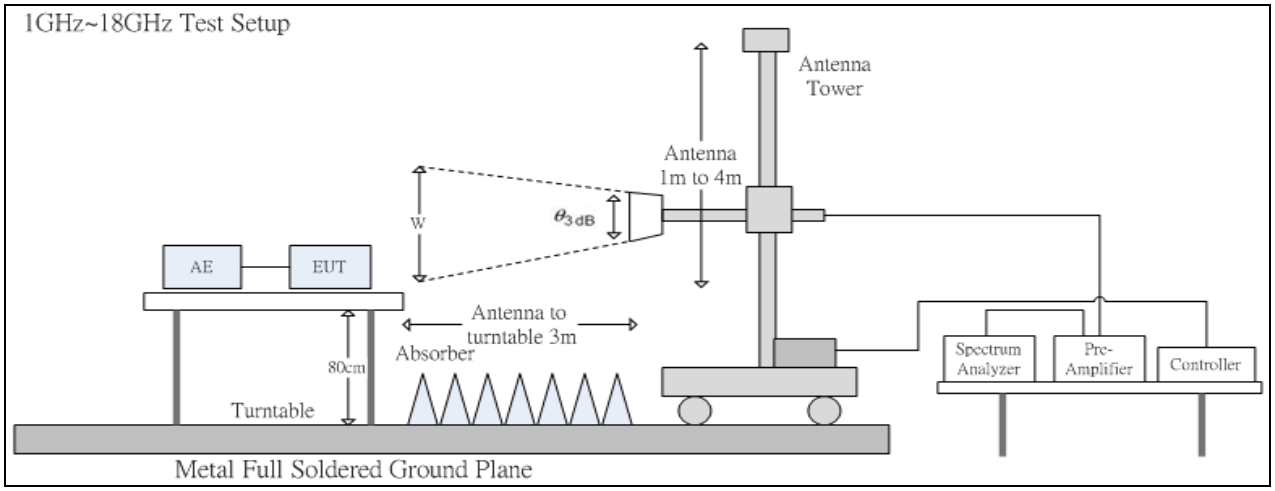
Back View

3. Radiated Disturbance Emissions

3.1 Test Setup and Procedure

3.1.1 Test Setup





The 3dB beam width of the horn antenna used for the test is as shown in the table below.

Frequency GHz	E-plane	H-plane	$\theta_{3\,dB}$ (min)	d= 3 m
				w (m)
1	88°	147°	88°	5.79
2	68°	119°	68°	4.04
3	73°	92°	73°	4.44
4	70°	89°	70°	4.20
5	55°	60°	55°	3.12
6	63°	62°	62°	3.60
7	48°	49°	48°	2.67
8	39°	46°	39°	2.12
9	32°	42°	32°	1.72
10	30°	39	30°	1.61
11	32°	35°	32°	1.72
12	35°	32°	35°	1.89
13	34°	31°	31°	1.66
14	32°	27°	27°	1.44
15	36°	26°	26°	1.39
16	40°	28°	28°	1.50
17	43°	26°	26°	1.39
18	41°	22°	22°	1.17

3.1.2 Test Procedure

The radiated emissions test will then be repeated on the open site or chamber to measure the amplitudes accurately and without the multiple reflections existing in the shielded room. The EUT and support equipment are set up on the turntable of one of 10 meter open field sites or 10 meter chamber. Desktop EUT are set up on a wooden stand 0.8 meter above the ground or floor-standing arrangement shall be placed on the horizontal ground reference plane. The test volume for a height of up to 30 cm may be obstructed by absorber placed on the ground plane.

For the initial measurements, the receiving antenna is varied from 1-4 meter height and is changed in the vertical plane from vertical to horizontal polarization at each frequency. The highest emissions between 30 MHz to 1000 MHz were analyzed in details by operating the spectrum analyzer and/or EMI receiver in quasi-peak mode to determine the precise amplitude of the emissions. The highest emissions between 1 GHz to 18 GHz were analyzed in details by operating the spectrum analyzer in peak and average mode to determine the precise amplitude of the emissions.

At the highest amplitudes observed, the EUT is rotated in the horizontal plane while changing the antenna polarization in the vertical plane to maximize the reading. The interconnecting cables were arranged and moved to get the maximum measurement. Once the maximum reading is obtained, the antenna elevation and polarization will be varied between specified limits to maximize the readings. All of the interfaces cables were manipulated according to EN 55011 requirements.

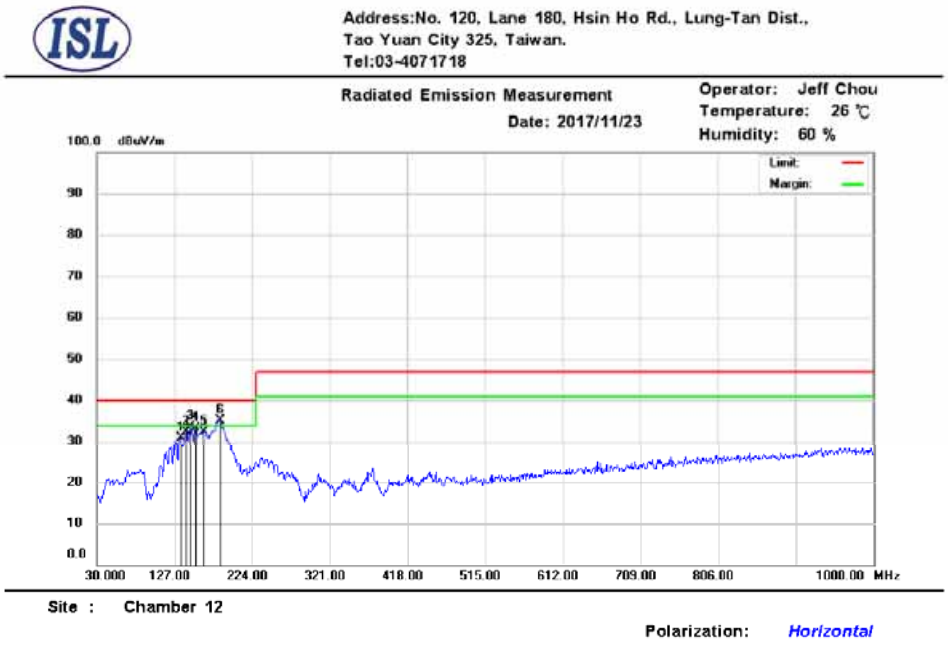
The highest internal source of an EUT is defined as the highest frequency generated or used within the EUT or on which the EUT operates or tunes. If the highest frequency of the internal sources of the EUT is less than 108 MHz, the measurement shall only be made up to 1 GHz. If the highest frequency of the internal sources of the EUT is between 108 MHz and 500 MHz, the measurement shall only be made up to 2 GHz. If the highest frequency of the internal sources of the EUT is between 500 MHz and 1 GHz, the measurement shall only be made up to 5 GHz. If the highest frequency of the internal sources of the EUT is above 1 GHz, the measurement shall be made up to 5 times the highest frequency or 18 GHz, whichever is less.

3.1.3 Spectrum Analyzer Configuration (for the frequencies tested)

Frequency Range:	30MHz--1000MHz
Detector Function:	Quasi-Peak Mode
Resolution Bandwidth:	120KHz

Frequency Range:	Above 1 GHz to 18 GHz
Detector Function:	Peak/Average Mode
Resolution Bandwidth:	1MHz

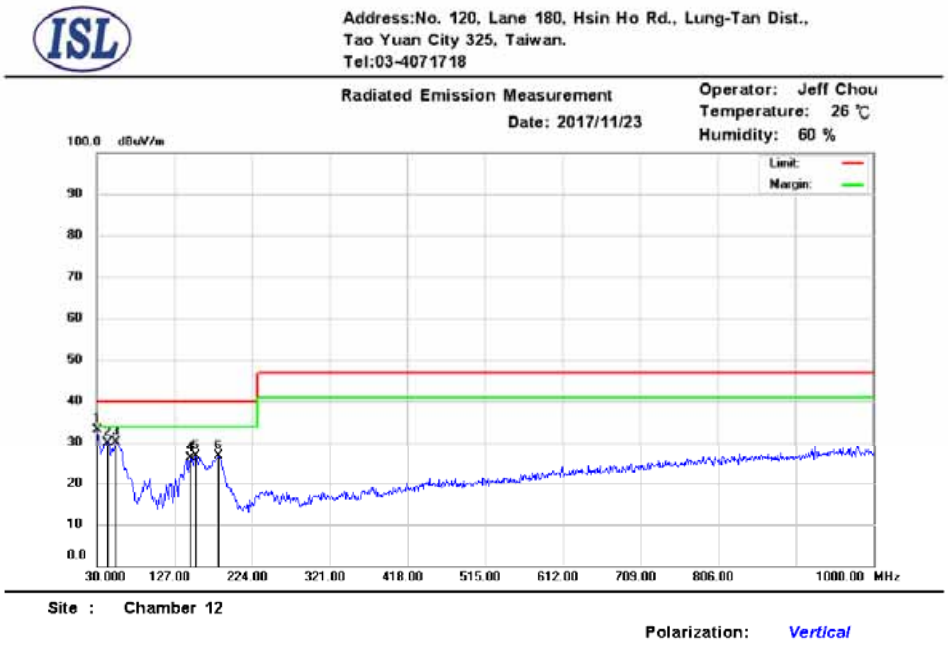
3.2 Radiation Test Data: Configuration 1
- Radiated Emissions (Horizontal)



Mk.	Frequency (MHz)	RX_R (dBuV)	Correct Factor(dB/m)	Emission (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Ant.Pos (cm)	Tab.Pos (deg.)	Detector
1	134.76	48.08	-17.08	31.00	40.00	-9.00	100	8	peak
2	141.55	48.83	-16.45	32.38	40.00	-7.62	304	190	peak
3	147.37	49.69	-16.09	33.60	40.00	-6.40	100	242	peak
4	153.19	49.28	-15.86	33.42	40.00	-6.58	341	332	peak
5	163.86	48.28	-15.82	32.46	40.00	-7.54	256	242	peak
6	184.23	52.62	-17.57	35.05	40.00	-4.95	301	41	peak

* Note:
Margin = Emission – Limit
Emission = Radiated Amplitude + Correct Factor
Correct Factor = Antenna Correction Factor + Cable Loss – Pre-Amplifier Gain
A margin of -8dB means that the emission is 8dB below the limit
BILOG Antenna Distance: 10 meters
Below 1GHz test, if the peak measured value meets the QP limit, it is unnecessary to perform the QP measurement.

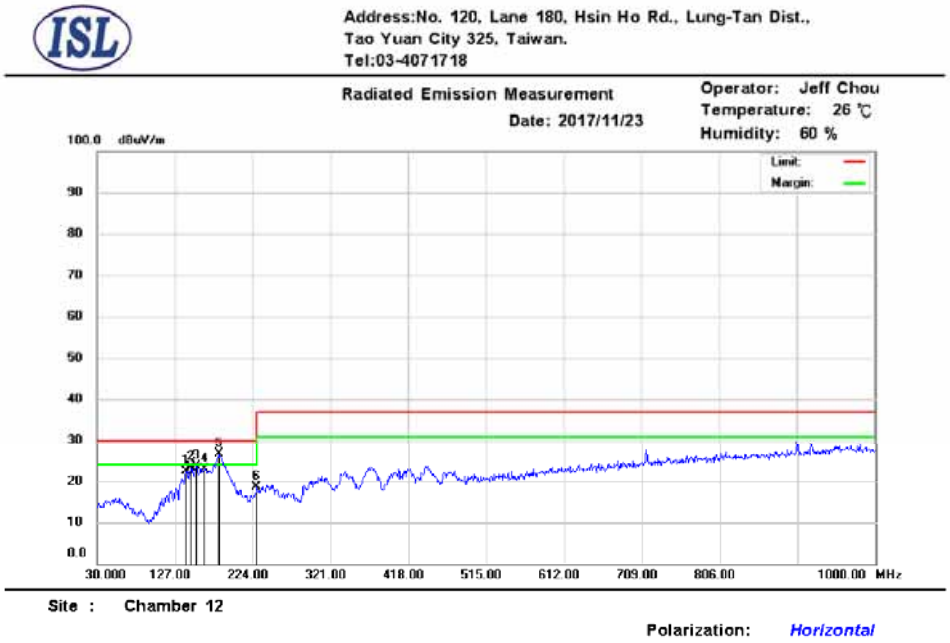
- Radiated Emissions (Vertical)



Mk.	Frequency (MHz)	RX_R (dBuV)	Correct Factor(dB/m)	Emission (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Ant.Pos (cm)	Tab.Pos (deg.)	Detector
1	30.00	51.95	-18.79	33.16	40.00	-6.84	336	294	peak
2	43.58	47.21	-17.26	29.95	40.00	-10.05	207	335	peak
3	54.25	47.21	-17.09	30.12	40.00	-9.88	388	10	peak
4	147.37	42.28	-16.09	26.19	40.00	-13.81	100	10	peak
5	153.19	42.52	-15.86	26.66	40.00	-13.34	110	211	peak
6	182.29	44.01	-17.35	26.66	40.00	-13.34	210	324	peak

* Note:
Margin = Emission – Limit
Emission = Radiated Amplitude + Correct Factor
Correct Factor = Antenna Correction Factor + Cable Loss – Pre-Amplifier Gain
A margin of -8dB means that the emission is 8dB below the limit
BILOG Antenna Distance: 10 meters
Below 1GHz test, if the peak measured value meets the QP limit, it is unnecessary to perform the QP measurement.

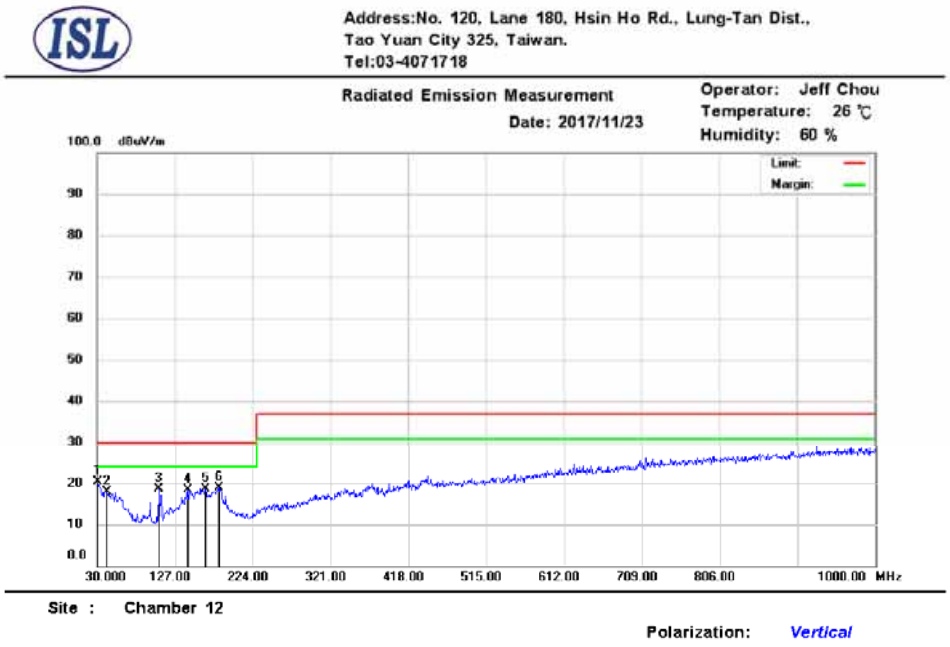
3.3 Radiation Test Data: Configuration 2
- Radiated Emissions (Horizontal)



Mk.	Frequency (MHz)	RX_R (dBuV)	Correct Factor(dB/m)	Emission (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Ant.Pos (cm)	Tab.Pos (deg.)	Detector
1	140.58	38.97	-16.51	22.46	30.00	-7.54	100	86	peak
2	147.37	39.51	-16.09	23.42	30.00	-6.58	100	133	peak
3	153.19	39.44	-15.86	23.58	30.00	-6.42	279	98	peak
4	163.86	38.65	-15.82	22.83	30.00	-7.17	102	350	peak
5	182.29	43.89	-17.35	26.54	30.00	-3.46	314	83	peak
6	228.85	37.05	-18.41	18.64	30.00	-11.36	207	353	peak

* Note:
Margin = Emission – Limit
Emission = Radiated Amplitude + Correct Factor
Correct Factor = Antenna Correction Factor + Cable Loss – Pre-Amplifier Gain
A margin of -8dB means that the emission is 8dB below the limit
BILOG Antenna Distance: 10 meters
Below 1GHz test, if the peak measured value meets the QP limit, it is unnecessary to perform the QP measurement.

- Radiated Emissions (Vertical)



Mk.	Frequency (MHz)	RX_R (dBuV)	Correct Factor(dB/m)	Emission (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Ant.Pos (cm)	Tab.Pos (deg.)	Detector
1	30.00	39.09	-18.79	20.30	30.00	-9.70	171	78	peak
2	42.61	35.27	-17.38	17.89	30.00	-12.11	127	280	peak
3	106.63	38.71	-20.07	18.64	30.00	-11.36	100	25	peak
4	142.52	34.88	-16.38	18.50	30.00	-11.50	100	95	peak
5	164.83	34.58	-15.84	18.74	30.00	-11.26	355	93	peak
6	181.32	36.06	-17.22	18.84	30.00	-11.16	390	321	peak

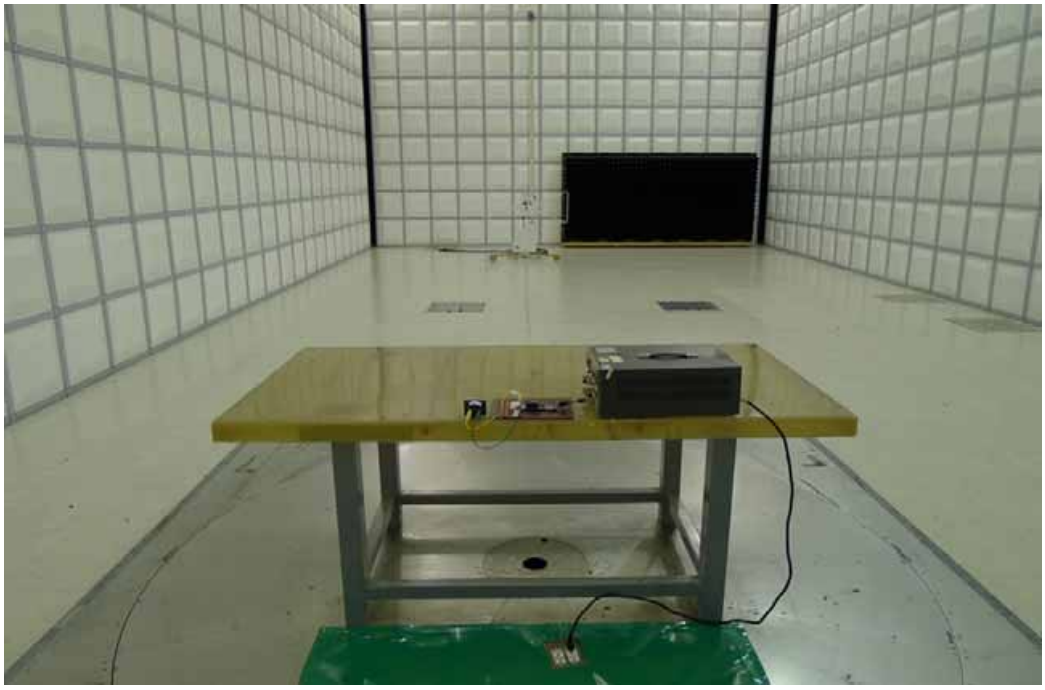
* Note:
Margin = Emission – Limit
Emission = Radiated Amplitude + Correct Factor
Correct Factor = Antenna Correction Factor + Cable Loss – Pre-Amplifier Gain
A margin of -8dB means that the emission is 8dB below the limit
BILOG Antenna Distance: 10 meters
Below 1GHz test, if the peak measured value meets the QP limit, it is unnecessary to perform the QP measurement.

3.4 Test Setup Photo

Configuration 1

Front View (30MHz~1GHz)

Back View (30MHz~1GHz)



Configuration 2

Front View (30MHz~1GHz)

Back View (30MHz~1GHz)

4. Electrostatic discharge (ESD) immunity

4.1 Test Specification

Port:	Enclosure
Basic Standard:	EN 61000-4-2/ IEC 61000-4-2 (details referred to Sec 1.2)
Test Level:	Air +/- 2 kV, +/- 4 kV, +/- 8 kV, +/- 15 kV Contact +/- 8 kV
Result:	Pass
Test Procedure	refer to ISL QA -T4-E-S7

Selected Test Point

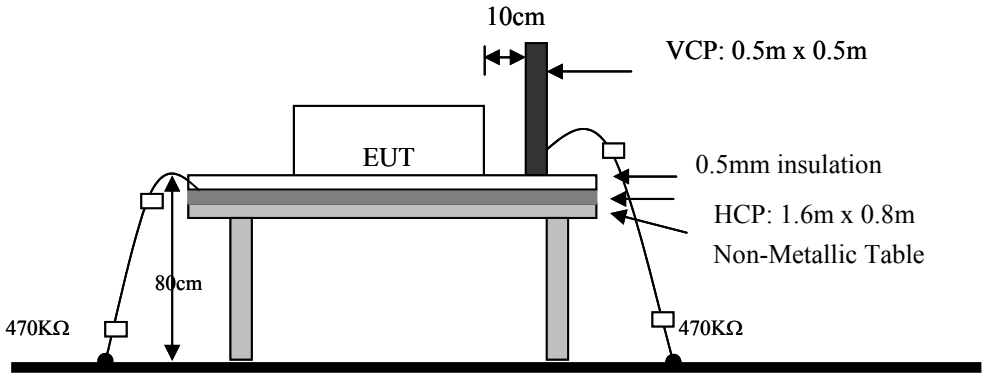
Air: discharges were applied to slots, aperture or insulating surfaces. 10 single air discharges were applied to each selected points.

Contact: Total 200 discharges minimum were to the selected contact points.

Indirect Contact Points: 10 discharges were applied to center of one edge of VCP and each EUT side of HCP with 10 cm away from EUT.

4.2 Test Setup

EUT is 1m from the wall and other metallic structure. When Battery test mode is needed, a cable with one 470KΩ resister at two rare ends is connected from metallic part of EUT and screwed to HCP.



4.3 Test Result

Performance of EUT complies with the given specification

4.4 Test Data:

Date: 11/23/2017	Temperature: 23℃	Engineer: James Kuo
EUT Model Name : THM 20-2411WI	Humidity: 40%	Equipment: EM TEST(Model: Dito)
	Barometer Pressure: 100.1kPa	ESD Site: ESD 1F
Support Unit : Class A test board	Voltage/Freq: 24 Vdc	Basic Standard: EN61000-4-2

→ Blue arrow represent Air discharge point
→ Red arrow represent Contact discharge point
ND=No Discharge; meets criteria but unable to obtain an electrostatic discharge (ESD) at this test point.
X=EUT DOES NOT meet the acceptance criteria
A=criteria A, B=criteria B, C=criteria C

Air Discharge	Voltage kV Level 10 Discharge @ 1 PPS								
Test Location	+2	-2	+4	-4	+8	-8	+15	-15	Comments
1	ND	ND	ND	ND	ND	ND	ND	ND	Note 1
2	ND	ND	ND	ND	ND	ND	ND	ND	Note 1
3	ND	ND	ND	ND	ND	ND	ND	ND	Note 1
4	ND	ND	ND	ND	ND	ND	ND	ND	Note 1
5	ND	ND	ND	ND	ND	ND	ND	ND	Note 1
Contact Discharge	Voltage kV Level 25 Discharge @ 1 PPS								
Test Location	+4	-4	+6	-6	+8	-8			Comments
1	ND	ND	ND	ND	ND	ND			Note 1
2	ND	ND	ND	ND	ND	ND			Note 1
3	ND	ND	ND	ND	ND	ND			Note 1
4	ND	ND	ND	ND	ND	ND			Note 1
5	ND	ND	ND	ND	ND	ND			Note 1
Indirect Contact	Voltage kV Level 25 Discharge @ 1 PPS								
Test Location	+4	-4	+6	-6	+8	-8			Comments
VCP Front	A	A	A	A	A	A			
VCP Right	A	A	A	A	A	A			
VCP Left	A	A	A	A	A	A			
VCP Back	A	A	A	A	A	A			
Test Location	+4	-4	+6	-6	+8	-8			Comments
HCP Front	A	A	A	A	A	A			
HCP Right	A	A	A	A	A	A			
HCP Left	A	A	A	A	A	A			
HCP Back	A	A	A	A	A	A			

Additional Notes: A=criteria A, B=criteria B, C=criteria C

Note 1 :"ND" means PASS criteria A.

4.5 Test Point

Red arrow lines indicate the contact points, and blue arrow lines indicate the air points.

Figure 1: Test Point Assignments Discharge:

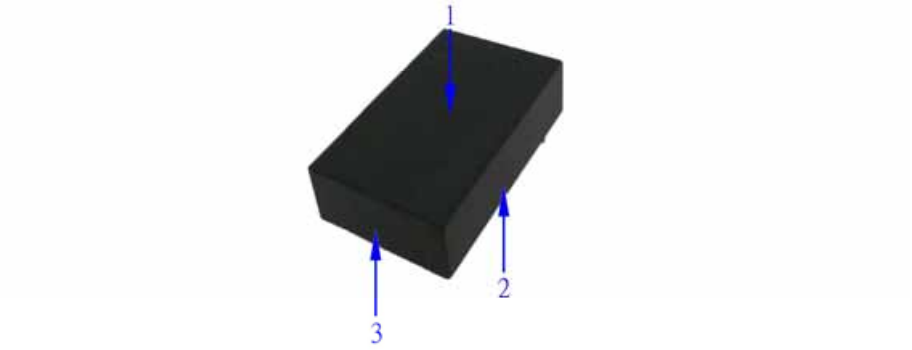


Figure 2: Test Point Assignments Discharge:

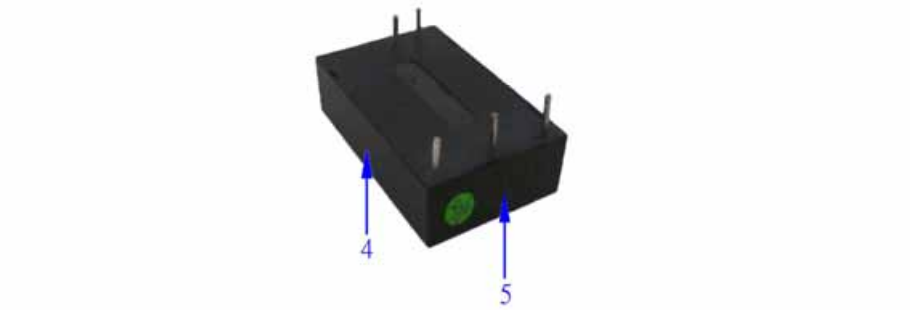
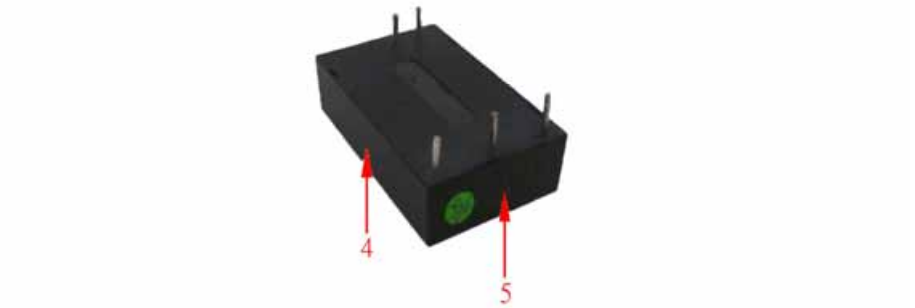
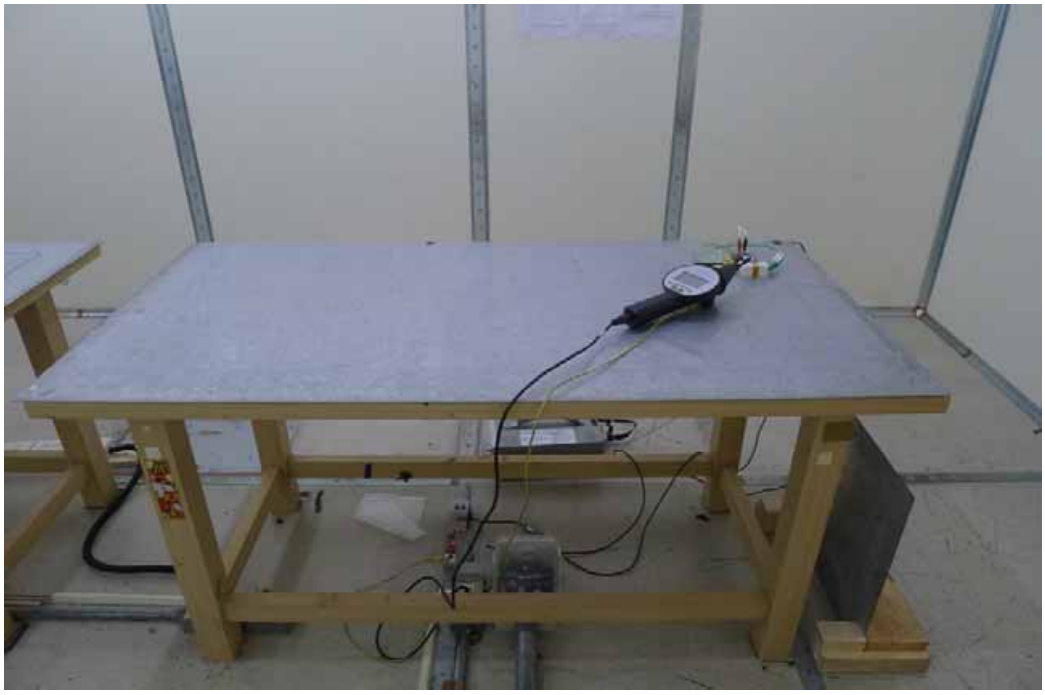


Figure 3: Test Point Assignments Discharge:

Figure 4: Test Point Assignments Discharge:



4.6 Test Setup Photo



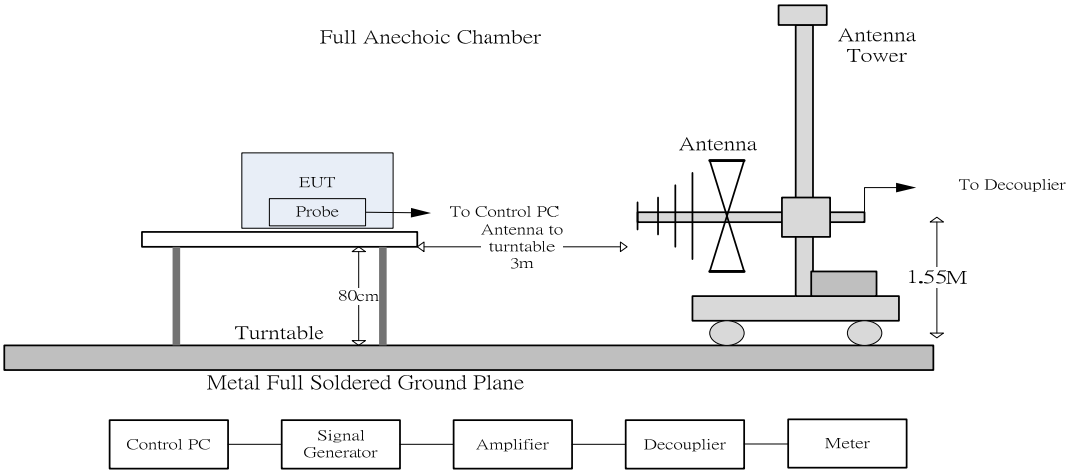
5. Radio-Frequency, Electromagnetic Field immunity

5.1 Test Specification

Port:	Enclosure
Basic Standard:	EN 61000-4-3/ IEC 61000-4-3 (details referred to Sec 1.2)
Test Level:	☐3 V/m, ☒10 V/m
Modulation:	AM 1KHz 80%
Frequency range:	80 MHz~2.7 GHz
Frequency Step:	1% of last step frequency
Dwell time:	3s
Polarization:	Vertical and Horizontal
EUT Azimuth Angle	☒0° ☒90° ☒180° ☒270°
Result:	Pass
Test Procedure	refer to ISL QA -T4-E-S8

5.2 Test Setup

The field sensor is placed at one calibration grid point to check the intensity of the established fields on both polarizations. EUT is adjusted to have each side of EUT face coincident with the calibration plane. A CCD camera and speakers are used to monitor the condition of EUT for the performance judgment.



5.3 Test Result

Performance of EUT complies with the given specification

5.4 Test Data:

Date: 2017/11/10	Temperature:23℃	Engineer: Mark Chan
EUT Model Name : THM 20-2411WI	Humidity:59%	Test Chamber: Chamber 04
Power :	Barometer Pressure:100.1kPa	Basic Standard: EN61000-4-3 & EN60601-1-2
Support Unit : Class A test board	Voltage/Freq: 24 Vdc	

A=criteria A, B=criteria B, C=criteria C

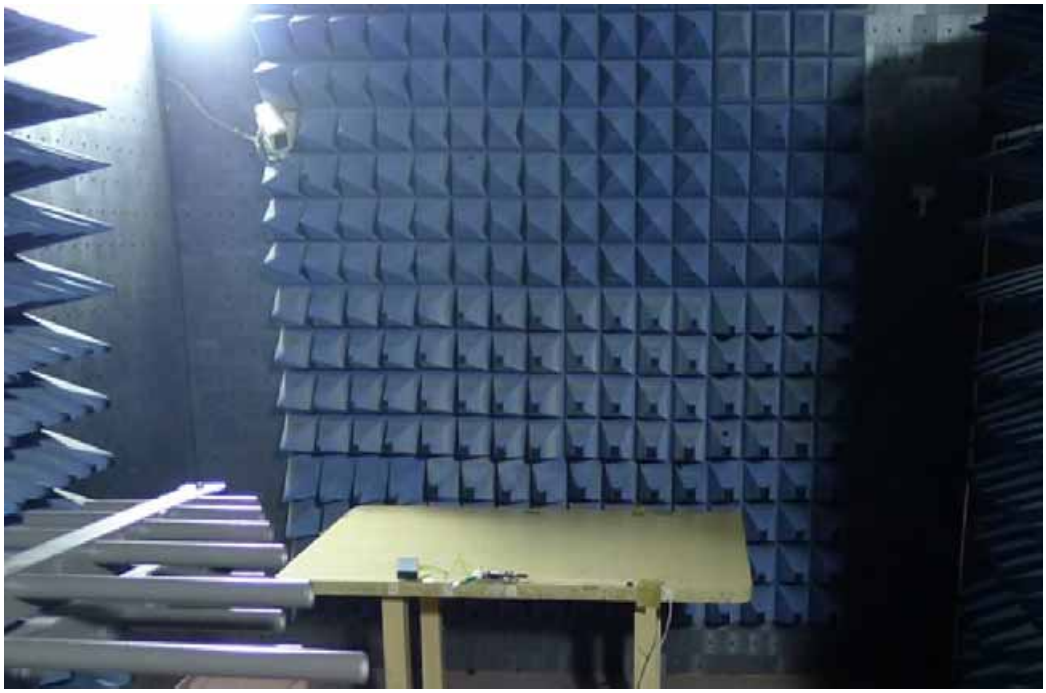
EUT Angle	Frequency		Dwell time	Modulation	Level (V/m)	Antenna Polarization	EUT Status	Comments
	Range (MHz)	Steps %						
0° (front)	80-27000	1	3s	80% @ 1KHz	10	Vertical	A	
90° (left)	80-27000	1	3s	80% @ 1KHz	10	Vertical	A	
180° (back)	80-27000	1	3s	80% @ 1KHz	10	Vertical	A	
270° (right)	80-27000	1	3s	80% @ 1KHz	10	Vertical	A	
0° (front)	80-27000	1	3s	80% @ 1KHz	10	Horizontal	A	
90° (left)	80-27000	1	3s	80% @ 1KHz	10	Horizontal	A	
180° (back)	80-27000	1	3s	80% @ 1KHz	10	Horizontal	A	
270° (right)	80-27000	1	3s	80% @ 1KHz	10	Horizontal	A	
0° (front)	385		3s	PM 18Hz	27	Vertical	A	
90° (left)	385		3s	PM 18Hz	27	Vertical	A	
180° (back)	385		3s	PM 18Hz	27	Vertical	A	
270° (right)	385		3s	PM 18Hz	27	Vertical	A	
0° (front)	385		3s	PM 18Hz	27	Horizontal	A	
90° (left)	385		3s	PM 18Hz	27	Horizontal	A	
180° (back)	385		3s	PM 18Hz	27	Horizontal	A	
270° (right)	385		3s	PM 18Hz	27	Horizontal	A	

EUT Angle	Frequency		Dwell time	Modulation	Level (V/m)	Antenna Polarization	EUT Status	Comments
	Range (MHz)	Steps %						
0° (front)	450		3s	FM ±5kHz deviation 1kHz sine	28	Vertical	A	
90° (left)	450		3s	FM ±5kHz deviation 1kHz sine	28	Vertical	A	
180° (back)	450		3s	FM ±5kHz deviation 1kHz sine	28	Vertical	A	
270° (right)	450		3s	FM ±5kHz deviation 1kHz sine	28	Vertical	A	
0° (front)	450		3s	FM ±5kHz deviation 1kHz sine	28	Horizontal	A	
90° (left)	450		3s	FM ±5kHz deviation 1kHz sine	28	Horizontal	A	
180° (back)	450		3s	FM ±5kHz deviation 1kHz sine	28	Horizontal	A	
270° (right)	450		3s	FM ±5kHz deviation 1kHz sine	28	Horizontal	A	
0° (front)	710/745/780		3s	PM 217Hz	9	Vertical	A	
90° (left)	710/745/780		3s	PM 217Hz	9	Vertical	A	
180° (back)	710/745/780		3s	PM 217Hz	9	Vertical	A	
270° (right)	710/745/780		3s	PM 217Hz	9	Vertical	A	
0° (front)	710/745/780		3s	PM 217Hz	9	Horizontal	A	
90° (left)	710/745/780		3s	PM 217Hz	9	Horizontal	A	
180° (back)	710/745/780		3s	PM 217Hz	9	Horizontal	A	
270° (right)	710/745/780		3s	PM 217Hz	9	Horizontal	A	
0° (front)	810/870/930		3s	PM 18Hz	28	Vertical	A	
90° (left)	810/870/930		3s	PM 18Hz	28	Vertical	A	
180° (back)	810/870/930		3s	PM 18Hz	28	Vertical	A	
270° (right)	810/870/930		3s	PM 18Hz	28	Vertical	A	

EUT Angle	Frequency		Dwell time	Modulation	Level (V/m)	Antenna Polarization	EUT Status	Comments
	Range (MHz)	Steps %						
0° (front)	810/870/930		3s	PM 18Hz	28	Horizontal	A	
90° (left)	810/870/930		3s	PM 18Hz	28	Horizontal	A	
180° (back)	810/870/930		3s	PM 18Hz	28	Horizontal	A	
270° (right)	810/870/930		3s	PM 18Hz	28	Horizontal	A	
0° (front)	1720/1845/1970		3s	PM 217Hz	28	Vertical	A	
90° (left)	1720/1845/1970		3s	PM 217Hz	28	Vertical	A	
180° (back)	1720/1845/1970		3s	PM 217Hz	28	Vertical	A	
270° (right)	1720/1845/1970		3s	PM 217Hz	28	Vertical	A	
0° (front)	1720/1845/1970		3s	PM 217Hz	28	Horizontal	A	
90° (left)	1720/1845/1970		3s	PM 217Hz	28	Horizontal	A	
180° (back)	1720/1845/1970		3s	PM 217Hz	28	Horizontal	A	
270° (right)	1720/1845/1970		3s	PM 217Hz	28	Horizontal	A	
0° (front)	2450		3s	PM 217Hz	28	Vertical	A	
90° (left)	2450		3s	PM 217Hz	28	Vertical	A	
180° (back)	2450		3s	PM 217Hz	28	Vertical	A	
270° (right)	2450		3s	PM 217Hz	28	Vertical	A	
0° (front)	2450		3s	PM 217Hz	28	Horizontal	A	
90° (left)	2450		3s	PM 217Hz	28	Horizontal	A	
180° (back)	2450		3s	PM 217Hz	28	Horizontal	A	
270° (right)	2450		3s	PM 217Hz	28	Horizontal	A	
0° (front)	5240/5500/5785		3s	PM 217Hz	9	Vertical	A	
90° (left)	5240/5500/5785		3s	PM 217Hz	9	Vertical	A	
180° (back)	5240/5500/5785		3s	PM 217Hz	9	Vertical	A	
270° (right)	5240/5500/5785		3s	PM 217Hz	9	Vertical	A	

EUT Angle	Frequency		Dwell time	Modulation	Level (V/m)	Antenna Polarization	EUT Status	Comments
	Range (MHz)	Steps %						
0° (front)	5240/5500/5785		3s	PM 217Hz	9	Horizontal	A	
90° (left)	5240/5500/5785		3s	PM 217Hz	9	Horizontal	A	
180° (back)	5240/5500/5785		3s	PM 217Hz	9	Horizontal	A	
270° (right)	5240/5500/5785		3s	PM 217Hz	9	Horizontal	A	
Additional Notes: A=criteria A, B=criteria B, C=criteria C								

5.5 Test Setup Photo



6. Electrical Fast transients/burst immunity

6.1 Test Specification

Port:	mains
Basic Standard:	EN 61000-4-4/ IEC 61000-4-4 (details referred to Sec 1.2)
Test Level:	DC Power Port: +/- 2 kV
Rise Time:	5ns
Hold Time:	50ns
Repetition Frequency:	100 KHz
Result:	Pass
Test Procedure	refer to ISL QA -T4-E-S9

Test Procedure

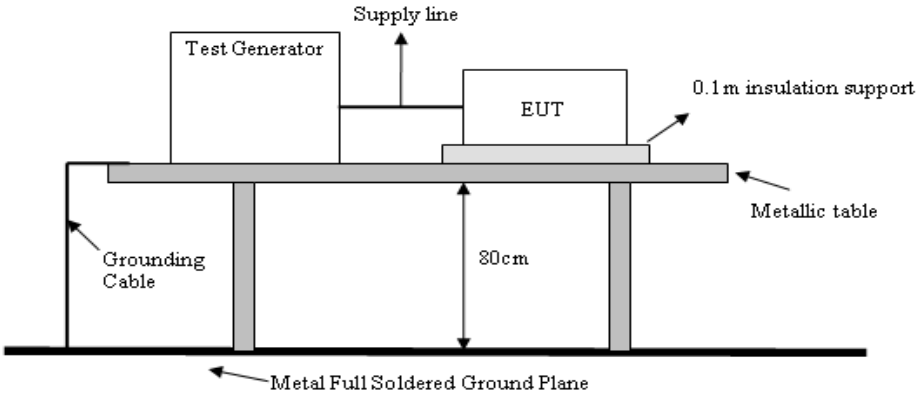
The EUT was setup on a nonconductive table 0.1 m above a reference ground plane.

Test Points	Polarity	Result	Comment
Line	+	N	60 sec
	-	N	60 sec
Neutral	+	N	60 sec
	-	N	60 sec
Line to Neutral	+	N	60 sec
	-	N	60 sec

Note: 'N' means normal, the EUT function is correct during the test.

6.2 Test Setup

EUT is at least 50cm from the conductive structure.



6.3 Test Result

Performance of EUT complies with the given specification

6.4 Test Data:

Date: 2017/11/10	Temperature:23℃	Engineer: SAWYER
EUT Model Name : THM 20-2411WI	Humidity:59%	Equipment: EM TEST (Model: UCS-500 M6B)
	Barometer Pressure:100.1kPa	
Support Unit: With 2pcs of aluminun electrolytic capacitor test board	Voltage/Freq: 24 Vdc	Basic Standard: EN61000-4-4

A=criteria A, B=criteria B, C=criteria C

DC Power Port: ☑ Signal Port: Telephone Port: ☐ LAN Port: ☐

DC Power Port

Line Under Test	Voltage Level	Severity Level	Pulse Polarity	Burst Repetition Rate	Test Duration	EUT Status	Comments
Line	0.5kV	1	+	5/50(Tr/Th)/5.0kHz	1 Minutes	A	
Line	0.5kV	1	-	5/50(Tr/Th)/5.0kHz	1 Minutes	A	
Neutral	0.5kV	1	+	5/50(Tr/Th)/5.0kHz	1 Minutes	A	
Neutral	0.5kV	1	-	5/50(Tr/Th)/5.0kHz	1 Minutes	A	
Line/Neutral	0.5kV	1	+	5/50(Tr/Th)/5.0kHz	1 Minutes	A	
Line/Neutral	0.5kV	1	-	5/50(Tr/Th)/5.0kHz	1 Minutes	A	
Line	1.0kV	2	+	5/50(Tr/Th)/5.0kHz	1 Minutes	A	
Line	1.0kV	2	-	5/50(Tr/Th)/5.0kHz	1 Minutes	A	
Neutral	1.0kV	2	+	5/50(Tr/Th)/5.0kHz	1 Minutes	A	
Neutral	1.0kV	2	-	5/50(Tr/Th)/5.0kHz	1 Minutes	A	
Line/Neutral	1.0kV	2	+	5/50(Tr/Th)/5.0kHz	1 Minutes	A	
Line/Neutral	1.0kV	2	-	5/50(Tr/Th)/5.0kHz	1 Minutes	A	
Line	2.0kV	3	+	5/50(Tr/Th)/5.0kHz	1 Minutes	A	
Line	2.0kV	3	-	5/50(Tr/Th)/5.0kHz	1 Minutes	A	
Neutral	2.0kV	3	+	5/50(Tr/Th)/5.0kHz	1 Minutes	A	
Neutral	2.0kV	3	-	5/50(Tr/Th)/5.0kHz	1 Minutes	A	
Line/Neutral	2.0kV	3	+	5/50(Tr/Th)/5.0kHz	1 Minutes	A	
Line/Neutral	2.0kV	3	-	5/50(Tr/Th)/5.0kHz	1 Minutes	A	

Additional Notes: A=criteria A, B=criteria B, C=criteria C

The test procedure is required by the clients:

THM15/20-12☐☐☐ (Input range: 9-18 VDC)
With 2 pcs of aluminum electrolytic capacitor
(Nippon chemi-con KY series, 220μF/100V) and a TVS (SMDJ36A, 36V, 3000 Watt peak pulse power) in parallel.

THM15/20-24☐☐☐ (Input range: 18-36 VDC)
THM15/20-24☐☐☐WI (Input range: 9-36 VDC)
With 2 pcs of aluminum electrolytic capacitor
(Nippon chemi-con KY series, 220μF/100V) and a TVS (SMDJ58A, 58V, 3000 Watt peak pulse power) in parallel.

THM15/20-48☐☐☐ (Input range: 36-75 VDC)
THM15/20-48☐☐☐WI (Input range: 18-75 VDC)
With 2 pcs of aluminum electrolytic capacitor
(Nippon chemi-con KY series, 220μF/100V) and a TVS (SMDJ120A,120V, 3000 Watt peak pulse power) in parallel.

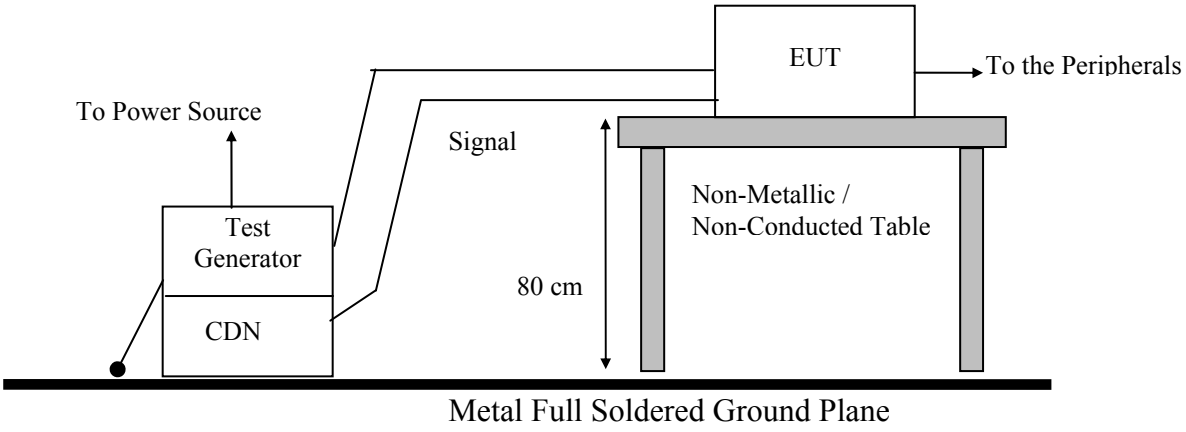
6.5 Test Setup Photo

7. Surge Immunity

7.1 Test Specification

Port:	mains
Basic Standard:	EN 61000-4-5/ IEC 61000-4-5(details referred to Sec 1.2)
Test Level:	DC PORT: Line to Line: +/- 0.5 kV, +/- 1 kV, +/- 2kV
Rise Time:	1.2us
Hold Time:	50us
Repetition Rate:	30 seconds
Angle:	☒0° ☒90° ☒180° ☒270°
Result:	Pass
Test Procedure:	refer to ISL QA -T4-E-S10

7.2 Test Setup



7.3 Test Result

Performance of EUT complies with the given specification

7.4 Test Data:

Date: 2017/11/10	Temperature:23℃	Engineer : SAWYER
EUT Model Name : THM 20-2411WI	Humidity:59%	Equipment: EMC PARINER(Model:MIG0603IN3)
	Barometer Pressure:100.1kPa	
Support Unit: With 2pcs of aluminum electrolytic capacitor test board	Voltage/Freq: 24 Vdc	Basic Standard: EN61000-4-5

A=criteria A, B=criteria B, C=criteria C

DC Power Port: ☑	Telephone Port: ☐	LAN Port: ☐

DC Power Port

Line Under Test	Voltage	Level	Polarity	Repetition Rate	Cycle	Pulse Position	EUT Status	Comments
Line-Neutral	0.5kV	1	+	30 sec	5		A	
Line-Neutral	0.5kV	1	−	30 sec	5		A	
Line- Neutral	1.0kV	2	+	30 sec	5		A	
Line- Neutral	1.0kV	2	−	30 sec	5		A	
Line- Neutral	2.0kV	3	+	30 sec	5		A	
Line- Neutral	2.0kV	3	−	30 sec	5		A	

Additional Notes: A=criteria A, B=criteria B, C=criteria C

The test procedure is required by the clients:

THM15/20-12☐☐☐ (Input range: 9-18 VDC)
With 2 pcs of aluminum electrolytic capacitor
(Nippon chemi-con KY series, 220μF/100V) and a TVS (SMDJ36A, 36V, 3000 Watt peak pulse power) in parallel.

THM15/20-24☐☐☐ (Input range: 18-36 VDC)
THM15/20-24☐☐☐WI (Input range: 9-36 VDC)
With 2 pcs of aluminum electrolytic capacitor
(Nippon chemi-con KY series, 220μF/100V) and a TVS (SMDJ58A, 58V, 3000 Watt peak pulse power) in parallel.

THM15/20-48☐☐☐ (Input range: 36-75 VDC)
THM15/20-48☐☐☐WI (Input range: 18-75 VDC)
With 2 pcs of aluminum electrolytic capacitor
(Nippon chemi-con KY series, 220μF/100V) and a TVS (SMDJ120A,120V, 3000 Watt peak pulse power) in parallel.

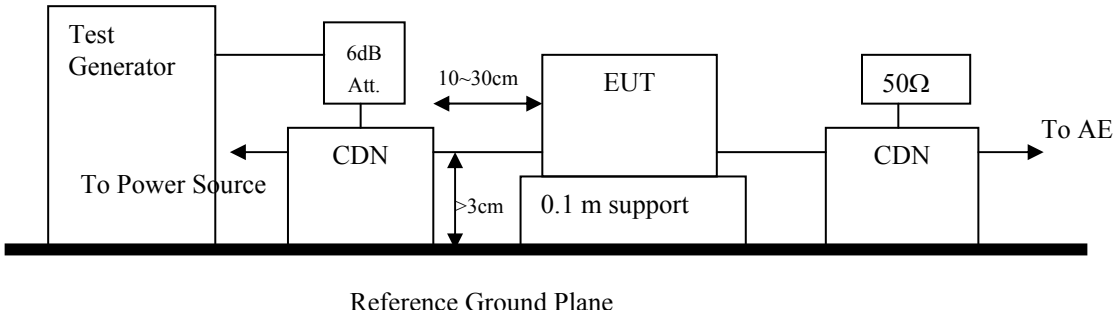
7.5 Test Setup Photo

8. Immunity to Conductive Disturbance

8.1 Test Specification

Port:	mains
Basic Standard:	EN 61000-4-6/ IEC 61000-4-6 (details referred to Sec 1.2)
Test Level:(By manufacture reference)	☐3 V ☒10 V for ISM and amateur radio bands ☒10 V
Modulation:	AM 1KHz 80%
Frequency range:	0.15 MHz - 80MHz
Frequency Step:	1% of last Frequency
Dwell time:	3s
Result:	Pass
CDN Type:	CDN M2+M3
Test Procedure	refer to ISL QA -T4-E-S11

8.2 Test Setup



8.3 Test Result

Performance of EUT complies with the given specification

8.4 Test Data:

Date : 2017/11/06	Temperature :24 ℃	Engineer : SAWYER
EUT Model Name : THM 20-2411WI	Humidity :58 %	Equipment: Frankonia (CIT-10/75)
	Barometer Pressure:100.1kPa	
Support Unit : Class A test board	Voltage/Freq: 24 Vdc	Basic Standard: EN61000-4-6

A=criteria A, B=criteria B, C=criteria C

Line Under Test	Frequency		Level	Modulation	Dwell time	EUT Status	Comments
	Range(MHz)	Steps %					
DC Power Port	0.15-80	1	10V	80% @ 1KHz	3s	A	
ISM bands							
DC Power Port	6.765		10V	80% @ 1KHz	3s	A	
	6.795		10V	80% @ 1KHz	3s	A	
	13.553		10V	80% @ 1KHz	3s	A	
	13.567		10V	80% @ 1KHz	3s	A	
	26.957		10V	80% @ 1KHz	3s	A	
	27.283		10V	80% @ 1KHz	3s	A	
	40.66		10V	80% @ 1KHz	3s	A	
	40.70		10V	80% @ 1KHz	3s	A	

A=criteria A, B=criteria B, C=criteria C

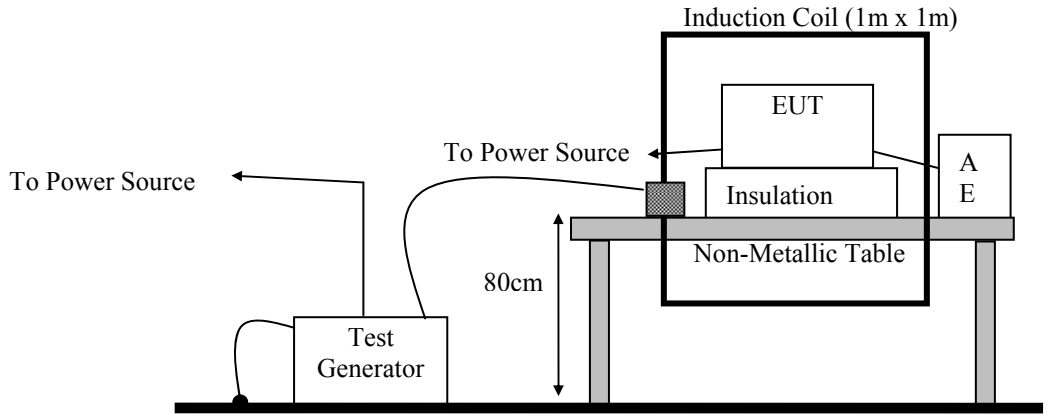
8.5 Test Setup Photo

9. Power Frequency Magnetic Field immunity

9.1 Test Specification

Port:	Enclosure
Basic Standard:	EN 61000-4-8/ IEC 61000-4-8 (details referred to Sec 1.2)
Test Level:(By manufacture reference)	100A/m , 1 minutes
Test Level:(By manufacture reference)	1000A/m , 1 sec
Polarization:	X, Y, Z
Result:	Pass
Test Procedure	refer to ISL QA -T4-E-S12

9.2 Test Setup



9.3 Test Result

Performance of EUT complies with the given specification

9.4 Test Data:

Date : 2017/11/20	Temperature:23 ℃	Engineer: SAWYER
EUT Model Name : THM 20-2411WI	Humidity:59 %	Equipment: FCC (F-1000-4-8-G-125A) Immunity Loop: FCC (F-100-4-8-L-1M)
	Barometer Pressure:100.1kPa	Basic Standard: EN61000-4-8
Support Unit: Class A test board	Voltage/Freq: 24 Vdc	

A=criteria A, B=criteria B, C=criteria C

Antenna Polarization	Frequency Hz	Test Level (A/m)	Test Duration	EUT Status	Comments
X	50	100	1 minutes	A	
Y	50	100	1 minutes	A	
Z	50	100	1 minutes	A	
X	50	1000	1 sec	A	
Y	50	1000	1 sec	A	
Z	50	1000	1 sec	A	

Additional Notes: A=criteria A, B=criteria B, C=criteria C

9.5 Test Setup Photo

10. Appendix

10.1 Appendix A: Test Equipment

10.1.1 Test Equipment List

Location Con02	Equipment Name	Brand	Model	S/N	Last Cal. Date	Next Cal. Date
Conduction 02	LISN 20	R&S	ENV216	101477	08/23/2017	08/23/2018
Conduction 02	LISN 23	FCC	FCC-LISN-50-25-2-01	07038	12/30/2016	12/30/2017
Conduction 02	Conduction 02-1 Cable	WOKEN	CFD 300-NL	Conduction 02 -1	09/01/2017	09/01/2018
Conduction 02	EMI Receiver 14	ROHDE& SCHWARZ	ESCI	101034	06/06/2017	06/06/2018

Location Chamber02	Equipment Name	Brand	Model	S/N	Last Cal. Date	Next Cal. Date
Radiation (Chamber02)	BILOG Antenna 17	Schwarzbeck	Schwarzbeck VULB 9168+EMCI-N-6-05	645	02/07/2017	02/07/2018
Radiation (Chamber02)	Preamplifier 25	EMCI	EMC9135	980295	01/18/2017	01/18/2018
Radiation (Chamber02)	Coaxial Cable Chmb 02-10M-02	EMC	RG214U	Chmb 02-10M-02	09/01//2017	09/01/2018
Radiation (Chamber02)	EMI Receiver 12	ROHDE & SCHWARZ	ESCI	100804	07/10/2017	07/10/2018

Location	Equipment Name	Brand	Model	S/N	Last Cal. Date	Next Cal. Date
EN61K-4-2	ESD Gun 12	EM TEST	Dito	P1650188689	03/21/2017	03/21/2018
EN61K-4-3	Broadband Log-Periodic Antenna	AR	AT1080	310698	N/A	N/A
EN61K-4-3	Horn Antenna RF-01	AR	ATS700M11G	0335864	N/A	N/A
EN61K-4-3	Amplifier 80Mz~1GHz 250W	AR	250W1000A	312494	N/A	N/A
EN61K-4-3	Amplifier 800MHz~4.2GHz 50W	AR	50S1G4M1	312762	N/A	N/A
EN61K-4-3	Amplifier 4.0~8.0GHz 35W	AR	35S4G8AM1	0335752	N/A	N/A
EN61K-4-3	Broadband Coupler 80M~1GHz	Amplifier Research	DC6180A	0341805	N/A	N/A
EN61K-4-3	Coaxial Cable	INSULATED	NPS-4806-2360-NP3	108599.003.01.03	N/A	N/A
EN61K-4-3	Broadband Coupler 0.8G~4.26GHz	AR	DC7144A	0335226	N/A	N/A
EN61K-4-3	Broadband Coupler 4G~8GHz	AR	DC7350A	0335817	N/A	N/A
EN61K-4-3	Signal Generator 07	ROHDE& SCHWARZ	SMB100A	107780	10/26/2017	10/26/2018
EN61K-4-4	EFT and SURGE Test System	EMC Partner	IMU3000	1547	08/10/2017	08/10/2018
EN61K-4-5	SURGE-TESTER	EMC Partner	IMU3000	1547	08/10/2017	08/10/2018
EN61K-4-6	CDN M2+M3 05	Frankonia	CDN M2+M3	A2210235/2013	09/05/2017	09/05/2018
EN61K-4-6	CDN T2 04	FCC Inc.	FCC-801-T2	02067	08/21/2017	08/21/2018
EN61K-4-6	CDN T4 04	FCC Inc.	FCC-801-T4	02069	07/31/2017	07/31/2018
EN61K-4-6	CDN T8-10_1	Teseq GmbH	CDN T8 10	41242	02/22/2017	02/22/2018
EN61K-4-6	Coaxial Cable 4-6 02-1			4-6 02-1	N/A	N/A
EN61K-4-6	Conducted Immunity Test System 02	Frankonia	CIT-10-75-DC	126B1301/2014	02/23/2017	02/23/2018
EN61K-4-6	EM-Clamp	Schaffner	KEMZ-801	19215	11/03/2017	11/03/2018
EN61K-4-8	Magnetic Field Test Generator_02	PIC	PMF-1000	ANT150701	06/09/2017	06/09/2018

PS: N/A => The equipment does not need calibration.

****Software for Controlling Spectrum/Receiver and Calculating Test Data**

Test Item	Filename	Version
EN61000-4-2	N/A	2.0
EN61000-4-3	i2	4.130102k
EN61000-4-4	EMC TEST	4.10
EN61000-4-5	EMC Partner	1.69
EN61000-4-6	FRANKONIA CD-LAB	V5.221
EN61000-4-8	N/A	

Site	Filename	Version	Issue Date
Conduction/Radiation	EZ EMC	ISL-03A2	3/6/2013

10.2 Appendix B: Uncertainty of Measurement

The measurement uncertainty refers to CISPR 16-4-2:2011. The coverage factor k = 2 yields approximately a 95 % level of confidence.

<Conduction 02>
AMN: ±2.88dB

<Chamber 12 (10M)>
Horizontal
30MHz~200MHz: ±3.93dB
200MHz~1000MHz: ±4.09dB
Vertical
30MHz~200MHz: ±4.58dB
200MHz~1000MHz: ±3.99dB

<Immunity 02>

Test item	Uncertainty	Test item	Uncertainty
EN 61000-4-2 (ESD)		EN 61000-4-6 (CS)	
Rise time tr	≦ 15%	CDN	± 1.36dB
Peak current Ip	≦ 6.3%	EM Clamp	± 3.19dB
current at 30 ns	≦ 6.3%	EN 61000-4-8 (Magnetic)	± 5.59%
current at 60 ns	≦ 6.3%		
EN 61000-4-3 (RS)	± 2.19dB		
EN 61000-4-4 (EFT)			
voltage rise time (tr)	± 6.2%		
peak voltage value (VP)	± 8.6%		
voltage pulse width (tw)	± 5.9%		
EN 61000-4-5 (Surge)			
Time	± 3.9%		
Voltage	± 3.9%		
Current	± 2.7%		

10.3 Appendix C: Photographs of EUT

Please refer to the File of **ISL-17LE733P-MA**