

TEST REPORT

of

EN 50155 / BS EN 50155 (EMC, Characteristic, Environmental Test)

Product: **THN 10UIR Series**
Main Model: **THN 10-7215UIR**
Series Model: **THN 10-3610UIR-def(a); THN 10-3611BUIR-def(a);
THN 10-3611UIR-def(a); THN 10-3612UIR-def(a);
THN 10-3613UIR-def(a); THN 10-3615UIR-def(a);
THN 10-3621UIR-def(a); THN 10-3622UIR-def(a);
THN 10-3623UIR-def(a); THN 10-7210UIR-def(a);
THN 10-7211BUIR-def(a); THN 10-7211UIR-def(a);
THN 10-7212UIR-def(a); THN 10-7213UIR-def(a);
THN 10-7215UIR-def(a); THN 10-7221UIR-def(a);
THN 10-7222UIR-def(a); THN 10-7223UIR-def(a) "-"
can be optional. "d" can be N or blank; When d= N
represents Negative logic. When d= blank represents
Positive logic. "e" can be B1, A1 or blank; When e= B1
represents None. When e= A1 represents with UVP adj.
When e= blank represents with Bus. "f" can be HS2,
HS3, HS4 or blank; When f= HS2, HS3, HS4 represents
with Heatsink. When f= blank represents without
Heatsink. "(a)" can be six variables, each variable may
be A through Z, 0 through 9, dash, any punctuation
marks or blank)**

Brand:



TRACO POWER

Applicant:

TRACO ELECTRONIC AG

Address:

Sihlbruggstrasse 111, CH-6340 Baar

Test Performed by:



International Standards Laboratory Corp. LT Lab.

TEL: +886-3-263-8888 FAX: +886-3-263-8899

No. 120, Lane 180, Hsin Ho Rd., Lung-Tan Dist., Tao Yuan City 325, Taiwan

Report No.: **ISL-24LE0443CE50155-MA**

Issue Date : **July 23, 2024**



Test results given in this report apply only to the specific sample(s) tested and are traceable to national or international standard through calibration of the equipment and evaluating measurement uncertainty herein. According to customer agreement, the laboratory issues test reports based on the regulations or standards specifications, the measurement uncertainty is not considered in conformity decision rules.

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1. General

1.1 Certification of Accuracy of Test Data

Standards:	Please refer to 1.2
Equipment Tested:	THN 10UIR Series
Main Model:	THN 10-7215UIR
Series Model:	THN 10-3610UIR-def(a); THN 10-3611BUIR-def(a); THN 10-3611UIR-def(a); THN 10-3612UIR-def(a); THN 10-3613UIR-def(a); THN 10-3615UIR-def(a); THN 10-3621UIR-def(a); THN 10-3622UIR-def(a); THN 10-3623UIR-def(a); THN 10-7210UIR-def(a); THN 10-7211BUIR-def(a); THN 10-7211UIR-def(a); THN 10-7212UIR-def(a); THN 10-7213UIR-def(a); THN 10-7215UIR-def(a); THN 10-7221UIR-def(a); THN 10-7222UIR-def(a); THN 10-7223UIR-def(a) "- " can be optional. "d" can be N or blank; When d= N represents Negative logic. When d= blank represents Positive logic. "e" can be B1, A1 or blank; When e= B1 represents None. When e= A1 represents with UVP adj. When e= blank represents with Bus. "f" can be HS2, HS3, HS4 or blank; When f= HS2, HS3, HS4 represents with Heatsink. When f= blank represents without Heatsink. "(a)" can be six variables, each variable may be A through Z, 0 through 9, dash, any punctuation marks or blank)
Brand:	 TRACO POWER
Applicant:	TRACO ELECTRONIC AG
Sample received Date:	April 1, 2024
Final test Date:	EMI: refer to the date of test data EMS: June 27, 2024
Test Site:	Chamber 02; Conduction 03; Immunity 02
Test Distance:	10m (EMI test)
Temperature:	refer to each site test data
Humidity:	refer to each site test data
Input power:	Conduction input power: DC 72 V Radiation input power: DC 72 V Immunity input power: DC 72 V

Test Result: PASS

Report Engineer: Cheryl Tung

Test Engineer:

Jovi Liu

Jovi Liu

Approved By:

Angus Chu

Angus Chu / Sr. Manager

1.2 Test Standards

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

- EN 50155:2021 and BS EN 50155:2021 for EMC, Environmental and Characteristic
- EN 50121-3-2:2016+A1:2019 and BS EN 50121-3-2:2016+A1:2019 for EMC
- EN 60068-2-1:2007 for Environmental
- EN 60068-2-2:2007 for Environmental
- EN 60068-2-30:2005 for Environmental
- EN 61373:2010 for Environmental

Characteristic Test					
Report Clause	Performed Item	EN 50155 Reference Clause(s)	Reference Standard	Result	Location of Test
2.1	Visual Inspection and Performance test	13.4.1 13.4.2	-	PASS	ISL LAB
2.2	DC Power Supply Test (Supply variations and Temporary supply dips)	13.4.3.2 13.4.3.3 13.4.3.4 5.2.2 5.2.3	-	PASS	ISL LAB
2.3	Power Supply Test (Interruptions of supply voltage)	13.4.3.5 5.2.4	-	PASS	ISL LAB
2.4	Power Supply Test (Supply charge-over)	13.4.3.6 5.2.5	-	PASS	ISL LAB
2.5	Insulation Test	13.4.7 7.2.1 4.6.8	-	PASS	ISL LAB

Electromagnetic Compatibility (EMC)					
Report Clause	Performed Item	EN 50155 Reference Clause(s)	Reference Standard	Result	Location of Test
3.1	Power Line Conducted Emission Measurement	13.4.8 4.4.6	EN 50121-3-2 / BS EN 50121-3-2 EN 61000-6-4 / BS EN 61000-6-4	PASS	ISL LAB
3.2	Radiated Emission Measurement	13.4.8 4.4.6	EN 50121-3-2 / BS EN 50121-3-2 EN 61000-6-4 / BS EN 61000-6-4	PASS	ISL LAB
3.3	Electrostatic Discharge Susceptibility Test	13.4.8 4.4.6	EN 50121-3-2 / BS EN 50121-3-2 EN 61000-4-2 / BS EN 61000-4-2	PASS	ISL LAB
3.4	Radio- Frequency interference (RFI) susceptibility Test	13.4.8 4.4.6	EN 50121-3-2 / BS EN 50121-3-2 EN IEC 61000-4-3 / BS EN IEC 61000-4-3	PASS	ISL LAB
3.5	Transient Burst Susceptibility Test	13.4.8 4.4.6	EN 50121-3-2 / BS EN 50121-3-2 EN 61000-4-4 / BS EN 61000-4-4	PASS	ISL LAB
3.6	Surges Test	13.4.8 4.4.6	EN 50121-3-2 / BS EN 50121-3-2 EN 61000-4-5 / BS EN 61000-4-5	PASS	ISL LAB
3.7	Radio- Frequency, Conducted Disturbances Immunity Test	13.4.8 4.4.6	EN 50121-3-2 / BS EN 50121-3-2 EN 61000-4-6 / BS EN 61000-4-6	PASS	ISL LAB

Environmental Tests					
Report Clause	Performed Item	EN 50155 Reference Clause(s)	Reference Standard	Result	Location of Test
4.1	Low temperature star-up test	13.4.4 4.4.2	EN 60068-2-1	PASS	ISL LAB
4.2	Dry Heat Test	13.4.5 4.4.2 4.4.3	EN 60068-2-2	PASS	ISL LAB
4.3	Cyclic Damp Heat Test	13.4.8 4.4.2 4.4.7	EN 60068-2-30	PASS	ISL LAB
4.4	Random Vibration Test	13.4.10 4.4.5	EN 61373	PASS	GTTI LAB
4.5	Increased Random Vibration Test	13.4.10 4.4.5	EN 61373	PASS	GTTI LAB
4.6	Shock Test	13.4.10 4.4.5	EN 61373	PASS	GTTI LAB

GTTI LAB= GOLDEN-TECH TECHNOLOGIES INC.

1.2.1 Performance Criteria for Compliance

Performance criterion A:

The apparatus shall continue to operate as intended during and after the test/event. No degradation of performance or loss of function is allowed.

Changes of actual operating state or stored data are not allowed.

If agreed between the involved parties, the normal performance level (all functions are working as specified) can be replaced by a minimum performance level.

Performance criterion B:

The apparatus shall continue to operate as intended after the test/event.

During the test/event, degradation of performance is however allowed.

Changes of actual operating state or stored data are not allowed.

Performance criterion C:

During the test/event temporary loss of function is allowed. The equipment could:

- automatically restart. The normal performance shall be obtained within a maximum defined time.

After this time the equipment shall retain the previous operating state and shall work as intended.

The loss of significant data is not allowed; or

- manually restart or process controlled restart. In this case this shall be agreed between user and supplier and/or clearly defined in the user manual. In this case the user manual shall be available to the user at the tender stage.

NOTE Significant stored data are application dependent and stated into the Performance specifications.

1.2.2 Performance Criteria for Compliance: EN 50121-1 and BS EN 50121-1 (only for EMC)

Performance criterion A: The apparatus shall continue to operate as intended during and after the test. No degradation of performance or loss of function is allowed below a performance level specified by the manufacturer, when the apparatus is used as intended. The performance level may be replaced by a permissible loss of performance. If the minimum performance level or the permissible performance loss is not specified by the manufacturer, either of these may be derived from the product description and documentation, and from what the user may reasonably expect from the apparatus if used as intended.

Performance criterion B: The apparatus shall continue to operate as intended after the test. No degradation of performance or loss of function is allowed below a performance level specified by the manufacturer, when the apparatus is used as intended. The performance level may be replaced by a permissible loss of performance. During the test, degradation of performance is however allowed. No change of actual operating state or stored data are allowed. If the minimum performance level or the permissible performance loss is not specified by the manufacturer, either of these may be derived from the product description and documentation, and from what the user may reasonably expect from the apparatus if used as intended.

Performance criterion C: Temporary loss of function is allowed, provided the function is self-recoverable or can be restored by the operation of the controls.

1.3 Description of EUT

EUT

This report test data using report number 24LE0443CE50155.

Description	THN 10UIR Series
Condition	Pre-Production
Main Model	THN 10-7215UIR
Serial Model	THN 10-3610UIR-def(a); THN 10-3611BUIR-def(a); THN 10-3611UIR-def(a); THN 10-3612UIR-def(a); THN 10-3613UIR-def(a); THN 10-3615UIR-def(a); THN 10-3621UIR-def(a); THN 10-3622UIR-def(a); THN 10-3623UIR-def(a); THN 10-7210UIR-def(a); THN 10-7211BUIR-def(a); THN 10-7211UIR-def(a); THN 10-7212UIR-def(a); THN 10-7213UIR-def(a); THN 10-7215UIR-def(a); THN 10-7221UIR-def(a); THN 10-7222UIR-def(a); THN 10-7223UIR-def(a) "- " can be optional. "d" can be N or blank; When d= N represents Negative logic. When d= blank represents Positive logic. "e" can be B1, A1 or blank; When e= B1 represents None. When e= A1 represents with UVP adj. When e= blank represents with Bus. "f" can be HS2, HS3, HS4 or blank; When f= HS2, HS3, HS4 represents with Heatsink. When f= blank represents without Heatsink. "(a)" can be six variables, each variable may be A through Z, 0 through 9, dash, any punctuation marks or blank)
Test Model	THN 10-7215UIR
Brand	TRACO POWER 
Serial Number	N/A
Highest working frequency	Less than 108MHz
The radiation test should be tested till	1GHz

For EMI test configuration:

Configuration	Model Name	Input VDC	Output Voltage VDC
1	THN 10-7215UIR	72	24

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

Configuration	Model Name	Input VDC	Output Voltage VDC	With an aluminum electrolytic capacitor test board
1	THN 10-7215UIR	72	24	No

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

Configuration	Model Name	Input VDC	Output Voltage VDC	With an aluminum electrolytic capacitor test board
1	THN 10-7215UIR	72	24	Yes

Different Model list:

Model Name	Input Range (VDC)	Output Voltage (VDC)
THN 10-3610UIR-def(a)	9 ~ 75	3.3
THN 10-3611BUIR-def(a)	9 ~ 75	5
THN 10-3611UIR-def(a)	9 ~ 75	5.1
THN 10-3612UIR-def(a)	9 ~ 75	12
THN 10-3613UIR-def(a)	9 ~ 75	15
THN 10-3615UIR-def(a)	9 ~ 75	24
THN 10-3621UIR-def(a)	9 ~ 75	±5
THN 10-3622UIR-def(a)	9 ~ 75	±12
THN 10-3623UIR-def(a)	9 ~ 75	±15
THN 10-7210UIR-def(a)	14 ~ 160	3.3
THN 10-7211BUIR-def(a)	14 ~ 160	5
THN 10-7211UIR-def(a)	14 ~ 160	5.1
THN 10-7212UIR-def(a)	14 ~ 160	12
THN 10-7213UIR-def(a)	14 ~ 160	15
THN 10-7215UIR-def(a)	14 ~ 160	24
THN 10-7221UIR-def(a)	14 ~ 160	±5
THN 10-7222UIR-def(a)	14 ~ 160	±12
THN 10-7223UIR-def(a)	14 ~ 160	±15

"-" can be optional.

"d" can be N or blank;
When d= N represents Negative logic.
When d= blank represents Positive logic.

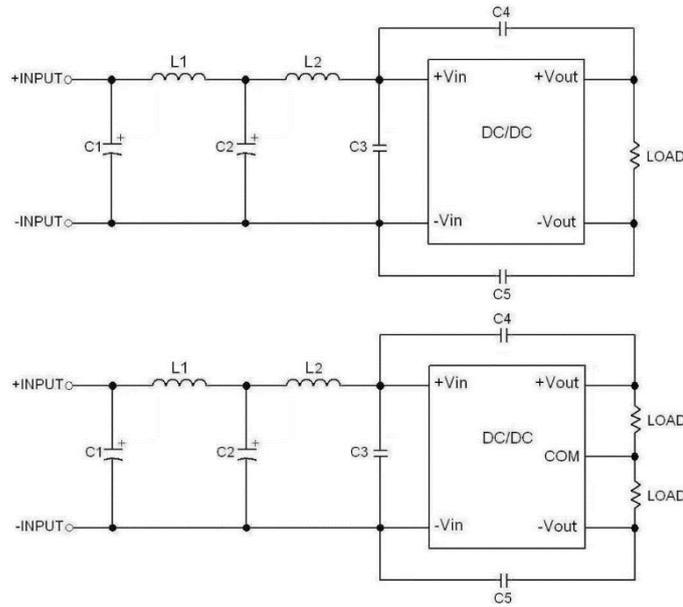
"e" can be B1, A1 or blank;
When e= B1 represents None.
When e= A1 represents with UVP adj.
When e= blank represents with Bus.

"f" can be HS2, HS3, HS4 or blank;
When f= HS2, HS3, HS4 represents with Heatsink.
When f= blank represents without Heatsink.

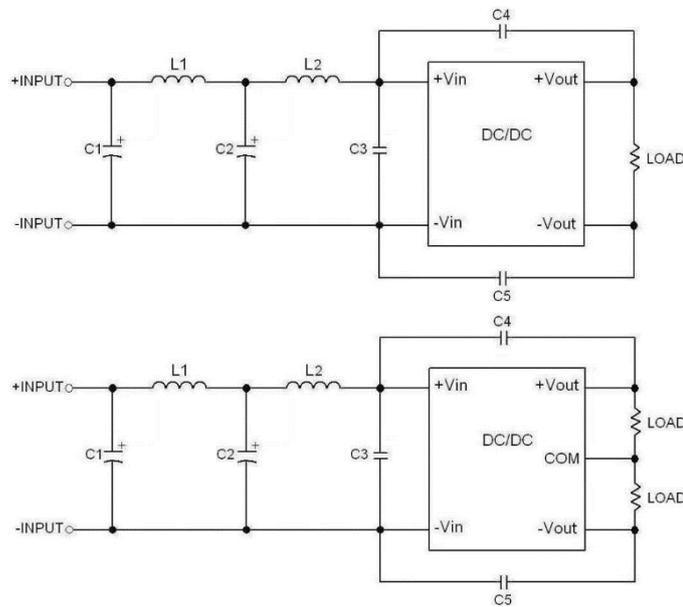
"(a)" can be six variables, each variable may be A through Z, 0 through 9, dash, any punctuation marks or blank)

EMI Noise Source:

For EMI test requirements/Class B

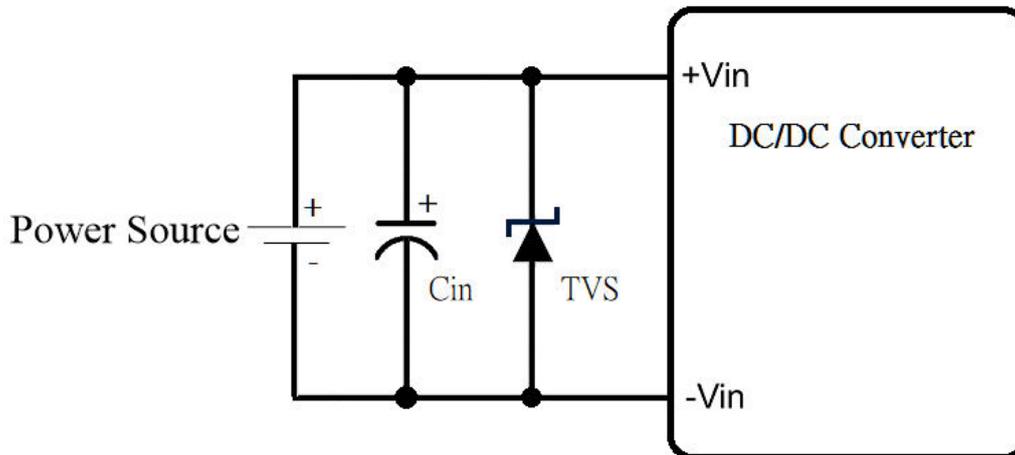


MODEL	C1、C2	C3	C4	C5	L1	L2
THN 10UIR-36 Vin	22 μ F/ 100V	4.7 μ F/ 100V	680pF/ 3kV	680pF/ 3kV	22uH	6.8uH



MODEL	C1、C2	C3	C4	C5	L1	L2
THN 10UIR-72 Vin	47 μ F/ 200V	1 μ F/ 250V	2200pF/ 3kV	1000pF/ 3kV	47uH	33uH

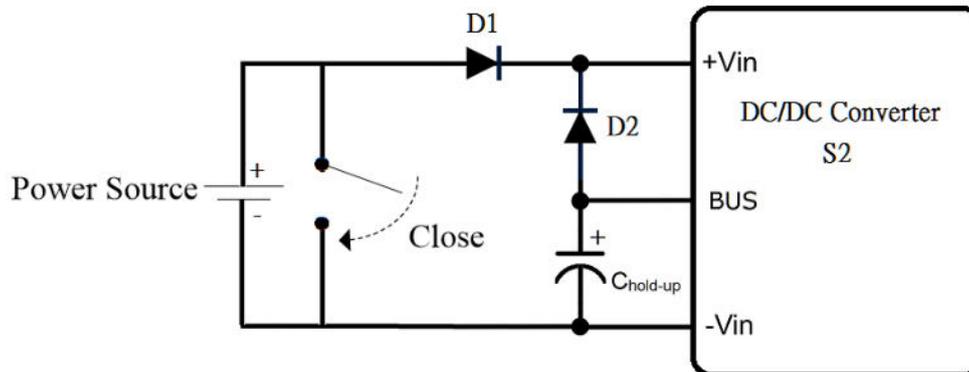
For Electrical Fast transient & Surge Immunity test requirements



Model Reference	Increase countermeasure components
THN 10UIR-36 Vin	With an external input filter Cin : 220μF/100V TVS : 120V/3000W
THN 10UIR-72Vin	With an external input filter Cin : 150μF/200V TVS : 170V/3000W

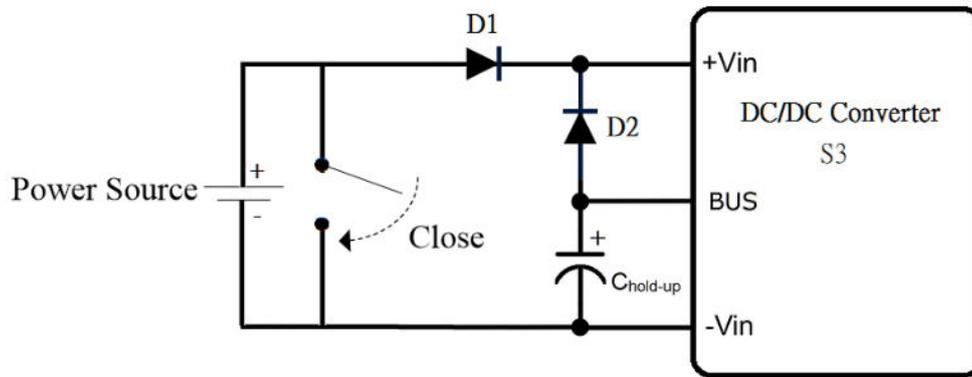
For Interruption voltage supply classes & supply change-over classes test requirements

Recommended external components for Interruptions of voltage supply Class S2



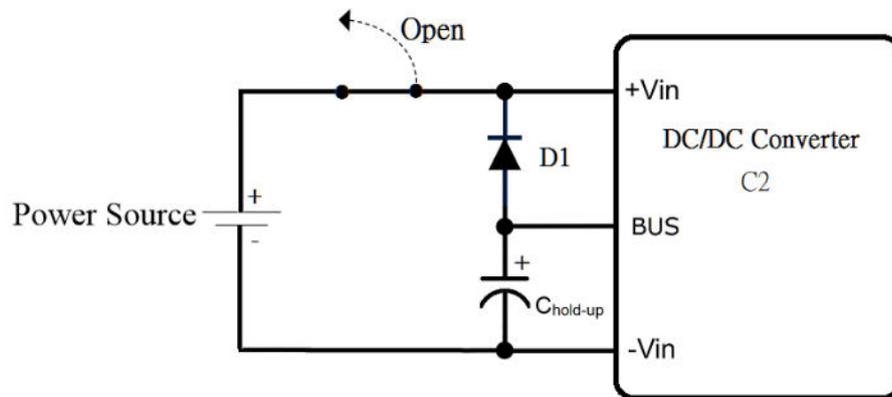
Model Reference	D1	D2	C _{hold-up}
THN 10UIR-36 Vin	400V / 5A	400V / 5A	900μF / 25V
THN 10UIR-72 Vin			1100μF / 25V

Recommended external components for Interruptions of voltage supply Class S3



Model Reference	D1	D2	C _{hold-up}
THN 10UIR-36 Vin	400V / 5A	400V / 5A	1800μF / 25V
THN 10UIR-72 Vin			2200μF / 25V

Recommended external components for supply change-over Class C2



Model Reference	D1	C _{hold-up}
THN 10UIR-36 Vin	400V / 5A	2700μF / 25V
THN 10UIR-72 Vin		3300μF / 25V

1.4 Description of Support Equipment

For EMI test Configuration Support unit: 1~2

For EMS test Configuration Support unit: 1~3

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
3	DC Voltage meter	BN-670 S/N: N/A	Bonny	N/A	N/A

2. Characteristic Test

2.1 Visual Inspection and Performance test

2.1.1 Requirement:

The visual inspection shall be carried out to ensure that the equipment construction meets its specified requirements.

The performance test verifies the functional requirements of the Electronic Equipment. The performance test is carried out according to the Performance test specification and Performance test procedure written by the supplier either for type test or for routine test.

2.1.2 Test Procedure

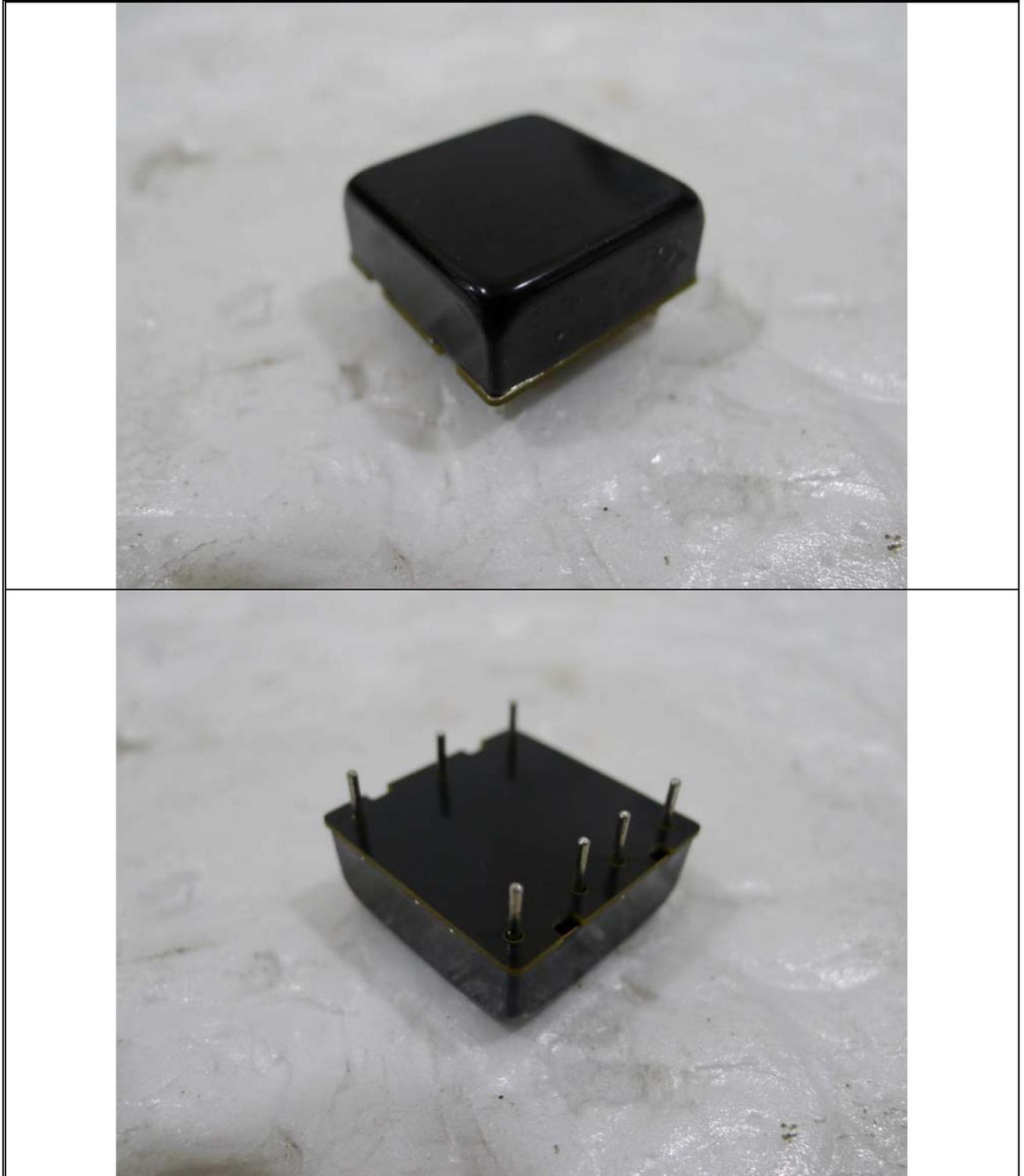
Test Procedures were referred to EN 50155 sub-clause 13.4.1 and 13.4.2

2.1.3 Test Result

Date: 2024/04/02	Temperature : 25 °C	Engineer: Hasan Yu
EUT Model Name: THN 10-7215UIR	Humidity: 56 %	Barometer Pressure: 97.6 kPa
		Standard: EN 50155
Voltage/Freq: 72Vdc		
Visual inspection requirement:		
The visual inspection shall be carried out to ensure that the equipment is of sound construction and, so far as can be ascertained, meets its specified requirements. A visual inspection shall also be carried out after a type test has been performed to check whether any damage or deterioration has occurred resulting from the tests.		

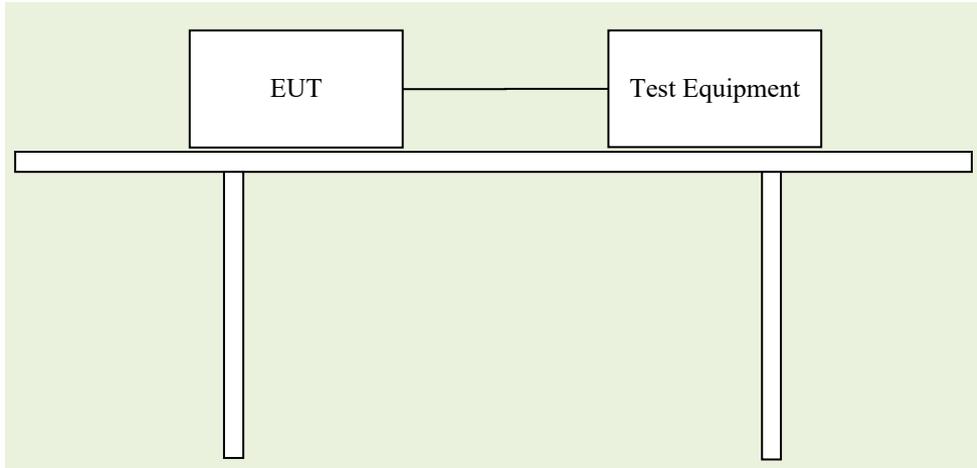
Inspection item	Result
EUT outside	OK
EUT function	OK

Before test : Ok



2.2 Power supply test (Supply variation and temporary supply dips)

2.2.1 Test Setup



2.2.2 Test Procedure

Test Procedures were referred to EN 50155 sub-clause 13.4.3.4 & 5.2.2 & 5.2.3

2.2.3 Test Requirement

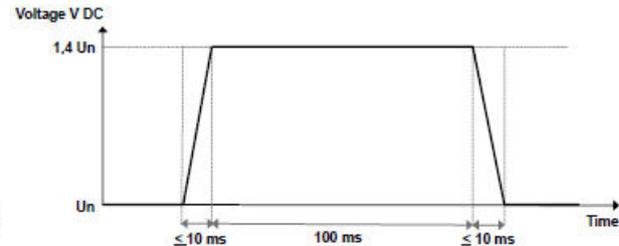
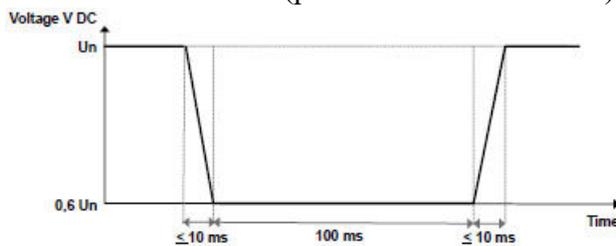
D.C. supplied equipment:

Test performed to prove correct functioning at nominal supply voltage and at the upper and lower limits of specified voltage as defined below:

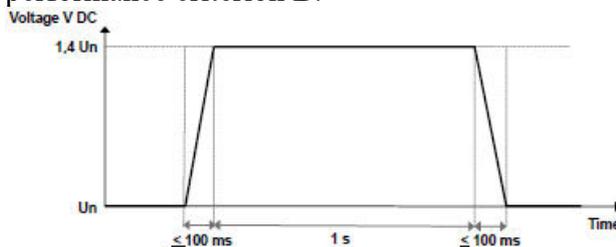
Minimum Continuous voltage: $0.7 U_n$

Maximum Continuous voltage: $1.25 U_n$

Voltage fluctuations and flicker (e.g. during start-up of auxiliary equipment or voltage oscillations of battery chargers) lying between $0.6 U_n$ and $1.4 U_n$ and not exceeding 0.1 s shall not cause deviation of function (performance criterion A).



For temporary supply overvoltages up to $1.4 U_n$ lasting no more than 1 s the equipment shall fulfil performance criterion B.



A.C. supplied equipment:

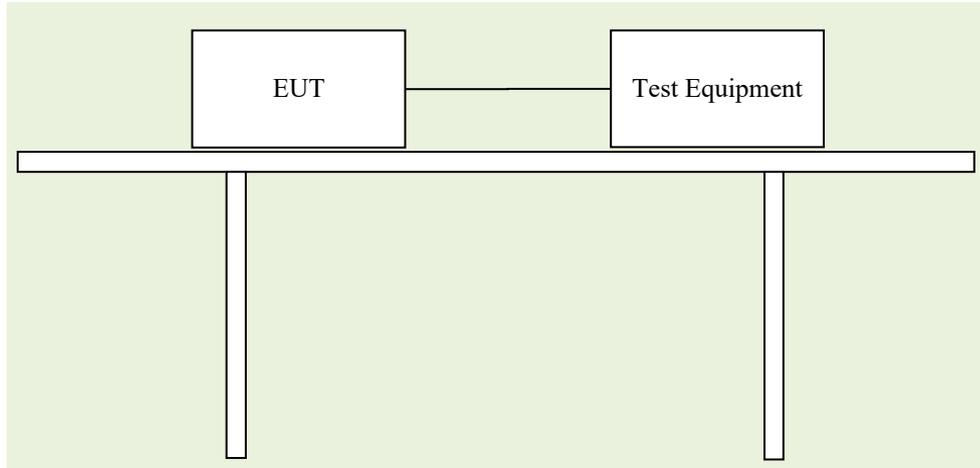
Test performed to prove correct functioning at: Nominal voltage and frequency; The upper and lower limits of voltage and frequency are in all combinations.

2.2.4 Test Result

Date: 2024/05/22		Temperature : 23 °C		Engineer: Hasan Yu		
EUT Model Name: THN 10-7215UIR		Humidity: 59 %		Barometer Pressure: 97.6 kPa		
				Standard: EN 50155		
Voltage/Freq: 72Vdc Un=Original test voltage						
Variations of Voltage supply	Level	Rise/ Decline time	Voltage	Test Time	EUT Status	Comments
Minimum voltage	0.7 Un	50µs	50.4Vdc	30 min	Pass	
Nominal voltage	Un	-	72Vdc	30 min	Pass	
Rated voltage	1.15 Un	50µs	82.8Vdc	30 min	Pass	
Maximum voltage	1.25 Un	50µs	90Vdc	30 min	Pass	
Temporary supply overvoltages/undervoltage						
Voltage fluctuations	Level	Rise/ Decline time	Voltage	Test Time	EUT Status	Comments
High voltage	1.4 Un	10ms	100.8Vdc	0.1 s	Pass	
Low voltage	0.6 Un	10ms	43.2Vdc	0.1 s	Pass	
High voltage	1.4 Un	100ms	100.8Vdc	1 s	Pass	

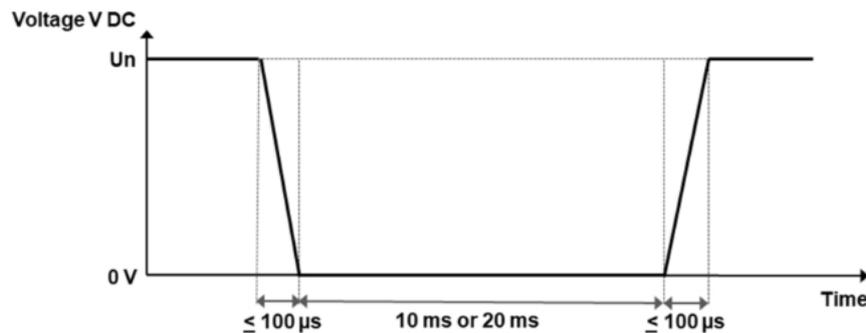
2.3 Power supply test (Supply Interruption)

2.3.1 Test Setup



2.3.2 Test Procedure

Test Procedures were referred to EN 50155 sub-clause 13.4.3.5 & 5.2.4

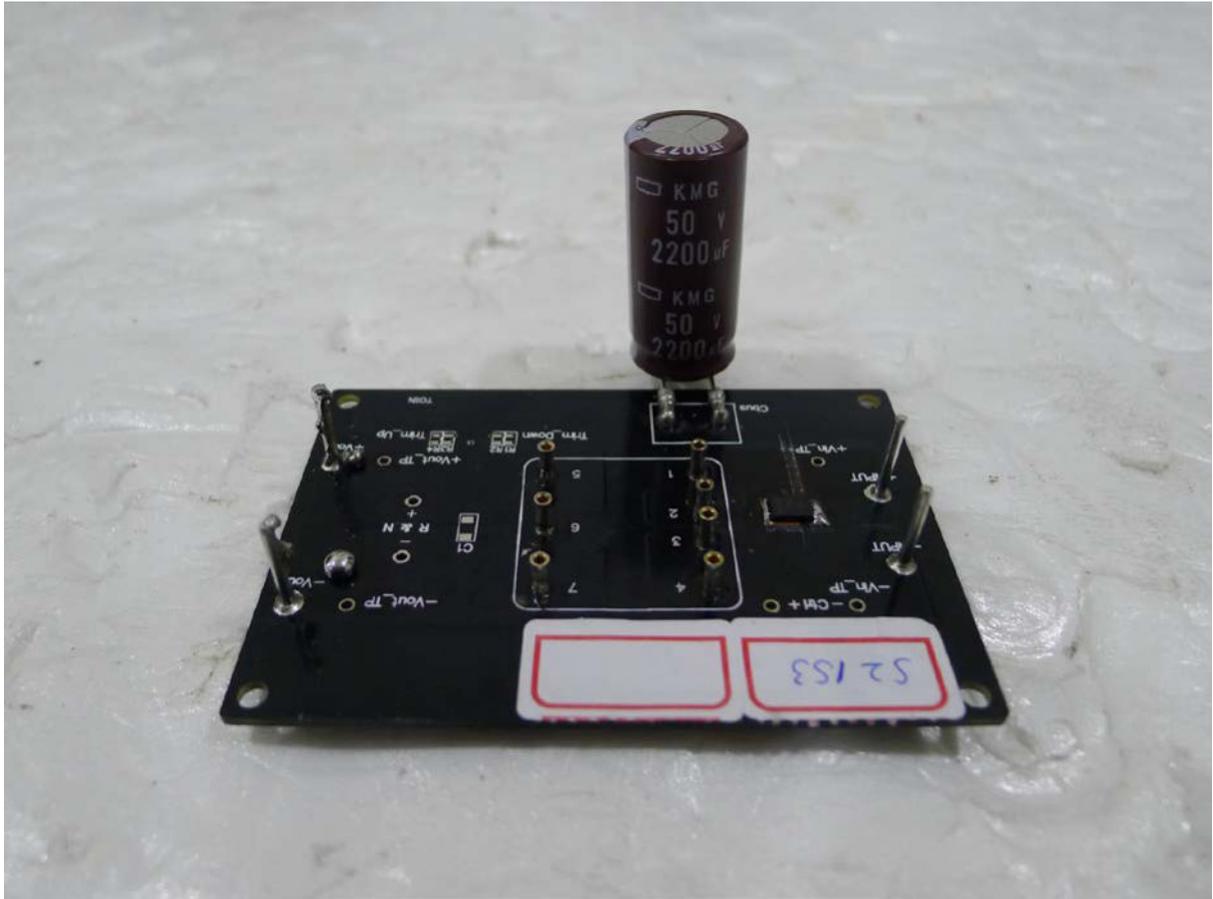


2.3.3 Test Requirement

Interruptions of input voltage as defined below:

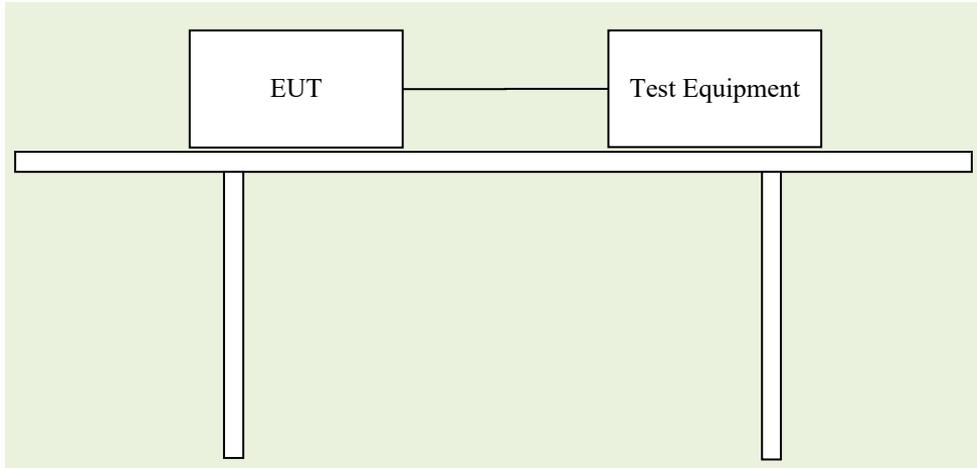
Class	Requirements	Duration of the interruption time T_{int}
S1	No performance criterion is requested but the equipment shall continue to operate as specified after the voltage interruption.	This test is not required.
S2	The equipment shall behave according performance criterion A.	$\leq 10\text{ ms}$
	The equipment shall behave according performance criterion C.	$> 10\text{ ms}$
S3	The equipment shall behave according performance criterion A.	$\leq 20\text{ ms}$
	The equipment shall behave according performance criterion C.	$> 20\text{ ms}$

For S3 test



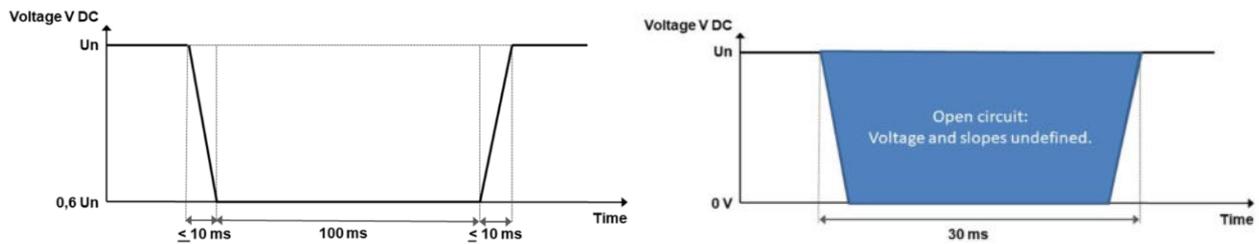
2.4 Power supply test (Supply Change Over)

2.4.1 Test Setup



2.4.2 Test Procedure

Test Procedures were referred to EN 50155 sub-clause 13.4.3.6 & 5.2.5



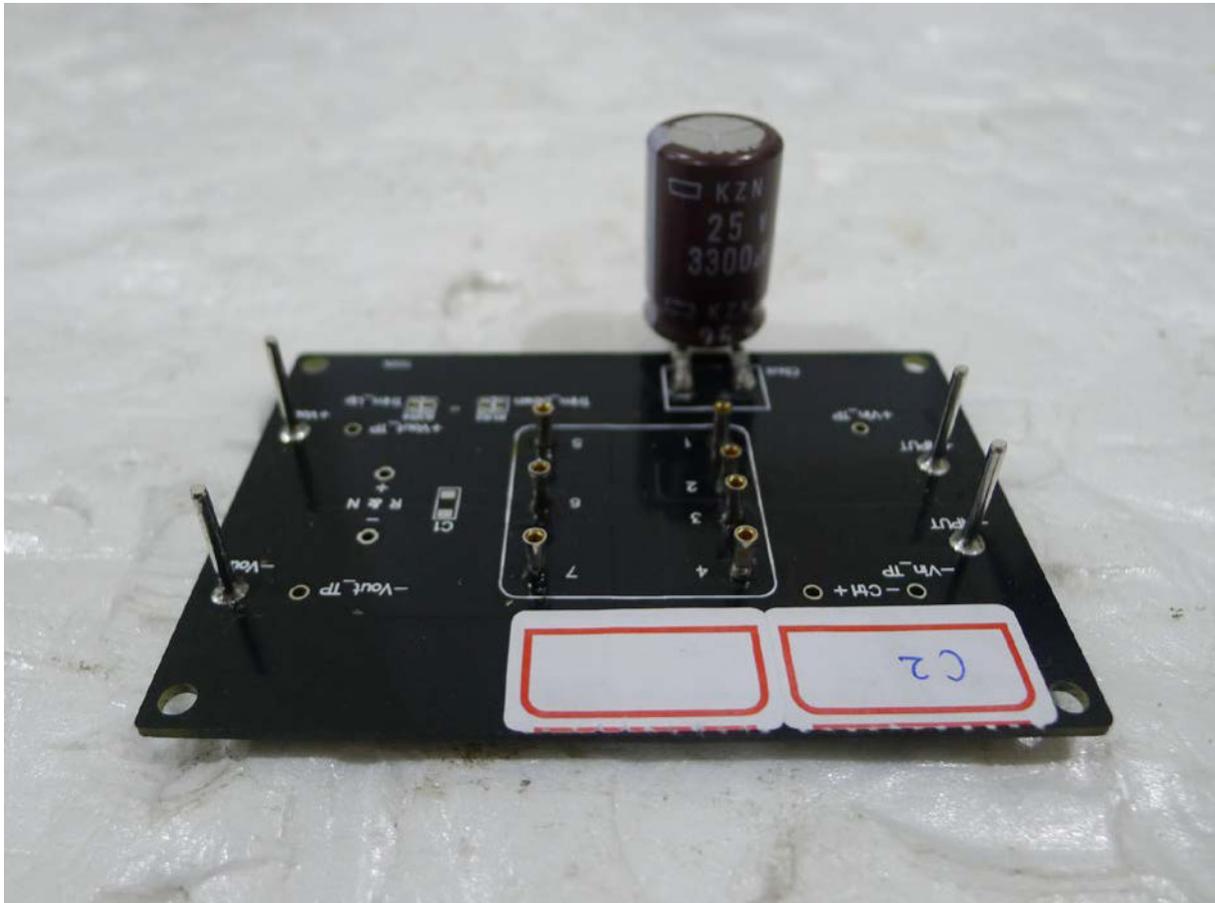
2.4.3 Test Requirement

- Class C1 at $0.6 U_n$ during ≤ 100 ms (without interruptions) **Performance criterion A;**
- Class C2: during a supply break of ≤ 30 ms starting at U_n **Performance criterion B.**

2.4.4 Test Result

Date: 2024/05/22	Temperature : 23 °C	Engineer: Hasan Yu				
EUT Model Name: THN 10-7215UIR	Humidity: 59 %	Barometer Pressure: 97.6 kPa				
Standard: EN 50155						
Voltage/Freq: 72Vdc Un=Original test voltage						
Supply change over	Level	Rise/ Decline time	Voltage	INT time	EUT Status	Comments
Class C1:60% residual voltage	0.6 Un	10ms	43.2Vdc	100ms	Pass	
Class C2:0% residual voltage	0 Un	50µs	0Vdc	30ms	Pass	Note
Note: Add an aluminum electrolytic capacitor (3300uF/25V) and a diode (5A/400V) to test.						

For C2 test



2.5 Insulation Test

2.5.1 Test Procedure

Test Procedures were referred to EN 50155 sub-clause 13.4.7 & 7.2.1 & 4.6.8

2.5.2 Test Requirement

Insulation measurement Test: 500VDC

The insulation resistance test carried out at 500 VDC and the values recorded.

The test repeated after the voltage withstand test.

Test acceptance requirements:

There shall be no fundamental deterioration from the initial measurement.

Voltage withstand test:

Nominal battery voltages and/or I/O voltage	Test Voltage
$< 72\text{Vdc}$ or $50\text{Vac}_{\text{rms}}$	500Vac or 750Vdc
$72\text{Vdc} \leq \text{Vdc} < 125\text{Vdc}$ or from 50 to 90 Vac_{rms}	1000Vac or 1500Vdc
$125\text{Vdc} \leq \text{Vdc} < 315\text{Vdc}$ or from 90 to 225 Vac_{rms}	1500Vac or 2200Vdc

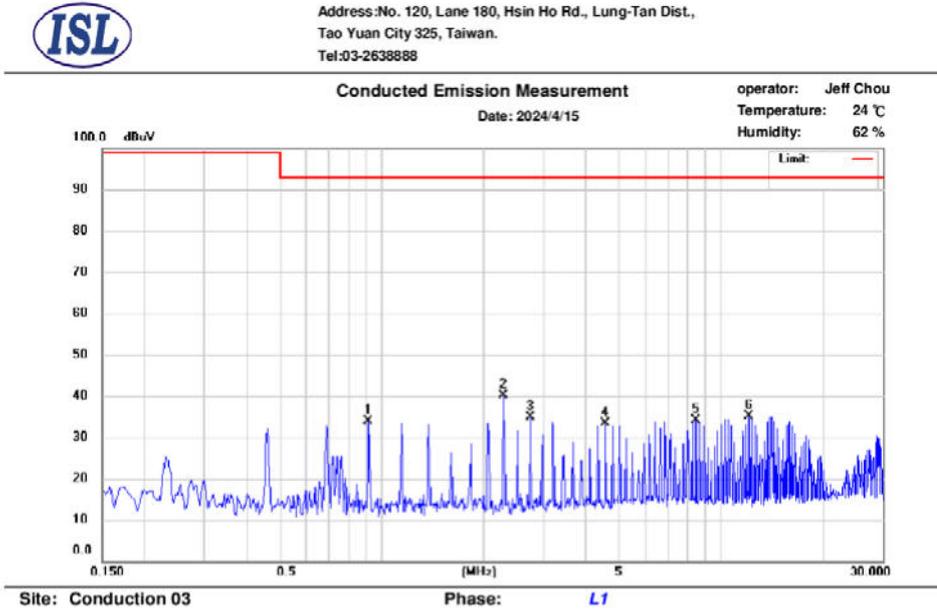
Test acceptance requirements:

Neither disruptive discharge nor flashover shall occur.

2.5.3 Test Result

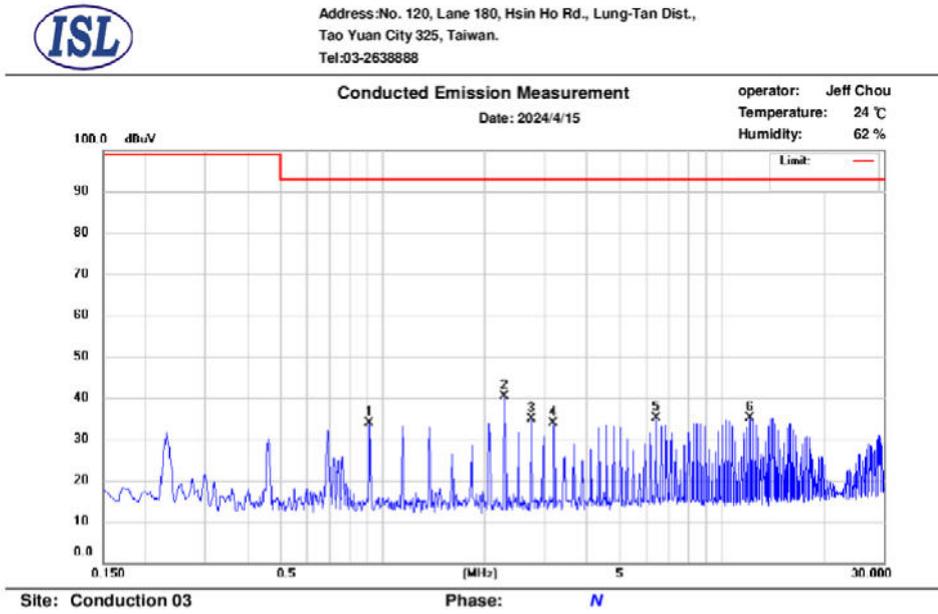
Date: 2024-06-13	Temperature : 22.1 °C	Engineer: Oscar Hsieh		
EUT Model Name: THN 10-7215UIR	Humidity: 65.1 %	Equipment: TH110-POSE, TH110-POSE		
	Barometer Pressure: 97.6kPa	Standard: EN 50155:2021 insulation test		
Insulation Test Requirement: Before testing				
1. Insulation measurement Test :				
The insulation resistance test shall be carried out at 500 Vdc and the values recorded. The test shall then be repeated after the voltage withstand test. There shall be no fundamental deterioration from the initial measurement.				
Test item	Test Time	Insulation measurement test		Comments
		before withstand	after withstand	
Primary side to secondary side(1500Vdc)	1 min	> 50 GΩ	> 50 GΩ	Pass
Primary side to secondary side(3000Vdc)	1 min	> 50 GΩ	> 50 GΩ	Pass
2. Voltage Withstand test				
500 Vac or 750 Vdc for nominal battery voltages below 72 Vdc (or 50 Vac). 1000 Vac or 1500 Vdc for nominal battery voltage from 72 Vdc up to 125 Vdc, (or from 50 to 90 Vac), and 1500 Vac or 2200 Vdc for nominal battery voltage above 125 Vdc and up to 315 Vdc, (or from 90 to 225 Vac). Neither disruptive discharge nor flashover shall occur				
Test item	Test Voltage	Test Time	Result	Comments
Primary side to secondary side	1500 Vdc	1 min	0 mA	Pass
Primary side to secondary side	3000 Vdc	1 min	0 mA	Pass
Supplementary information:				

Conduction Test Data: Configuration 1
-Live



Note:
 Margin = QP Emission – Limit
 QP Emission = QP_R + Correct Factor
 Correct Factor = LISN Loss + Cable Loss

-Neutral



No.	Frequency (MHz)	QP_R (dBuV)	AVG_R (dBuV)	Correct Factor (dB)	QP Emission (dBuV)	QP Limit (dBuV)	QP Margin (dB)
1	0.918	22.47	22.72	10.29	32.76	93.00	-60.24
2*	2.290	29.70	29.93	10.37	40.07	93.00	-52.93
3	2.750	23.70	23.85	10.38	34.08	93.00	-58.92
4	3.206	22.96	23.07	10.40	33.36	93.00	-59.64
5	6.414	23.74	23.87	10.51	34.25	93.00	-58.75
6	12.142	23.31	23.36	10.70	34.01	93.00	-58.99

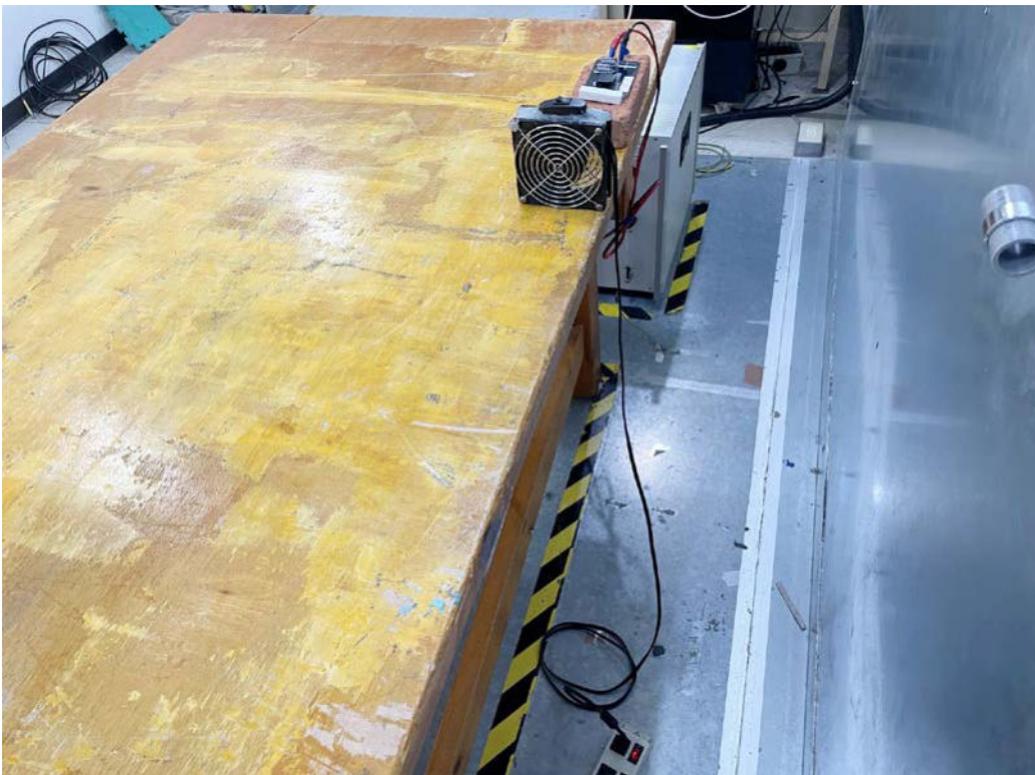
Note:
 Margin = QP Emission – Limit
 QP Emission = QP_R + Correct Factor
 Correct Factor = LISN Loss + Cable Loss

3.1.5 Test Setup Photo

Front View



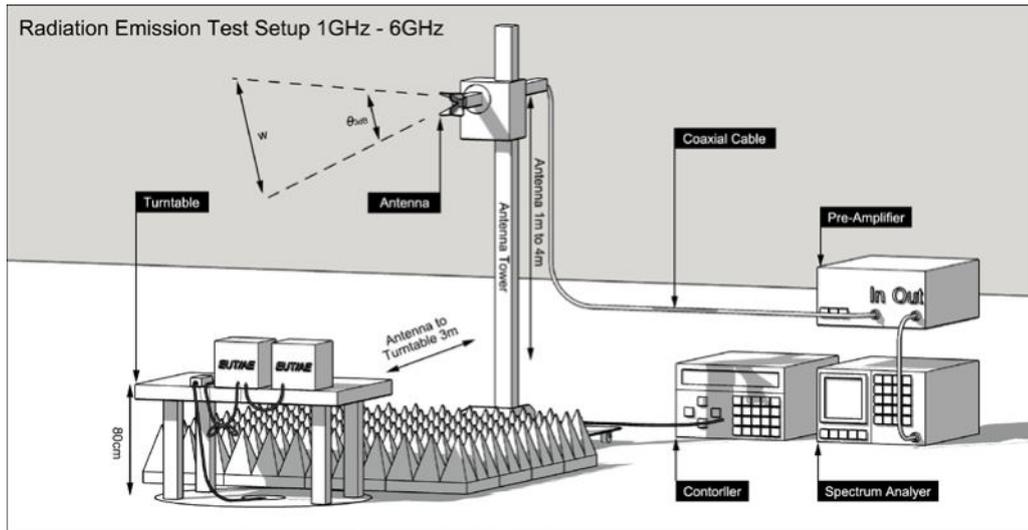
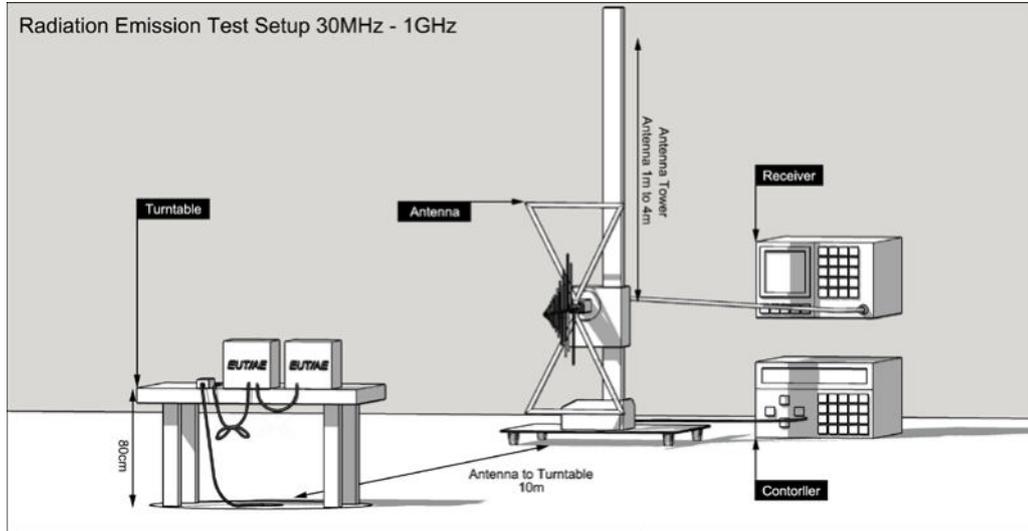
Back View



3.2 Radiated Disturbance Emissions

3.2.1 Test Setup and Procedure

3.2.2 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	$\theta_{3dB}(\text{min})$	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

3.2.3 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 6 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 interface cables were manipulated according to EN 61000-6-4 / BS EN 61000-6-4 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 6 GHz, whichever is less.

3.2.4 Spectrum Analyzer Configuration (for the frequencies tested)

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

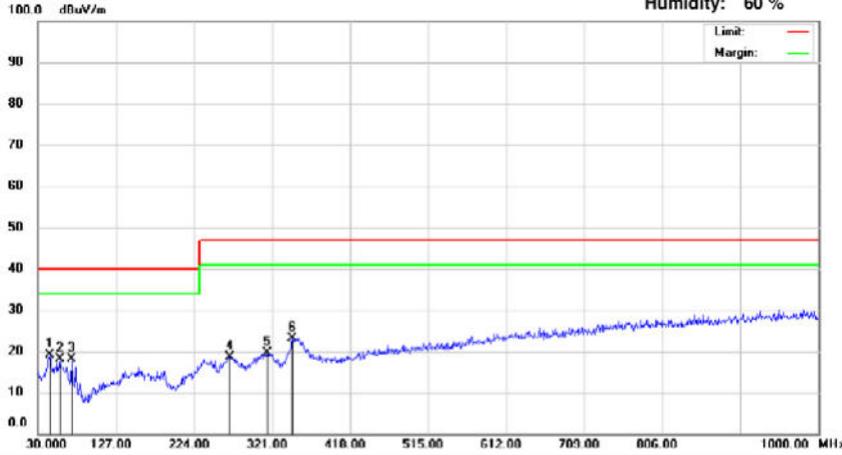
Frequency Range:	Above 1 GHz to 6 GHz
Detector Function:	Peak / Average Mode
Resolution Bandwidth:	1MHz

Radiation Test Data: Configuration 1 -Horizontal



Address: No. 120, Lane 180, Hsin Ho Rd., Lung-Tan Dist.,
Tao Yuan City 325, Taiwan.
Tel: 03-2638888

Radiated Emission Measurement Operator: Eric Chen
Date: 2024/4/10 Temperature: 24 °C
Humidity: 60 %



Site : Chamber 02

Polarization: *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*	44.55	36.08	-16.98	19.10	40.00	-20.90	400	143	peak
2	57.16	34.74	-16.63	18.11	40.00	-21.89	400	360	peak
3	71.71	37.27	-19.15	18.12	40.00	-21.88	400	182	peak
4	268.62	33.72	-14.98	18.74	47.00	-28.26	300	39	peak
5	315.18	32.82	-13.16	19.66	47.00	-27.34	300	60	peak
6	346.22	35.45	-12.43	23.02	47.00	-23.98	300	337	peak

* Note:

Margin = Emission – Limit

Emission = Radiated Amplitude + Correct Factor

Correct Factor = Antenna Correction Factor + Cable Loss

BILOG Antenna Distance: 10 meters

-Vertical



Address: No. 120, Lane 180, Hsin Ho Rd., Lung-Tan Dist.,
Tao Yuan City 325, Taiwan.
Tel: 03-2638888

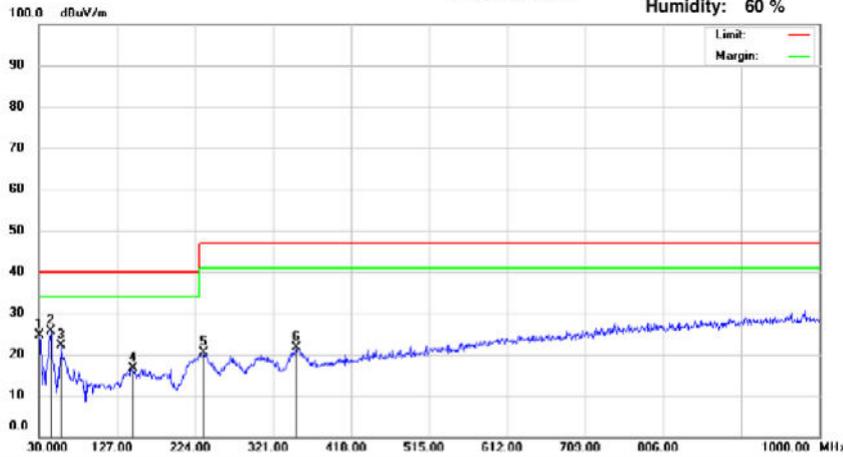
Radiated Emission Measurement

Date: 2024/4/10

Operator: Elric Chen

Temperature: 24 °C

Humidity: 60 %



Site : Chamber 02

Polarization: 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	30.97	43.03	-18.33	24.70	40.00	-15.30	100	6	peak
2*	44.55	42.51	-16.98	25.53	40.00	-14.47	100	188	peak
3	58.13	39.12	-16.94	22.18	40.00	-17.82	100	74	peak
4	147.37	32.20	-15.47	16.73	40.00	-23.27	150	354	peak
5	234.67	37.22	-16.82	20.40	47.00	-26.60	100	0	peak
6	350.10	34.09	-12.40	21.69	47.00	-25.31	100	13	peak

* Note:

Margin = Emission - Limit

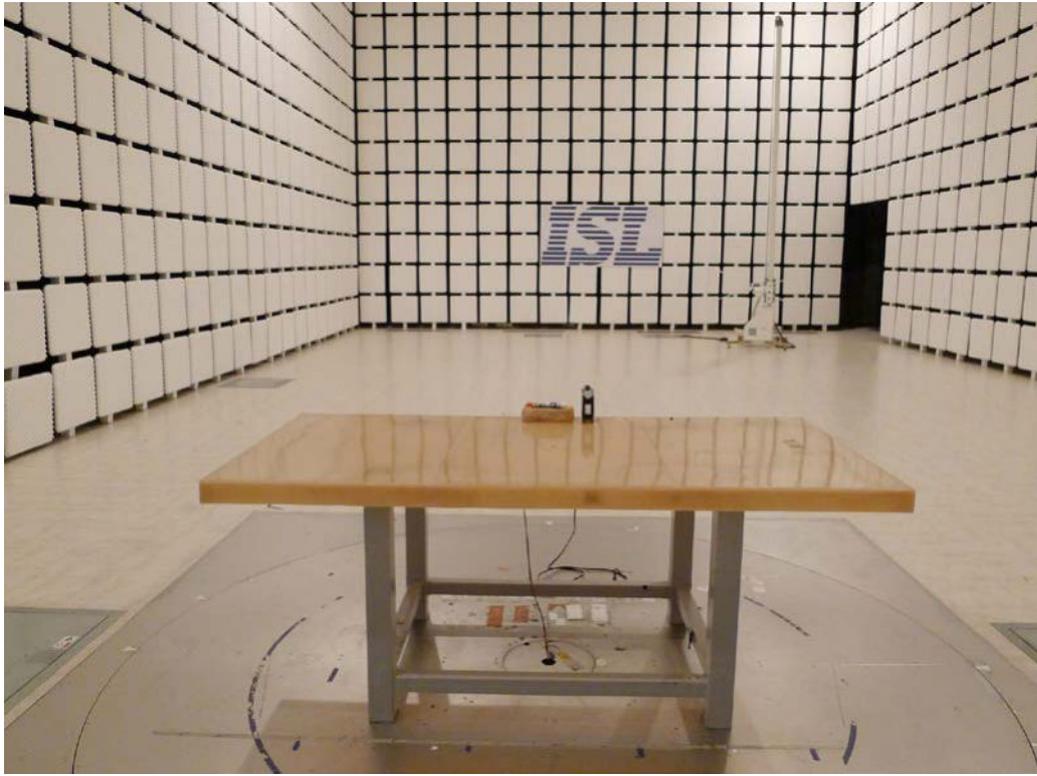
Emission = Radiated Amplitude + Correct Factor

Correct Factor = Antenna Correction Factor + Cable Loss

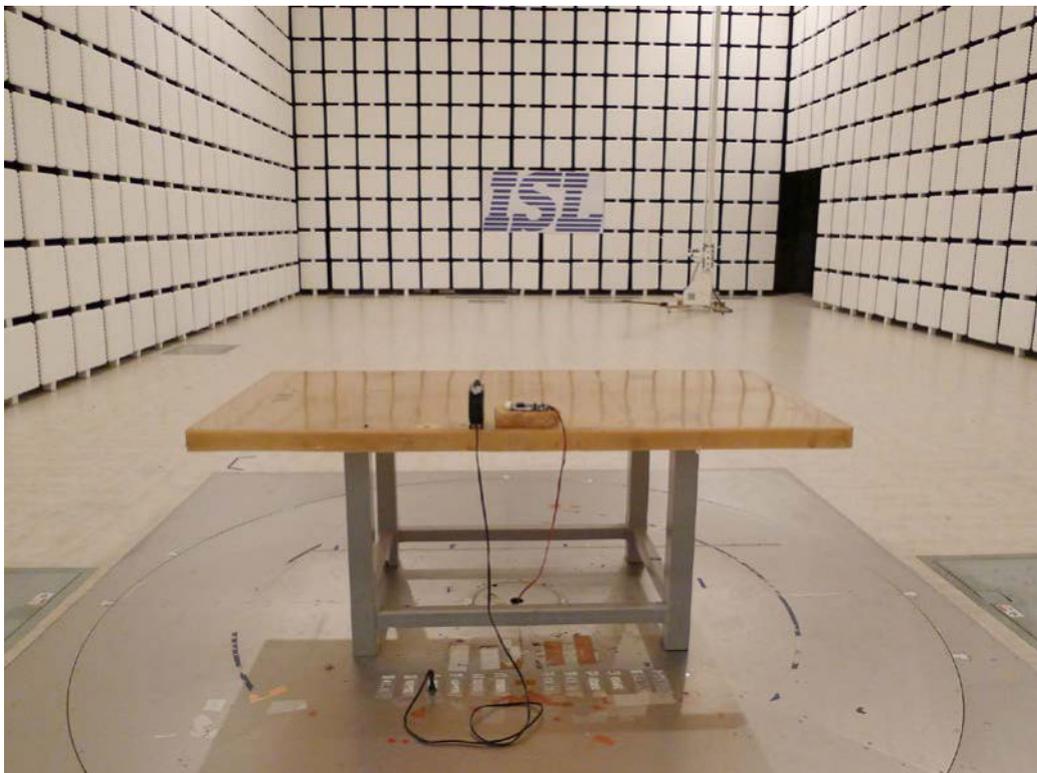
BILOG Antenna Distance: 10 meters

3.2.5 Test Setup Photo

Front View (30MHz~1GHz)



Back View (30MHz~1GHz)



3.3 Electrostatic discharge immunity

3.3.1 Test Specification

Port:	Enclosure
Basic Standard:	EN 61000-4-2 / IEC EN61000-4-2 / BS EN 61000-4-2 (details referred to Sec 1.2)
Test Level:	Air +/- 2 kV, +/- 4 kV, +/- 8 kV Contact +/- 4 kV, +/- 6 kV
Criteria:	B
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.

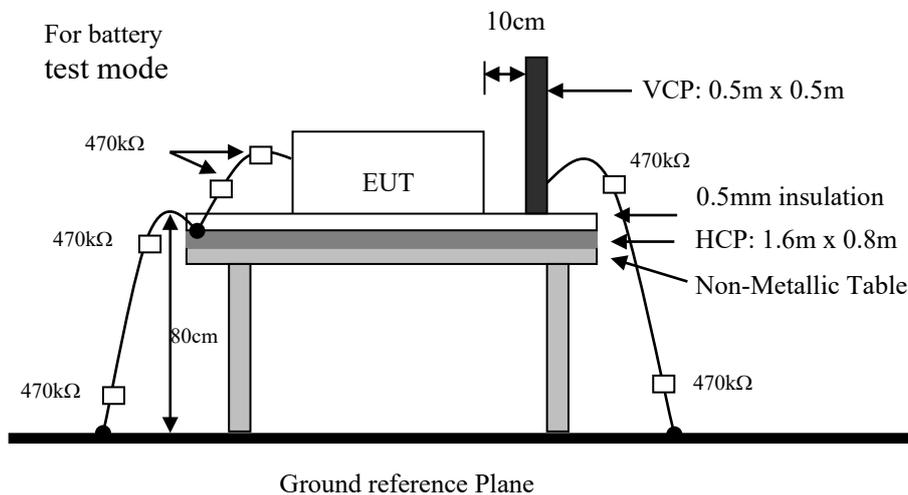
Contact: 10 discharges to the selected contact points.

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.

Energy-Storage Capacitor: 150 pF; Discharge Resistor: 330 Ω

3.3.2 Test Setup

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



3.3.3 Test Result

Performance of EUT complies with the given specification.

3.4 Test Data: Configuration 1

Basic Standard	EN 61000-4-2							Date		
EUT Model Name	THN 10-7215UIR							2024-05-16		
Barometer Pressure	97.6kPa							Engineer		
Temperature	22°C							Reyes Hsu		
Humidity	40%							Equipment & Test Site		
Voltage/Freq.	72V							EM TEST (Model: Dito) ESD GUN 12 & ESD 1F		
A=criteria A, B=criteria B, C=criteria C										
<p>→ Blue arrow represents Air discharge point → Red arrow represents 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</p>										
Contact Discharge		Voltage kV 25 Discharge @ 1 PPS								
Test Location	+4	-4	+6	-6						Comments
1	A	A	A	A						
2	A	A	A	A						
3	A	A	A	A						
4	A	A	A	A						
5	A	A	A	A						
Air Discharge		Voltage kV 10 Discharge @ 1 PPS								
Test Location	+2	-2	+4	-4	+8	-8				Comments
1	A	A	A	A	A	A				
2	A	A	A	A	A	A				
3	A	A	A	A	A	A				
4	A	A	A	A	A	A				
5	A	A	A	A	A	A				
Indirect Discharge		Voltage kV 25 Discharge @ 1 PPS								
Test Location	+4	-4	+6	-6						Comments
VCP Front	A	A	A	A						
VCP Right	A	A	A	A						
VCP Left	A	A	A	A						
VCP Back	A	A	A	A						
Test Location	+4	-4	+6	-6						Comments
HCP Front	A	A	A	A						
HCP Right	A	A	A	A						
HCP Left	A	A	A	A						
HCP Back	A	A	A	A						
Additional Notes: A=criteria A, B=criteria B, C=criteria C										

3.4.1 Test Point

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

Figure-1. Test Point Assignments Discharge:

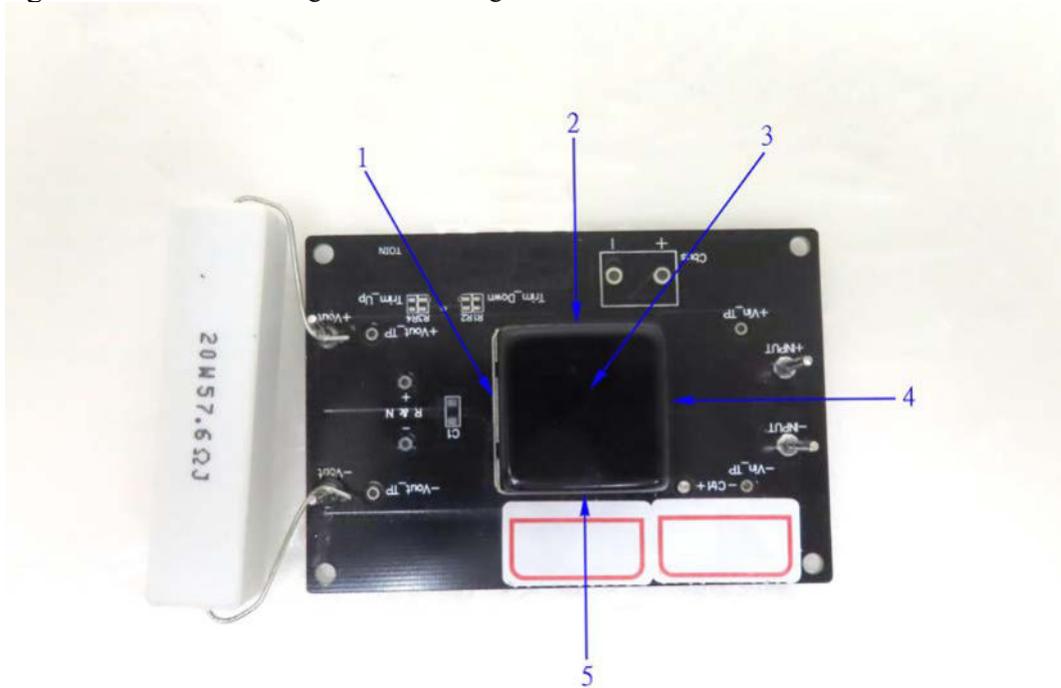
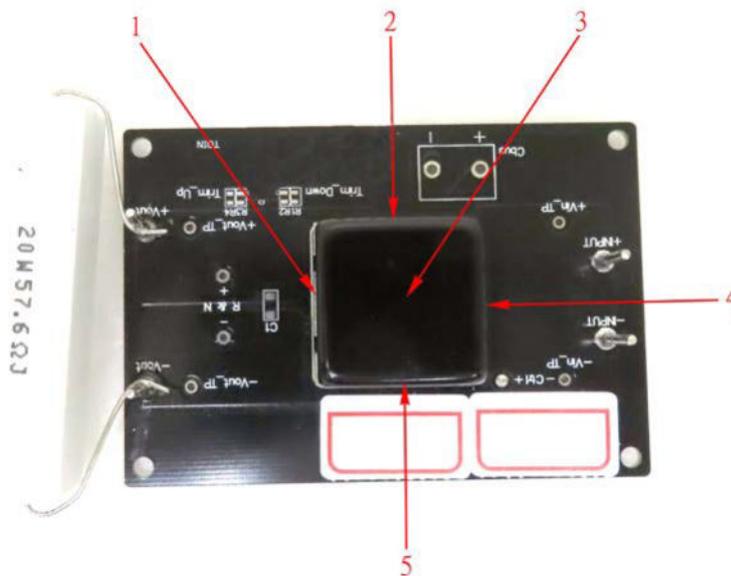


Figure-2. Test Point Assignments Discharge:



3.4.2 Test Setup Photo



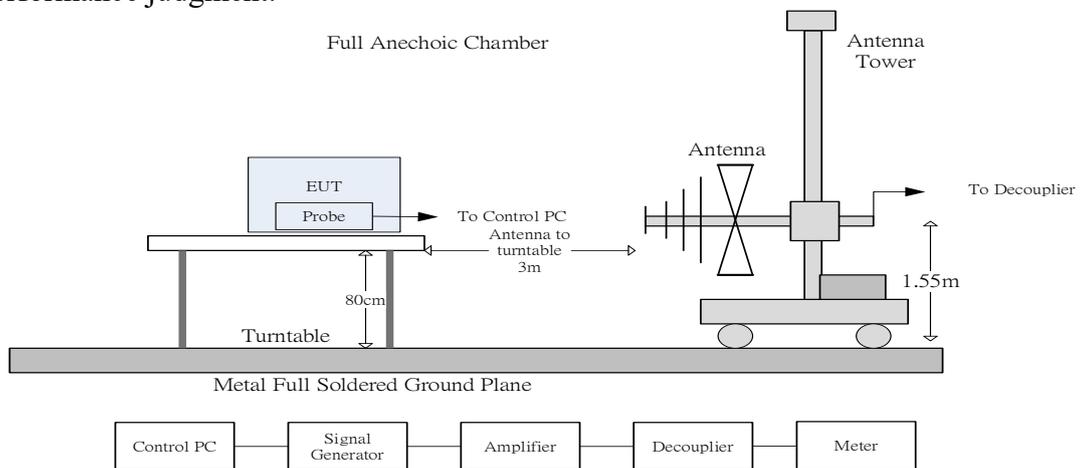
3.5 Radiated, radio-frequency, electromagnetic field immunity

3.5.1 Test Specification

Port:	Enclosure
Basic Standard:	EN IEC 61000-4-3 / IEC EN61000-4-3 / BS EN 61000-4-3 (details referred to Sec 1.2)
Frequency range/Test Level:	80 MHz to 1000 MHz: 20 V/m 1400 MHz to 2000 MHz: 10 V/m 2000 MHz to 2700 MHz: 5 V/m 5100 MHz to 6000 MHz: 3 V/m
Modulation:	AM 1KHz 80%
Frequency Step:	1% of last step frequency
Dwell time:	2s
Polarization:	Vertical and Horizontal
EUT Azimuth Angle	<input checked="" type="checkbox"/> 0° <input checked="" type="checkbox"/> 90° <input checked="" type="checkbox"/> 180° <input checked="" type="checkbox"/> 270°
Criteria:	A
Test Procedure:	refer to ISL QA -T4-E-S8

3.5.2 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.



3.5.3 Test Result

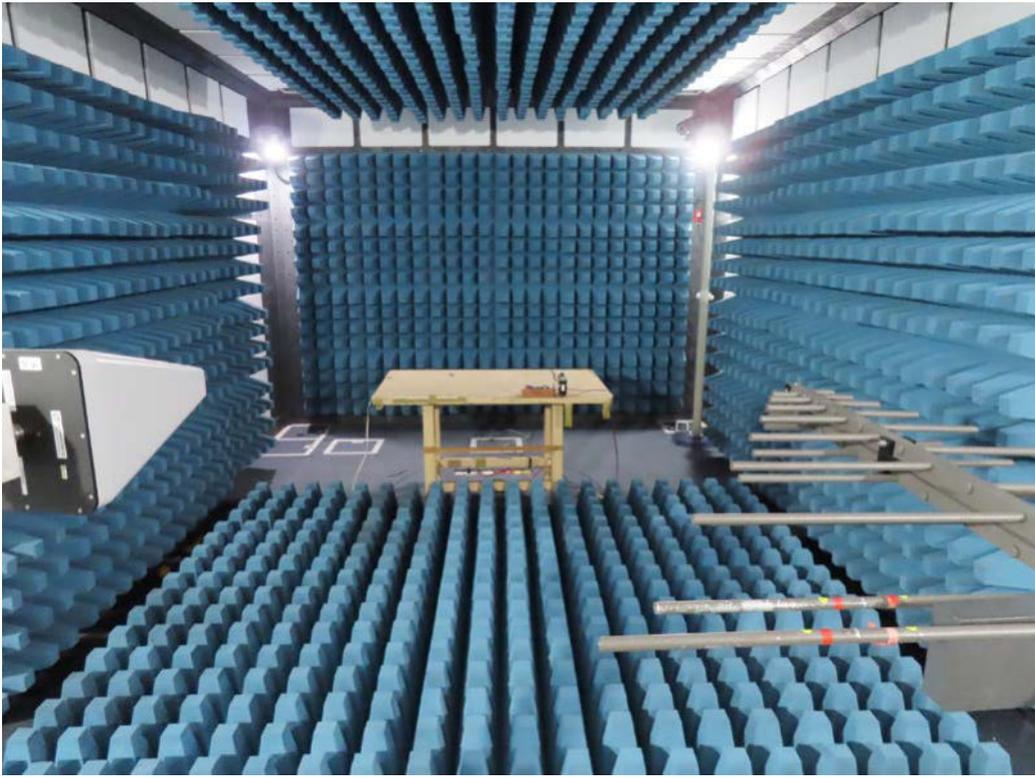
Performance of EUT complies with the given specification.

3.6 Test Data: Configuration 1

Basic Standard		EN 61000-4-3		Date				
EUT Model Name		THN 10-7215UIR		2024-05-22				
				Engineer				
Barometer Pressure		97.6kPa		Hasan Yu				
Temperature		23°C		Equipment & Test Site				
Humidity		55%		Chamber 15				
Voltage/Freq.		72 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)	80-1000	1	3s	80% @ 1KHz	20	Vertical	A	
90° (left)	80-1000	1	3s	80% @ 1KHz	20	Vertical	A	
180° (back)	80-1000	1	3s	80% @ 1KHz	20	Vertical	A	
270° (right)	80-1000	1	3s	80% @ 1KHz	20	Vertical	A	
0° (front)	80-1000	1	3s	80% @ 1KHz	20	Horizontal	A	
90° (left)	80-1000	1	3s	80% @ 1KHz	20	Horizontal	A	
180° (back)	80-1000	1	3s	80% @ 1KHz	20	Horizontal	A	
270° (right)	80-1000	1	3s	80% @ 1KHz	20	Horizontal	A	
EUT Angle	Frequency		Dwell time	Modulation	Level (V/m)	Antenna Polarization	EUT Status	Comments
	Range (MHz)	Steps %						
0° (front)	1400-2000	1	3s	80% @ 1KHz	10	Vertical	A	
90° (left)	1400-2000	1	3s	80% @ 1KHz	10	Vertical	A	
180° (back)	1400-2000	1	3s	80% @ 1KHz	10	Vertical	A	
270° (right)	1400-2000	1	3s	80% @ 1KHz	10	Vertical	A	
0° (front)	1400-2000	1	3s	80% @ 1KHz	10	Horizontal	A	
90° (left)	1400-2000	1	3s	80% @ 1KHz	10	Horizontal	A	
180° (back)	1400-2000	1	3s	80% @ 1KHz	10	Horizontal	A	
270° (right)	1400-2000	1	3s	80% @ 1KHz	10	Horizontal	A	

EUT Angle	Frequency		Dwell time	Modulation	Level (V/m)	Antenna Polarization	EUT Status	Comments
	Range (MHz)	Steps %						
0° (front)	2000-2700	1	3s	80% @ 1KHz	5	Vertical	A	
90° (left)	2000-2700	1	3s	80% @ 1KHz	5	Vertical	A	
180° (back)	2000-2700	1	3s	80% @ 1KHz	5	Vertical	A	
270° (right)	2000-2700	1	3s	80% @ 1KHz	5	Vertical	A	
0° (front)	2000-2700	1	3s	80% @ 1KHz	5	Horizontal	A	
90° (left)	2000-2700	1	3s	80% @ 1KHz	5	Horizontal	A	
180° (back)	2000-2700	1	3s	80% @ 1KHz	5	Horizontal	A	
270° (right)	2000-2700	1	3s	80% @ 1KHz	5	Horizontal	A	
EUT Angle	Frequency		Dwell time	Modulation	Level (V/m)	Antenna Polarization	EUT Status	Comments
	Range (MHz)	Steps %						
0° (front)	5100-6000	1	3s	80% @ 1KHz	3	Vertical	A	
90° (left)	5100-6000	1	3s	80% @ 1KHz	3	Vertical	A	
180° (back)	5100-6000	1	3s	80% @ 1KHz	3	Vertical	A	
270° (right)	5100-6000	1	3s	80% @ 1KHz	3	Vertical	A	
0° (front)	5100-6000	1	3s	80% @ 1KHz	3	Horizontal	A	
90° (left)	5100-6000	1	3s	80% @ 1KHz	3	Horizontal	A	
180° (back)	5100-6000	1	3s	80% @ 1KHz	3	Horizontal	A	
270° (right)	5100-6000	1	3s	80% @ 1KHz	3	Horizontal	A	
Additional Notes: A=criteria A, B=criteria B, C=criteria C								

3.6.1 Test Setup Photo



3.7 Electrical fast transient/burst immunity

3.7.1 Test Specification

Basic Standard:	EN 61000-4-4 / IEC EN61000-4-4 / BS EN 61000-4-4 (details referred to Sec 1.2)
Signal & communication, process measurement & control ports Test Level:	+/- 2 kV
Battery referenced ports (except at the output of energy sources) Auxiliary a.c. power input ports (rated voltage ≤ 400 V rms)	+/- 2 kV
Rise Time:	5ns
Hold Time:	50ns
Repetition Frequency:	5KHz
Criteria:	A
Test Procedure:	refer to ISL QA -T4-E-S9

Test Procedure

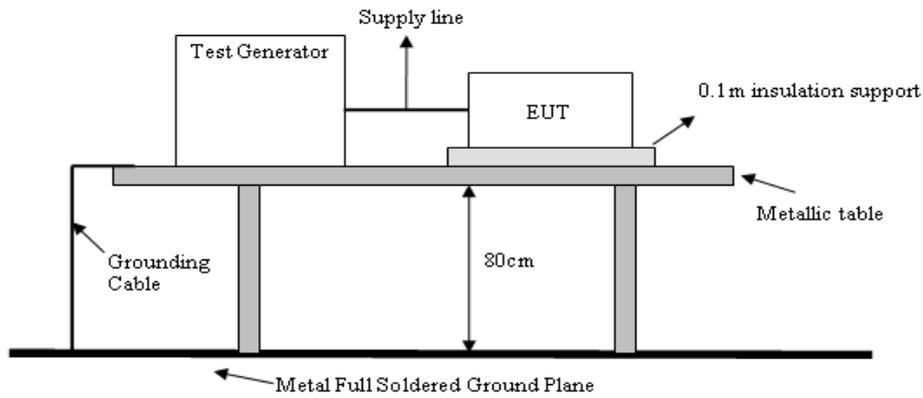
The EUT was setup on a nonconductive table 0.1 m above a reference ground plane.

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

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

3.7.2 Test Setup

EUT is at least 50cm from the conductive structure.

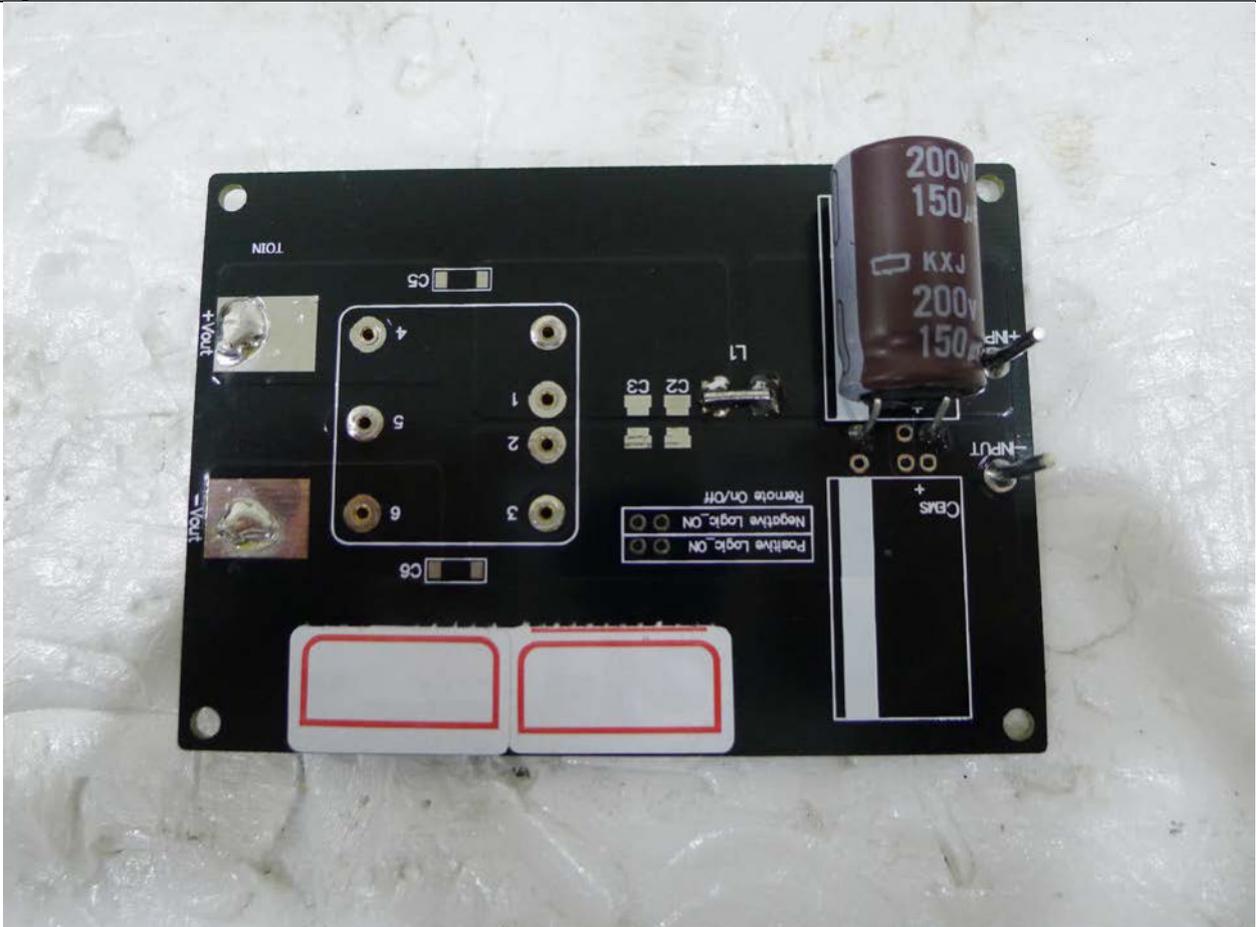


3.7.3 Test Result

Performance of EUT complies with the given specification.

3.8 Test Data: Configuration 1

Basic Standard	EN 61000-4-4	Date	2024-05-22				
EUT Model Name	THN 10-7215UIR	Engineer	Hasan Yu				
Barometer Pressure	97.6kPa	Equipment & Test Site	EMC-PARTNER (Model: IMU3000)				
Temperature	24°C						
Humidity	52%						
Voltage/Freq.	72 Vdc						
A=criteria A, B=criteria B, C=criteria C							
AC Power Port: <input type="checkbox"/>	DC Power Port: <input checked="" type="checkbox"/>	LAN Port: <input type="checkbox"/>	Telephone Port: <input type="checkbox"/>				
DC Power Port							
Line Under Test	Voltage Level	Severity Level	Pulse Polarity	Burst Repetition Rate	Test Duration	EUT Status	Comments
Line	2.0kV	3	+	300ms / 5.0kHz	1 Minutes	A	
Line	2.0kV	3	-	300ms / 5.0kHz	1 Minutes	A	
Neutral	2.0kV	3	+	300ms / 5.0kHz	1 Minutes	A	
Neutral	2.0kV	3	-	300ms / 5.0kHz	1 Minutes	A	
Line- Neutral	2.0kV	3	+	300ms / 5.0kHz	1 Minutes	A	
Line- Neutral	2.0kV	3	-	300ms / 5.0kHz	1 Minutes	A	
Additional Notes: A=criteria A, B=criteria B, C=criteria C							
NOTE: For the countermeasure components, please refer to Solution:” For Electrical Fast transient & Surge Immunity test requirements”							



3.8.1 Test Setup Photo

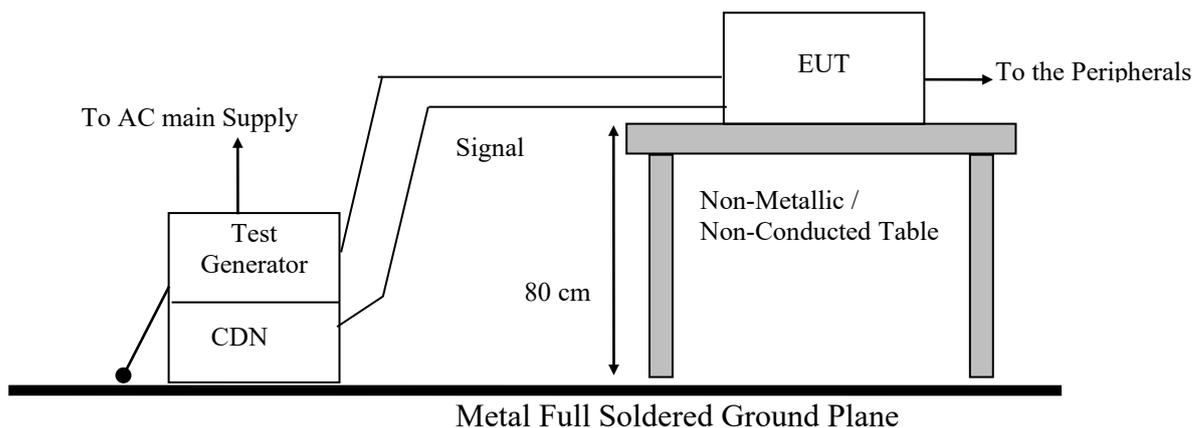


3.9 Surge immunity

3.9.1 Test Specification

Basic Standard:	EN 61000-4-5 / IEC EN61000-4-5 / BS EN 61000-4-5 (details referred to Sec 1.2)
Battery referenced ports (except at the output of energy sources) Auxiliary a.c. power input ports (rated voltage \leq 400 V rms)	Line to Line: 42 Ω , 0.5 μ F +/- 0.5 kV, +/- 1 kV, +/- 2 kV
Rise Time:	1.2us
Hold Time:	50us
Repetition Rate:	60 seconds, 5 time/each condition
Angle:	<input type="checkbox"/> 0° <input type="checkbox"/> 90° <input type="checkbox"/> 180° <input type="checkbox"/> 270°
Criteria:	B
Test Procedure:	refer to ISL QA -T4-E-S10

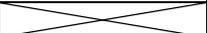
3.9.2 Test Setup

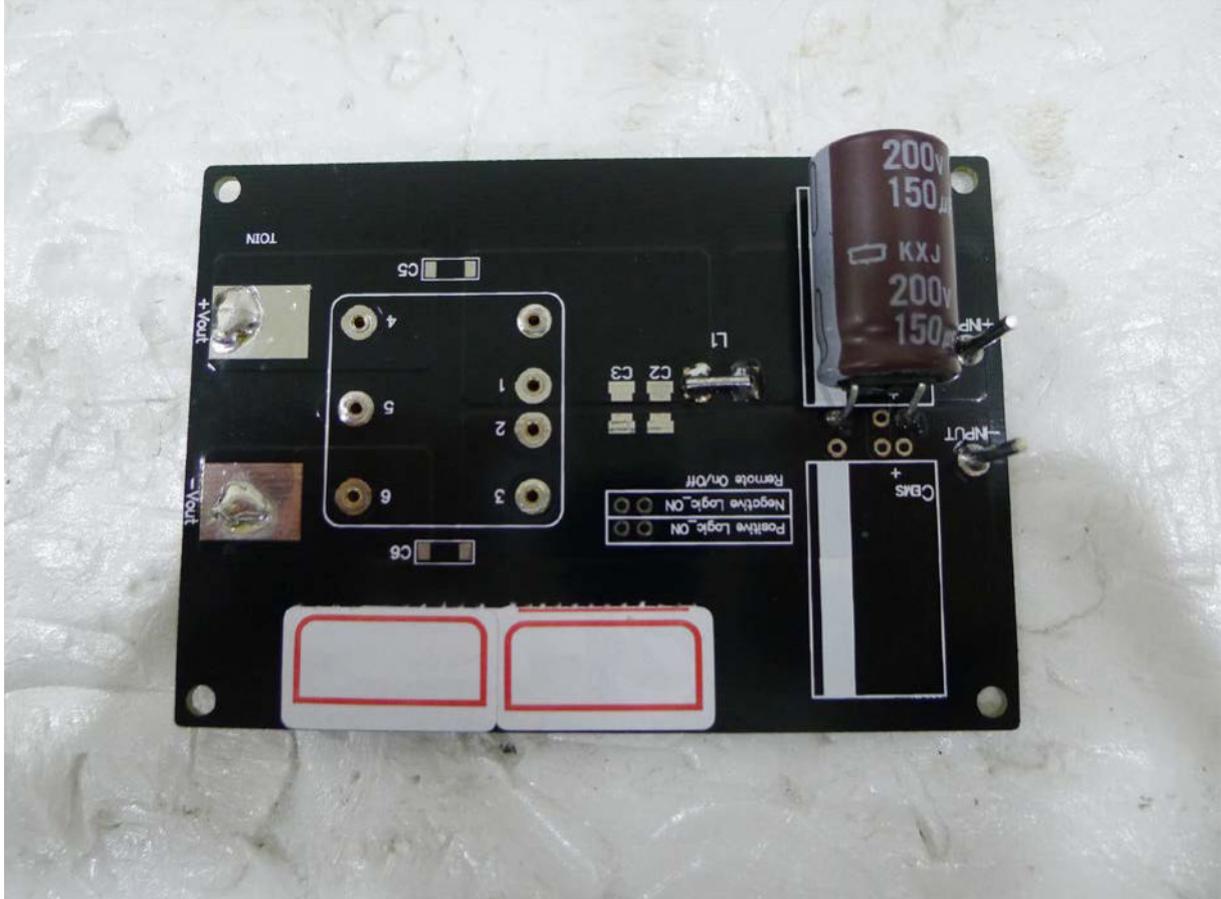


3.9.3 Test Result

Performance of EUT complies with the given specification.

3.10 Test Data: Configuration 1

Basic Standard	EN 61000-4-5	Date						
EUT Model Name	THN 10-7215UIR		2024-05-22					
		Engineer	Hasan Yu					
Barometer Pressure	97.6kPa		Equipment & Test Site					
Temperature	24°C		EMC-PARTNER (Model: IMU3000)					
Humidity	52%							
Voltage/Freq.	72 Vdc							
A=criteria A, B=criteria B, C=criteria C								
AC Power Port: <input type="checkbox"/>	DC Power Port: <input checked="" type="checkbox"/>	LAN Port: <input type="checkbox"/>	Telephone Port: <input type="checkbox"/>					
DC Power Port								
Line Under Test	Voltage	Level	Impedance	Repetition Rate	Cycle	Pulse Position	EUT Status	Comments
Line-Neutral	+0.5kV	2	42Ω	60 sec	5		A	
Line-Neutral	-0.5kV	2	42Ω	60 sec	5		A	
Line- Neutral	+1.0kV	3	42Ω	60 sec	5		A	
Line- Neutral	-1.0kV	3	42Ω	60 sec	5		A	
Line- Neutral	+2.0kV	4	42Ω	60 sec	5		A	
Line- Neutral	-2.0kV	4	42Ω	60 sec	5		A	
Additional Notes: A=criteria A, B=criteria B, C=criteria C								
NOTE: For the countermeasure components, please refer to Solution:” For Electrical Fast transient & Surge Immunity test requirements”								



3.10.1 Test Setup Photo

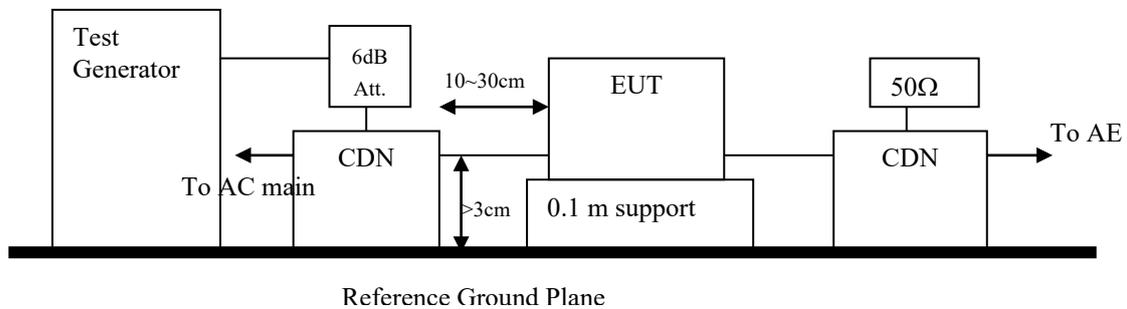


3.11 Immunity to conducted disturbances

3.11.1 Test Specification

Basic Standard:	EN 61000-4-6 / IEC EN61000-4-6 / BS EN 61000-4-6 (details referred to Sec 1.2)
Battery referenced ports (except at the output of energy sources) Auxiliary a.c. power input ports (rated voltage ≤ 400 V rms)Test Level:	10 V
Signal & communication, process measurement & control ports Test Level:	10 V
Modulation:	AM 1KHz 80%
Frequency range:	0.15 MHz - 80MHz
Frequency Step:	1% of last Frequency
Dwell time:	2s
Criteria:	A
CDN Type:	CDN M2+M3
Test Procedure:	refer to ISL QA -T4-E-S11

3.11.2 Test Setup



3.11.3 Test Result

Performance of EUT complies with the given specification.

3.12 Test Data: Configuration 1

Basic Standard	EN 61000-4-6	Date					
EUT Model Name	THN 10-7215UIR	2024-05-22					
		Engineer					
Barometer Pressure	97.6kPa	Hasan Yu					
Temperature	24°C	Equipment & Test Site					
Humidity	57%	FRANKONIA (Model: CIT-10/75)					
Voltage/Freq.	72 Vdc						
A=criteria A, B=criteria B, C=criteria C							
DC Power Port							
Line Under Test	Frequency		Level	Modulation	Dwell time	EUT Status	Comments
	Range (MHz)	Steps %					
DC Power Port	0.15 to 80	1	10V	80% @ 1kHz	2s	A	
Additional Notes: A=criteria A, B=criteria B, C=criteria C							

3.12.1 Test Setup Photo

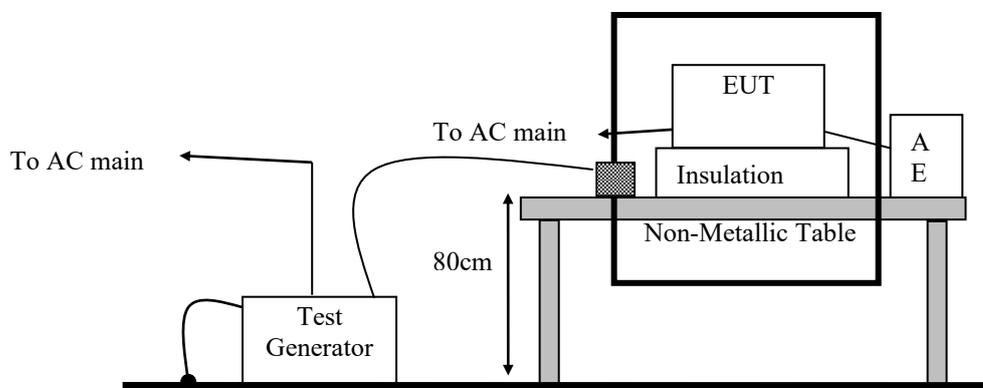


3.13 Power frequency magnetic field immunity

3.13.1 Test Specification

Port:	Enclosure
Basic Standard:	EN 61000-4-8 / IEC 61000-4-8 / BS EN 61000-4-8 (details referred to Sec 1.2)
D.C. systems Test Level:	100A/m(continuous),1000A/m(1s)
Polarization:	X, Y, Z
Criteria:	A
Test Procedure:	refer to ISL QA -T4-E-S12

3.13.2 Test Setup



3.13.3 Test Result

Performance of EUT complies with the given specification.

3.14 Test Data: Configuration 1

Basic Standard		EN 61000-4-8		Date	
EUT Model Name		THN 10-7215UIR		2024-05-22	
Barometer Pressure		97.6kPa		Engineer	
Temperature		24°C		Hasan Yu	
Humidity		55%		Equipment & Test Site	
Voltage/Freq.		72Vdc		Magnetic Field Immunity Loop Brand: Pic Model:PMF1000 & Magnetic Field Test AC Power Source Brand: Pic Model: AC Power Source	
A=criteria A, B=criteria B, C=criteria C					
Antenna Polarization	Frequency (Hz)	Test Level	Test Duration	EUT Status	Comment
X	0	100 A/m	1 Minutes	A	
Y	0	100 A/m	1 Minutes	A	
Z	0	100 A/m	1 Minutes	A	
X	0	1000 A/m	1 Second	A	
Y	0	1000 A/m	1 Second	A	
Z	0	1000 A/m	1 Second	A	
Additional Notes: A=criteria A, B=criteria B, C=criteria C					

3.14.1 Test Setup Photo



4. Environmental Tests

4.1 Low temperature start-up test

4.1.1 Test Ambience

Temperature: $21^{\circ}\text{C} \pm 2^{\circ}\text{C}$

Humidity: $53\% \pm 6\%$

4.1.2 Test Procedure

Test Procedures were referred to EN 50155 sub-clause 13.4.4 & 4.4.2

4.1.3 Test Condition

Table 1 – Operating temperature classes

Class	Equipment operating temperature range ($^{\circ}\text{C}$)	Test Condition
OT1	-25 to +55	
OT2	-40 to +55	
OT3	-25 to +70	
OT4	-40 to +70	V(Condition 1)
OT5	-25 to +85	
OT6	-40 to +85	V(Condition 2)

4.1.4 Test Result

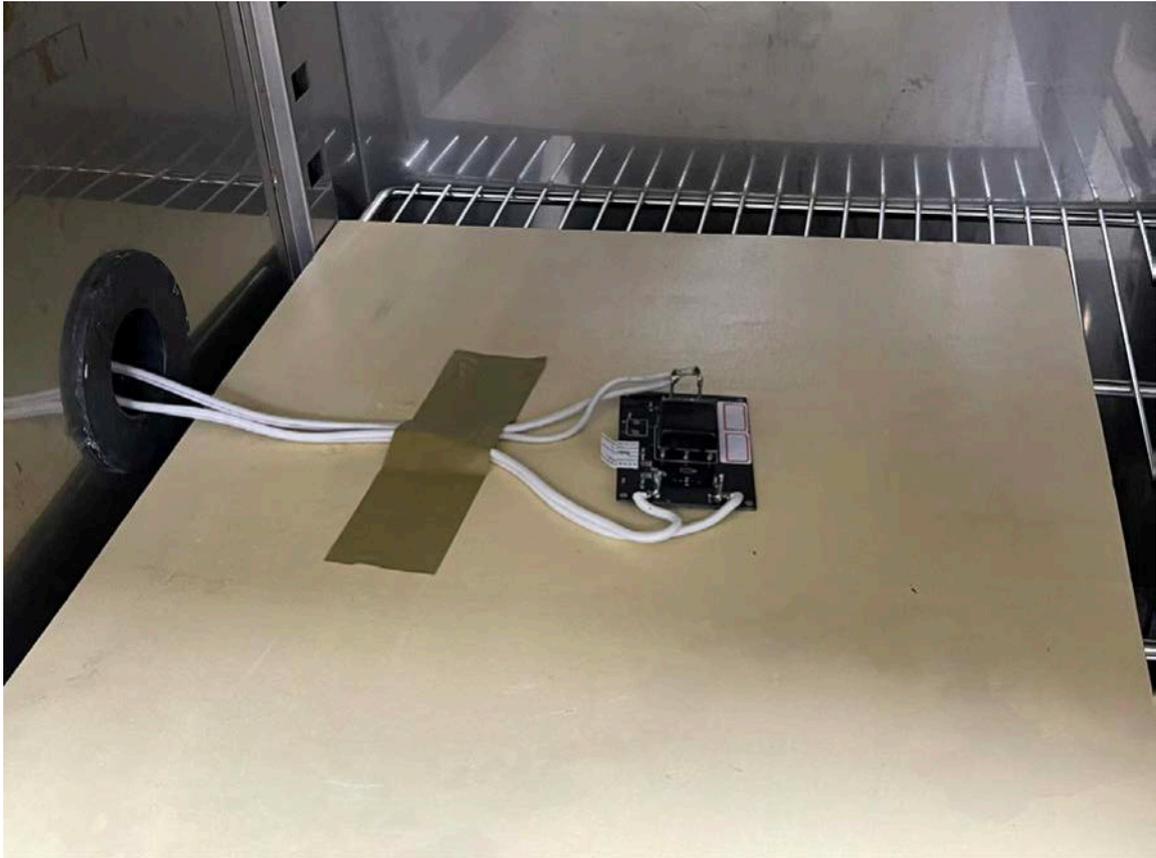
- A. Photo of test Setup was shown in 4.1.5
- B. Testing data were shown as below
- C. Test specimen was visually inspected after test. No physical damage occurred.
- D. The function of specimen was normal during and after the cooling test.
- E. According to test result, the specimen passed the EN 50155 sub-clause 13.4.4 Low temperature start-up test.

Condition 1 & Condition 2: Low temperature start-up test Record

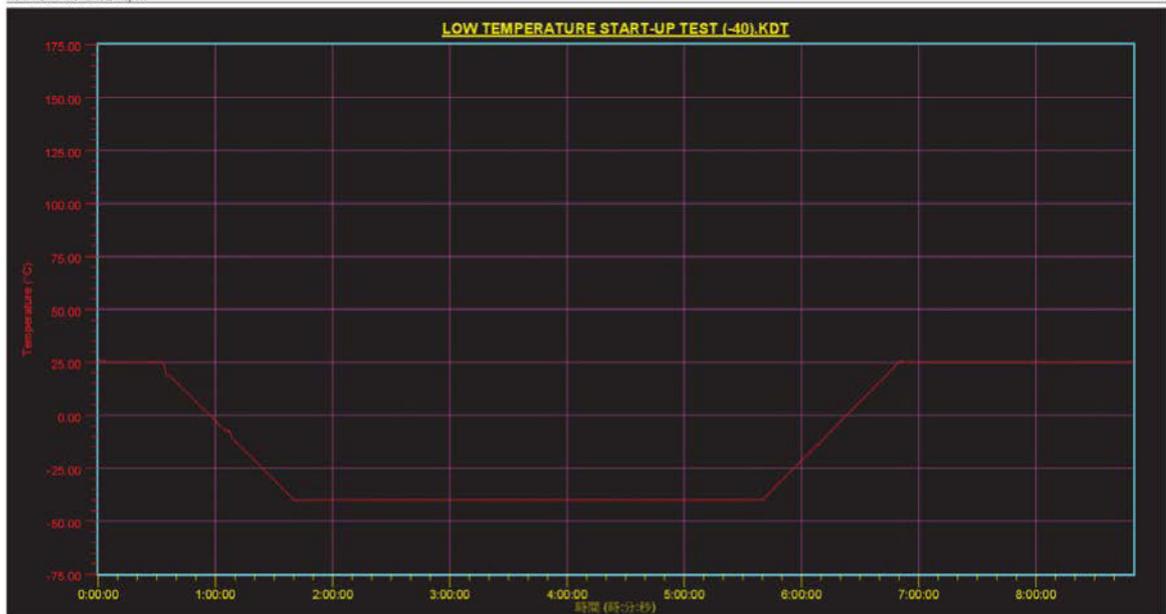
Performance test:	
Test mode	Comments
Test voltage: 72 Vdc	
At the beginning of the low temperature start-up test (-40°C)	Pass
At the end of the low temperature start-up test (-40°C)	Pass

Continuous operational checks:	
Test mode	Comments
Test voltage: 72 Vdc	
During low temperature start-up test (-40°C)	Pass

Low temperature start-up test (-40°C)



KSON DAT Viewer SE Report



檔案名稱: D:\Chart\Low temperature start-up test (-40).kdt
時間範圍: 09:37:21 06/13/2024 - 18:27:15 06/13/2024
時間範圍: 0:0:0 - 8:49:54

Y軸:
Temperature(°C) -75.000 ~ 175.000

曲線:
1. Temperature(°C) 

4.2 Dry Heat Test

4.2.1 Test Ambience

Temperature: 21°C ± 2°C

Humidity: 53% ± 6%

4.2.2 Test Procedure

Test Procedures were referred to EN 50155 sub-clause 13.4.5 & 4.4.2 & 4.4.3

4.2.3 Test Condition

Table 1 – Operating temperature classes

Class	Equipment operating temperature range (°C)	Test Condition
OT1	-25 to +55	
OT2	-40 to +55	
OT3	-25 to +70	
OT4	-40 to +70	V(Condition 1)
OT5	-25 to +85	
OT6	-40 to +85	V(Condition 2)

Table 2 – Switch-on extended Operating temperature classes

Class	Switch-on extended Operating temperature (duration: 10 min)	Thermal test cycle See 13.4.5	Test Condition
ST0	No switch-on extended operating temperature	Test cycle A	V(Condition 2)
ST1	OTx + 15 °C	Test cycle B	V(Condition 1)
ST2	OTx + 15 °C	Test cycle C	

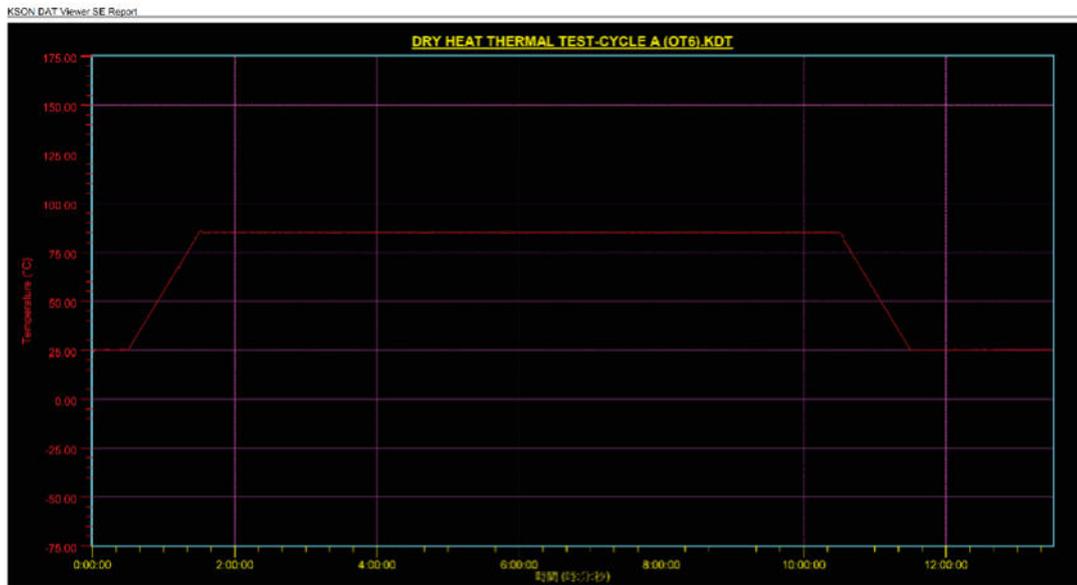
4.2.4 Test Result

- A. Photo of test Setup was shown in 4.1.5.
- B. The testing data were shown in Figure 1.
- C. The testing data were shown in Figure 2.
- D. Test specimen was visually inspected after test. No physical damage occurred.
- E. The function of specimen was normal during and after the Dry heat test.
- F. According to test result, the specimen passed the EN 50155 sub-clause 13.4.5 Dry heat test.

Dry Heat test Record (Test cycle A)

Performance test:	
Test mode	Comments
Test voltage: 82.8 Vdc	
At the beginning of the dry heat thermal test-Cycle A	Pass
At the end of the dry heat thermal test-Cycle A	Pass
Continuous operational checks:	
Test mode	Comments
Test voltage: 82.8 Vdc	
After the temperature reaches 85 degrees for two hours-Cycle A	Pass

Dry heat thermal test-Cycle A



檔案名稱: D:\Chart\Dry heat thermal Test-Cycle A (OT6).kdt
時間範圍: 09:28:24 06/20/2024 - 22:58:18 06/20/2024
時間範圍: 0:0:0 - 13:29:54

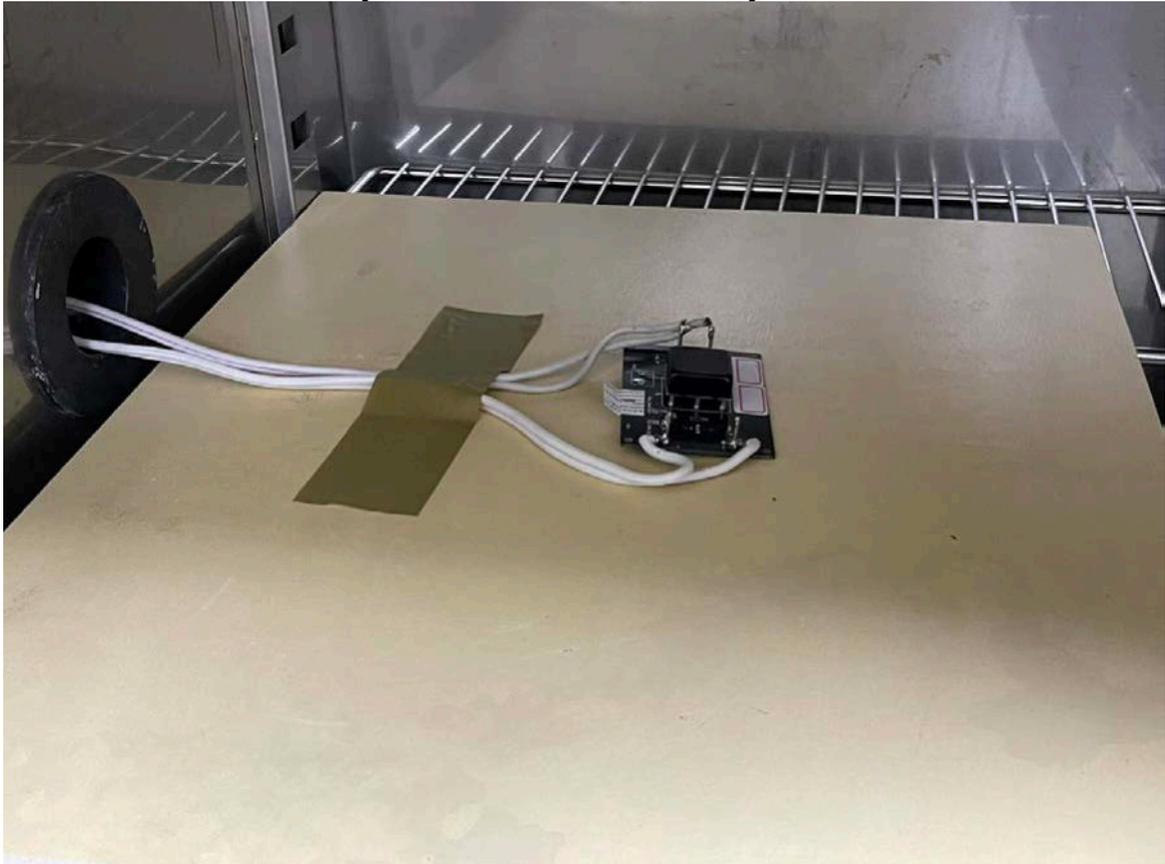
Y軸:
Temperature(°C) -75.000 ~ 175.000

曲線:
1. Temperature (°C) ————

Dry Heat test Record (Test cycle B)

Performance test:	
Test mode	Comments
Test voltage: 82.8 Vdc	
At the beginning of the dry heat thermal test-Cycle B	Pass
At the end of the dry heat thermal test-Cycle B	Pass
Continuous operational checks:	
Test mode	Comments
Test voltage: 82.8 Vdc	
After the temperature reaches 70 degrees for two hours-Cycle B	Pass
At 85 degrees during dry heat test -Cycle B	Pass

Dry heat thermal test-Cycle B



檔案名稱: D:\Chart\Dry heat thermal test-Cycle B.kdt
時間範圍: 09:39:27 06/14/2024 - 23:39:21 06/14/2024
時間範圍: 0:0:0 - 13:59:54

Y軸:
Temperature (°C) -75.000 ~ 175.000

曲線:
1. Temperature (°C)

4.3 Damp Heat Test

4.3.1 Test Ambience

Temperature: $21^{\circ}\text{C} \pm 2^{\circ}\text{C}$

Humidity: $53\% \pm 6\%$

4.3.2 Test Procedure

Test Procedures were referred to EN 50155 sub-clause 13.4.8 & 4.4.2 & 4.4.7

4.3.3 Test Condition

Temperature / Humidity: 55°C and 25°C , $95\% \pm 5\% \text{RH}$ without condensation, 48 hours.

Performance Check: The performance checks are performed before, before the end and after the Damp Heat Test.

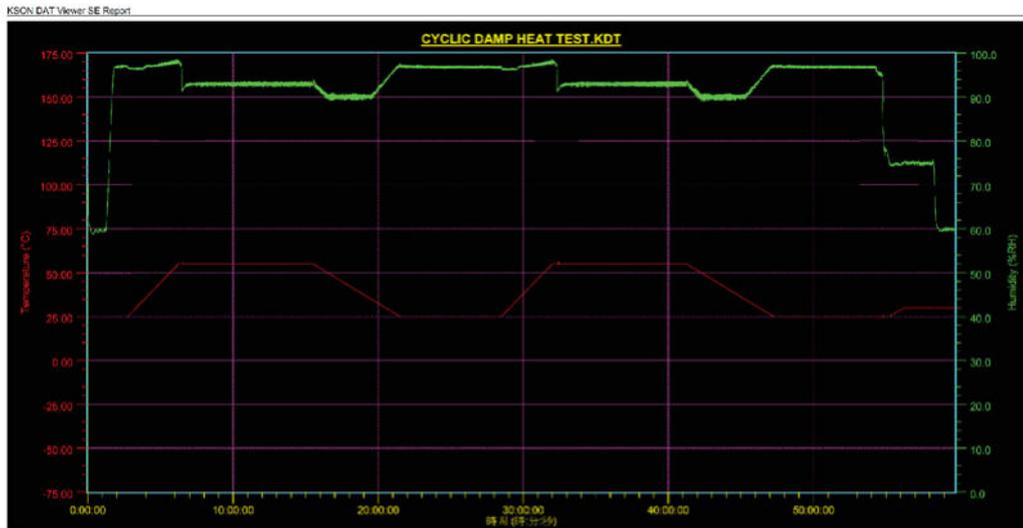
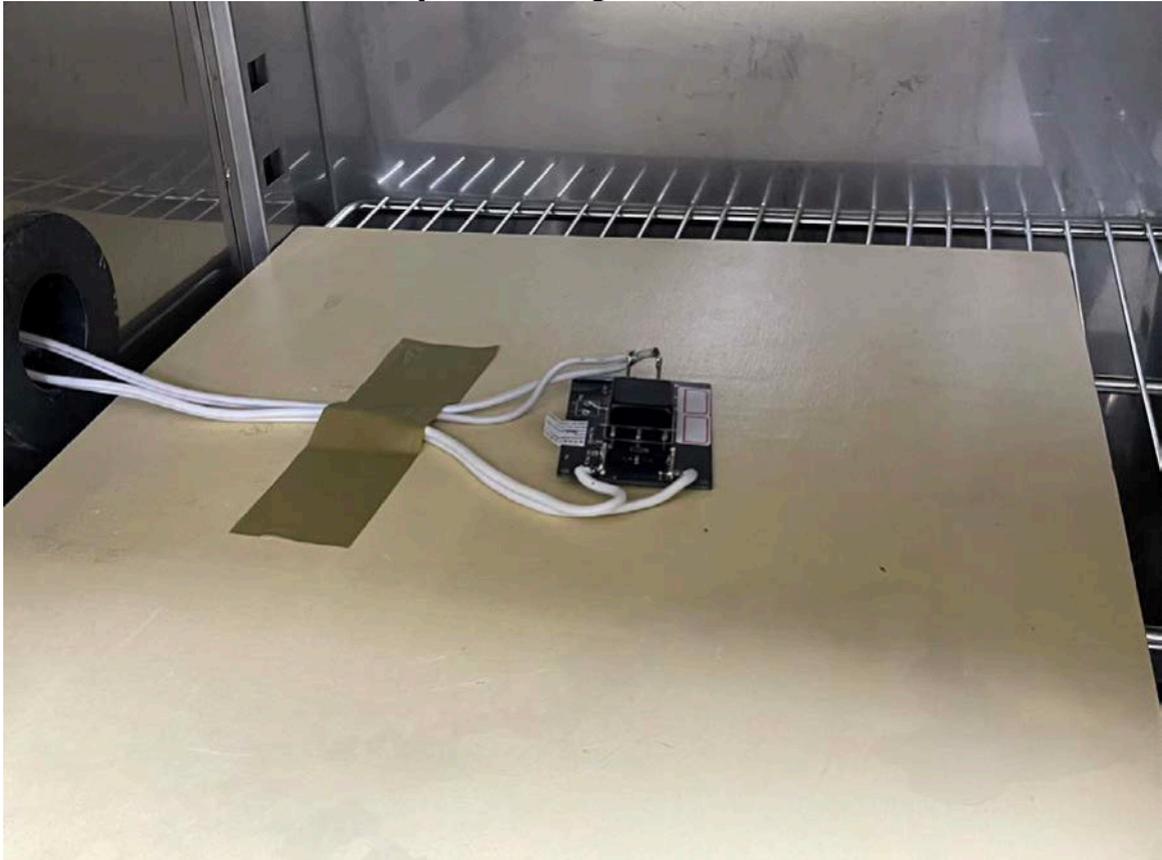
4.3.4 Test Result

- A. Photo of test Setup was shown in 4.1.5.
- B. The testing data were shown as below.
- C. Test specimen was visually inspected after test. No physical damage occurred.
- D. The function of specimen was normal during and after the Damp heat test.
- E. According to test result, the specimen passed the EN 50155 ch.13.4.7 Damp heat test.

Damp Heat Test Record

Performance test:	
Test mode	Comments
Test voltage: 72 Vdc	
At the beginning of the cyclic damp heat test	Pass
At the end of the cyclic damp heat test	Pass
Continuous operational checks:	
Test mode	Comments
Test voltage: 72 Vdc	
Cyclic Damp Heat Test during condensation on equipment at 35 °C + 2 °C when the temperature increases at the beginning of the second cycle	Pass
At the end of the recovery period of the cyclic damp heat test (Continuously switch on and off 30 times in total)	Pass

Cyclic damp heat test



檔案名稱: D:\Chart\Cyclic damp heat test.kdt
開始時間: 09:30:32 06/17/2024 - 21:15:46 06/19/2024
時間範圍: 0:0:0 - 59:44:54

Y軸:
Temperature(°C) -75.000 ~ 175.000
Humidity(%RH) 0.00 ~ 100.00

圖例:
1. Temperature(°C) [Red Line]
2. Humidity(%RH) [Green Line]

Date: 2024-06-17	Temperature : 22.2 °C	Engineer: Oscar Hsieh
EUT Model Name: THN 10-7215UIR	Humidity: 61.4 %	Equipment: TM-5955, TH110-POSE, THS-B4T-150, SE 7452
	Barometer Pressure: 97.6kPa	Standard: EN 50155:2021 insulation test

Insulation Test Requirement: Before the cyclic damp heat test

1. Insulation measurement Test:

The insulation resistance test shall be carried out at 500 Vdc and the values recorded.
The test shall then be repeated after the voltage withstand test.
There shall be no fundamental deterioration from the initial measurement.

Test item	Test Time	Insulation measurement test		Comments
		before withstand	after withstand	
Primary side to secondary side	1 min	> 50 GΩ	> 50 GΩ	Pass

2. Voltage Withstand test

500 Vac or 750 Vdc for nominal battery voltages below 72 Vdc (or 50 Vac).
1000 Vac or 1500 Vdc for nominal battery voltage from 72 Vdc up to 125 Vdc, (or from 50 to 90 Vac), and
1500 Vac or 2200 Vdc for nominal battery voltage above 125 Vdc and up to 315 Vdc, (or from 90 to 225 Vac).
Neither disruptive discharge nor flashover shall occur

Test item	Test Voltage	Test Time	Result	Comments
Primary side to secondary side	1500Vdc	1 min	0 mA	Pass

Date: 2024-06-19	Temperature : 23.2 °C	Engineer: Oscar Hsieh
EUT Model Name: THN 10-7215UIR	Humidity: 61.6 %	Equipment: TM-5955, TH110-POSE, THS-B4T-150, SE 7452
	Barometer Pressure: 97.6kPa	Standard: EN 50155:2021 insulation test

Insulation Test Requirement: Before the performance test of the cyclic damp heat test (before the end)

1. Insulation measurement Test:

The insulation resistance test shall be carried out at 500 Vdc and the values recorded.
The test shall then be repeated after the voltage withstand test.
There shall be no fundamental deterioration from the initial measurement.

Test item	Test Time	Insulation measurement test		Comments
		before withstand	after withstand	
Primary side to secondary side	1 min	> 50 GΩ	> 50 GΩ	Pass

2. Voltage Withstand test

500 Vac or 750 Vdc for nominal battery voltages below 72 Vdc (or 50 Vac).
1000 Vac or 1500 Vdc for nominal battery voltage from 72 Vdc up to 125 Vdc, (or from 50 to 90 Vac), and
1500 Vac or 2200 Vdc for nominal battery voltage above 125 Vdc and up to 315 Vdc, (or from 90 to 225 Vac).
Neither disruptive discharge nor flashover shall occur

Test item	Test Voltage	Test Time	Result	Comments
Primary side to secondary side	1500Vdc	1 min	0 mA	Pass

Date: 2024-06-19	Temperature : 23.5 °C	Engineer: Oscar Hsieh
EUT Model Name: THN 10-721UIR	Humidity: 61.7 %	Equipment: TM-5955, TH110-POSE, THS-B4T-150, SE 7452
	Barometer Pressure: 97.6kPa	Standard: EN 50155:2021 insulation test

Insulation Test Requirement: After cyclic damp heat test

1. Insulation measurement Test:

The insulation resistance test shall be carried out at 500 Vdc and the values recorded.
The test shall then be repeated after the voltage withstand test.
There shall be no fundamental deterioration from the initial measurement.

Test item	Test Time	Insulation measurement test		Test item
		before withstand	after withstand	
Primary side to secondary side	1 min	> 50 GΩ	> 50 GΩ	Pass

2. Voltage Withstand test

500 Vac or 750 Vdc for nominal battery voltages below 72 Vdc (or 50 Vac).
1000 Vac or 1500 Vdc for nominal battery voltage from 72 Vdc up to 125 Vdc, (or from 50 to 90 Vac), and
1500 Vac or 2200 Vdc for nominal battery voltage above 125 Vdc and up to 315 Vdc, (or from 90 to 225 Vac).
Neither disruptive discharge nor flashover shall occur

Test item	Test Voltage	Test Time	Test item	Test Voltage
Primary side to secondary side	1500Vdc	1 min	0 mA	Pass

4.4 Functional random Vibration Test

4.4.1 Test Specification and / or standard:

EN 61373:2010

4.4.2 Testing Equipment:

Vibration & Shock Environmental Equipment KD-9363EM-1000F2K-50N250

Max. force : 1000 kgf-peak / 250 kgw Loading

Max. displacement : 50 mm p-p

Max. acceleration : 55 g

Frequency range : 5 Hz to 2000 Hz

Calibrate trace code : VS-CV-120330-01

4.4.3 Test Condition and procedure:

Test Condition:

	Category	Orientation	RMS m/s ²
<input type="checkbox"/>	1 Class A Body mounted	Vertical Transverse Longitudinal	0.75 0.37 0.5
<input checked="" type="checkbox"/>	1 Class B Body mounted	Vertical Transverse Longitudinal	1.01 0.45 0.7
<input type="checkbox"/>	2 Bogie mounted	Vertical Transverse Longitudinal	5.4 4.7 2.5
<input type="checkbox"/>	3 Axle mounted	Vertical Transverse Longitudinal	38.0 34.0 17.0

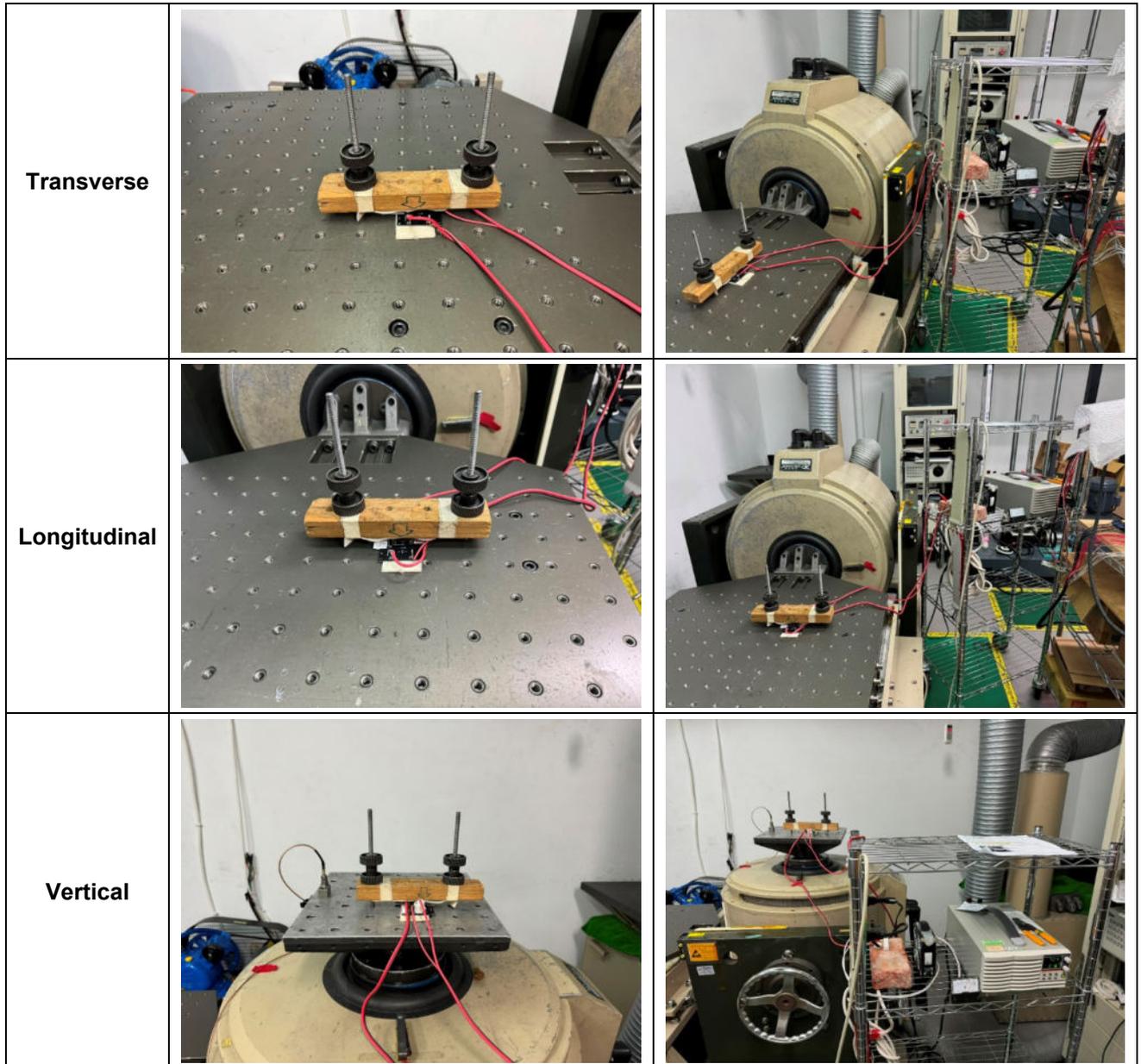
Test Procedure:

- A. Check out samples.
- B. Place the test samples on the vibration table in its normal operating orientation and configuration.
- C. Set test conditions and start to test.
- D. Finish testing, check out samples and prepare final report.

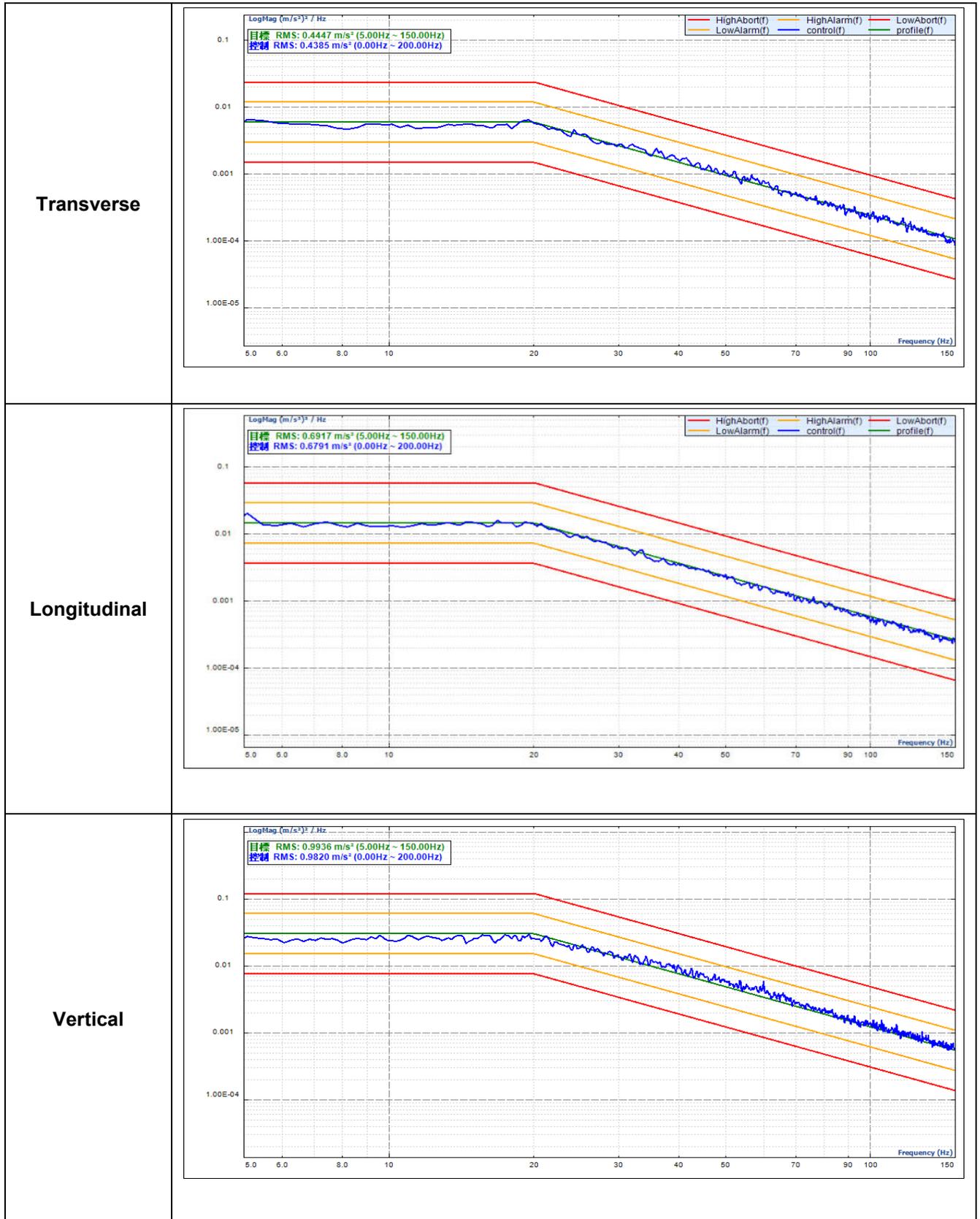
4.4.4 Test Result

Inspection item	Result
EUT	Pass

4.4.5 Test Setup Photo



4.4.6 Test Profile:



4.5 Simulated long-life testing at increased Random Vibration Test

4.5.1 Test Specification and/or standard:

EN 61373:2010

4.5.2 Testing Equipment:

Vibration & Shock Environmental Equipment KD-9363EM-1000F2K-50N250

Max. force : 1000 kgf-peak / 250 kgw Loading

Max. displacement : 50 mm p-p

Max. acceleration : 55 g

Frequency range : 5 Hz to 2000 Hz

Calibrate trace code : VS-CV-120330-01

4.5.3 Test Condition and procedure:

Test Condition:

	Category	Orientation	RMS 5 h test period m/s ²
<input type="checkbox"/>	1 Class A Body mounted	Vertical Transverse Longitudinal	4.25 2.09 2.83
<input checked="" type="checkbox"/>	1 Class B Body mounted	Vertical Transverse Longitudinal	5.72 2.55 3.96
<input type="checkbox"/>	2 Bogie mounted	Vertical Transverse Longitudinal	30.6 26.6 14.2
<input type="checkbox"/>	3 Axle mounted	Vertical Transverse Longitudinal	144 129 64.3

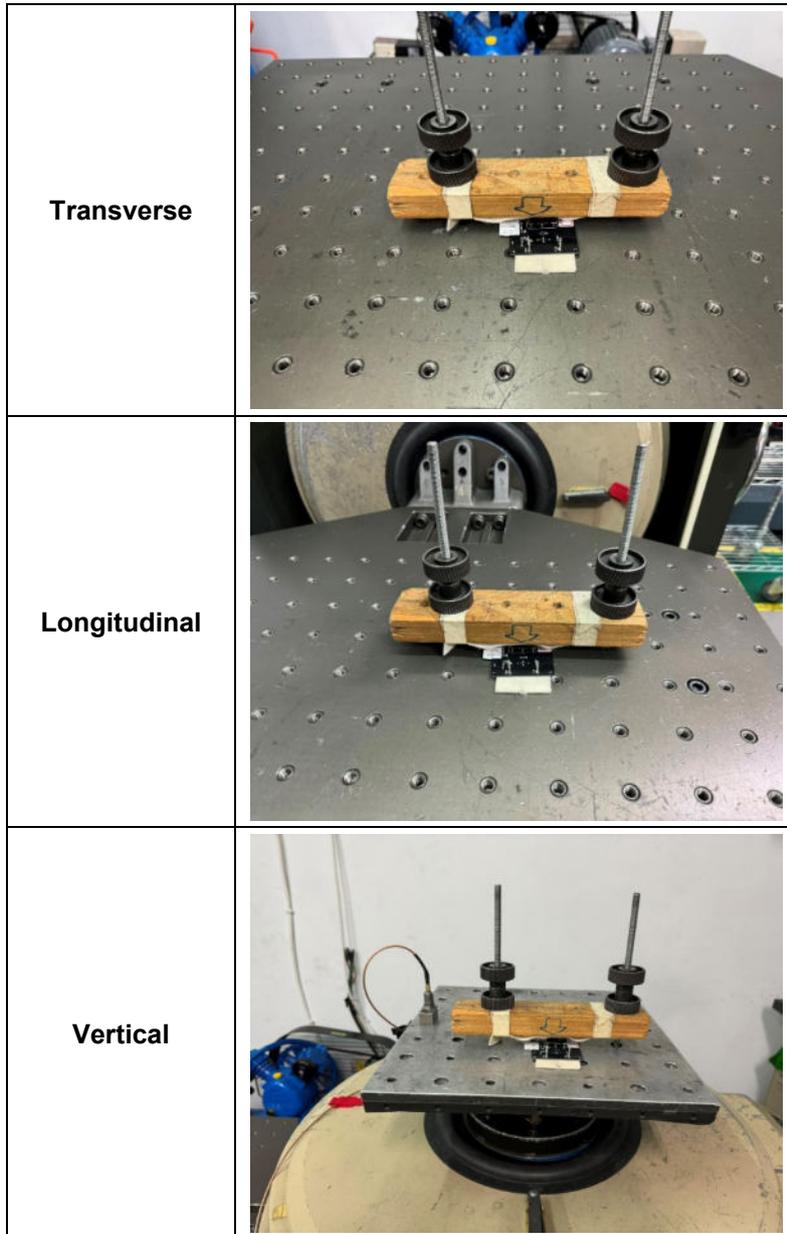
Test Procedure:

- A. Check out samples.
- B. Place the test samples on the vibration table in its normal operating orientation and configuration.
- C. Set test conditions and start to test.
- D. Finish testing, check out samples and prepare final report.

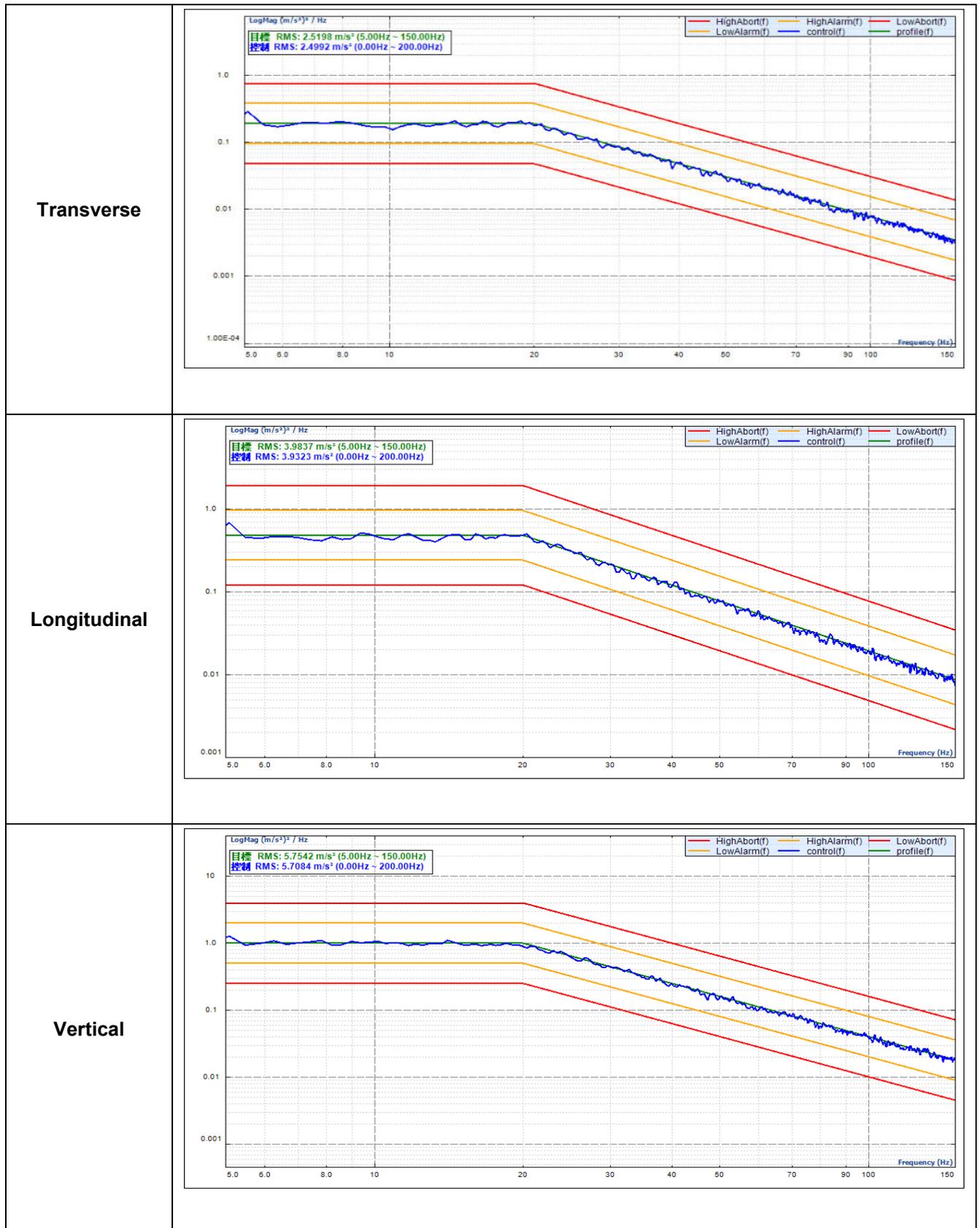
4.5.4 Test Result

Inspection item	Result
EUT	Pass

4.5.5 Test Setup Photo



4.5.6 Test Profile:



4.6 Shock Test

4.6.1 Test Specification and/or standard:

EN 61373:2010

4.6.2 Testing Equipment:

Vibration & Shock Environmental Equipment KD-9363EM-1000F2K-50N250

Max. force : 1000 kgf-peak / 250 kgw Loading

Max. displacement : 50 mm p-p

Max. acceleration : 55 g

Frequency range : 5 Hz to 2000 Hz

Calibrate trace code : VS-CV-120330-01

4.6.3 Test Condition and procedure:

Test Condition:

	Category	Orientation	Peak acceleration A m/s ²	Nominal duration D ms
<input checked="" type="checkbox"/>	1 Class A and Class B Body mounted	Vertical Transverse Longitudinal	30 30 50	30 30 30
<input type="checkbox"/>	2 Bogie mounted	Vertical Transverse Longitudinal	300	18
<input type="checkbox"/>	3 Axle mounted	Vertical Transverse Longitudinal	1000	6

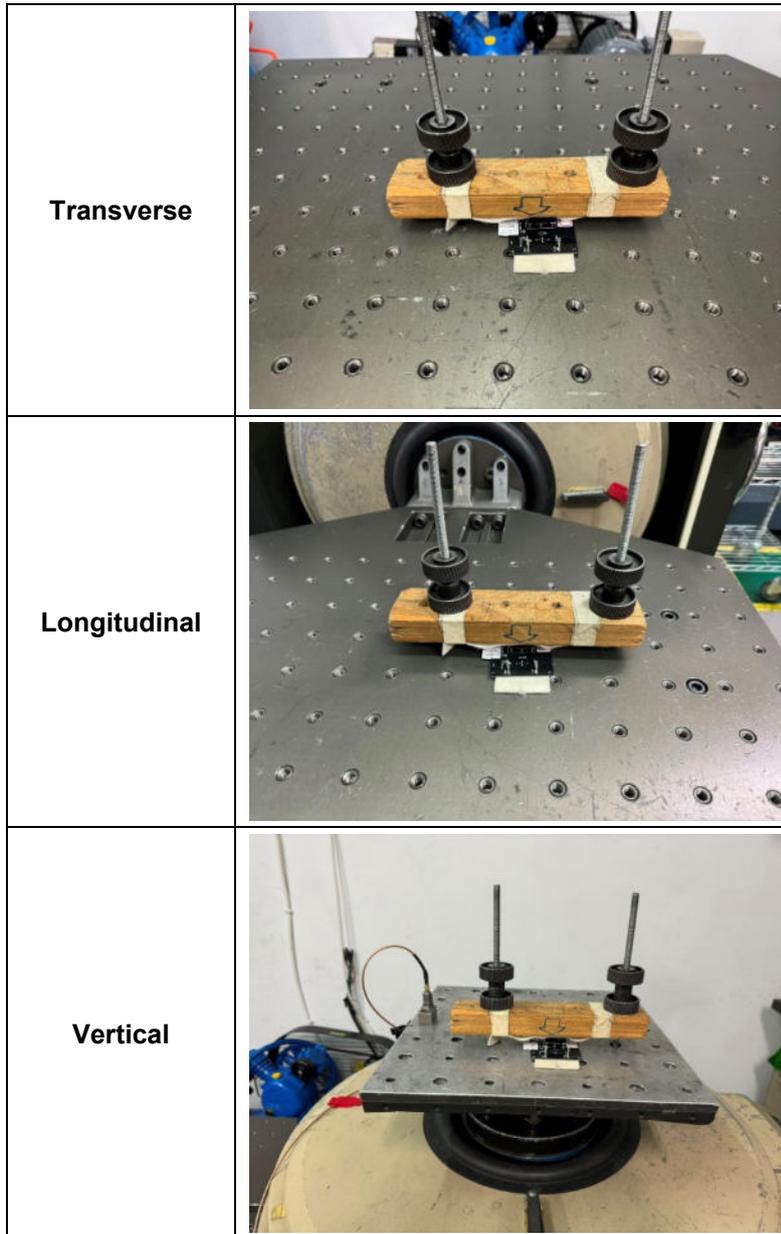
Test Procedure:

- A. Check out samples.
- B. Place the test samples on the vibration table in its normal operating Orientation and configuration.
- C. Set test conditions and start to test.
- D. Finish testing, check out samples and prepare final report.

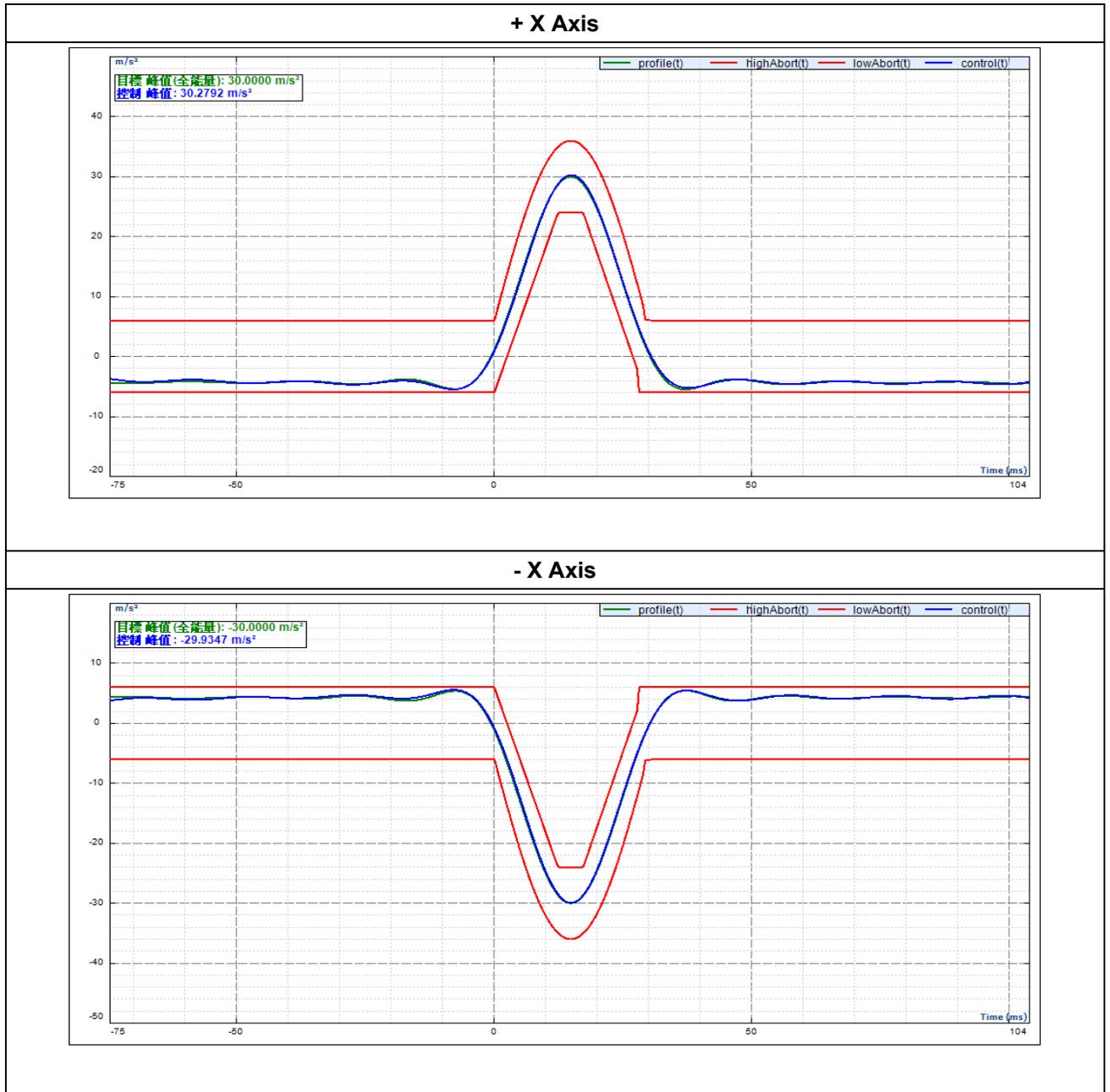
4.6.4 Test Result

Inspection item	Result
EUT	Pass

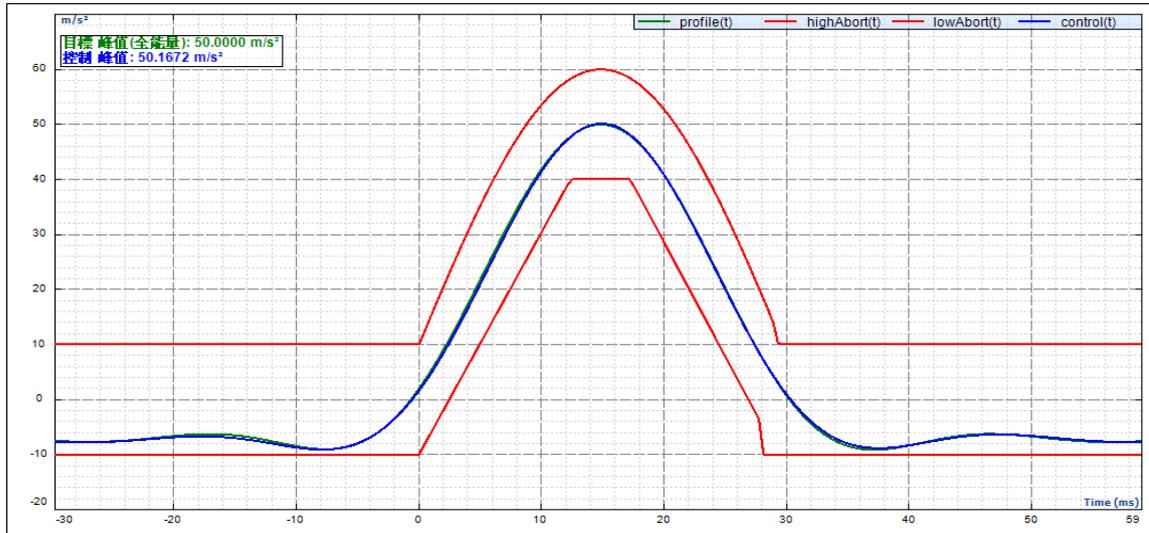
4.6.5 Test Setup Photo



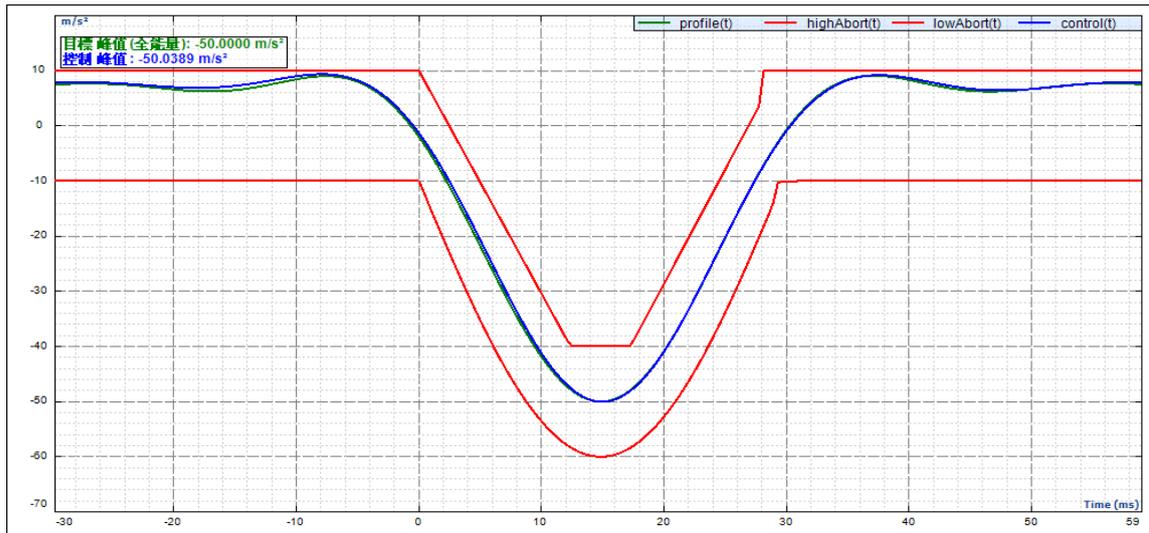
4.6.6 Test Profile:



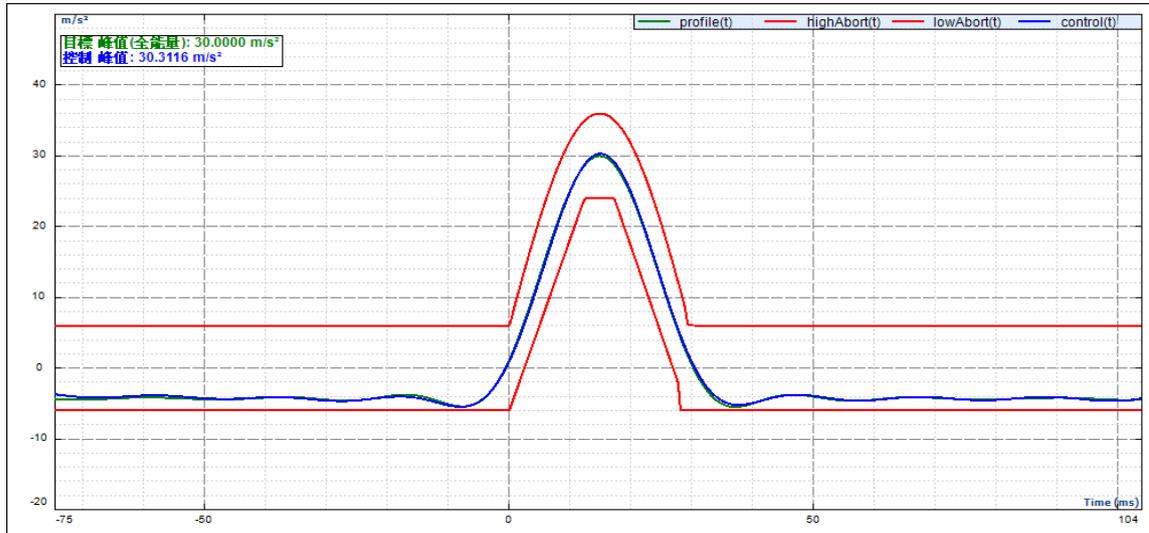
+ Y Axis



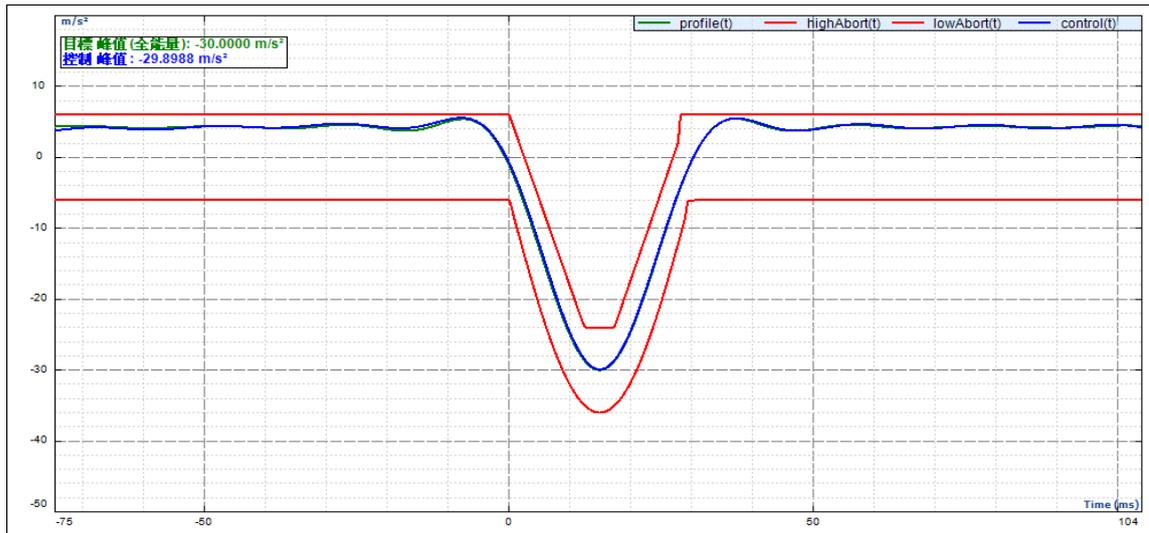
- Y Axis



+ Z Axis



- Z Axis



5. Appendix

5.1 Appendix A: Test Equipment

5.1.1 Test Equipment List

Safety Equipment Calibration List

Equipment	Model	Manufacturer	Serial No.	Equipment Range	Cal. Date	Due Date
Digital Timer - Alarm Clock	TM-5955	AVDr.AV	ISL-LT014	Timer (Full Range)	11/10/2023	11/10/2024
Temperature & Humidity Record	TH110-PO SE	KIMO	1F130907473	Temperature 10°C~35°C Humidity 20%~95%	03/22/2024	03/22/2025
Temperature / Humidity Chamber	THS-B4T-150	King San Technology	5290K	Temperature -40~150°C Humidity 20~95%	09/27/2023	09/27/2024
Electrical safety analyzer	SE 7452	Extech Electronics	1713353	AC 5kV/100mA, DC 5kV/10mA, IR 10MΩ~10GΩ, Ground 0A~40A, Timer 60s / 120s 0~300mΩ	05/24/2024	05/24/2025

Location	Equipment Name	Brand	Model	S/N	Last Cal. Date	Next Cal. Date
Conduction 03	EMI Receiver 20	R&S	ESR7	101326	05/25/2023	05/25/2024
Conduction 03	Chamber05-1 Cable	WOKEN	CFD 300-NL	Chamber05-1 Cable	08/25/2023	08/25/2024
Conduction 03	LISN 22	ROHDE & SCHWARZ	ENV216	101478	11/01/2023	11/01/2024
Conduction 03 (>16A)	LISN 24	SCHWARZBECK	NNLK 8121	8121-829	07/27/2023	07/27/2024

Location Chamber02	Equipment Name	Brand	Model	S/N	Last Cal. Date	Next Cal. Date
Radiation	BILOG Antenna 17 (30MHz~1GHz)	SCHWARZBECK	VULB 9168+EMCI-N-6-05	645	11/16/2023	11/16/2024
Radiation	Preamplifier 25	EMCI	EMC9135	980295	03/12/2024	03/12/2025
Radiation	Coaxial Cable Chmb 02-10M-02	EMC	RG214U	Chmb 02-10M-02	10/04/2023	10/04/2024
Radiation	EMI Receiver 14	R&S	ESCI	100887	05/19/2023	05/19/2024

Location	Equipment Name	Brand	Model	S/N	Last Cal. Date	Next Cal. Date
EN61K-4-2	ESD Gun 12	EM TEST	Dito	P1650188689	03/26/2024	03/26/2025
EN61K-4-3 (Railway)	Broadband Log-Periodic Antenna 80Mz~1GHz	AR	ATL80M1G	0340509	N/A	N/A
EN61K-4-3 (Railway)	Horn Antenna RF-01	AR	ATS700M11G	0335864	N/A	N/A
EN61K-4-3 (Railway)	Amplifier 80Mz~1GHz 750W	AR	750W1000A	0344168	N/A	N/A
EN61K-4-3 (Railway)	Amplifier 800MHz~4.2GHz 50W	AR	50S1G4M1	312762	N/A	N/A
EN61K-4-3 (Railway)	Amplifier 4.0~8.0GHz 35W	AR	35S4G8AM1	0335752	N/A	N/A
EN61K-4-3 (Railway)	Broadband Coupler 80MHz~1GHz 63dB	AR	DC6280AM1	0343831	N/A	N/A
EN61K-4-3 (Railway)	Coaxial Cable	INSULATED	NPS-4806-2360 -NP3	108599.003.01.0 3	N/A	N/A
EN61K-4-3 (Railway)	Broadband Coupler 0.8G~4.26GHz	AR	DC7144A	0335226	N/A	N/A
EN61K-4-3 (Railway)	Broadband Coupler 4G~8GHz	AR	DC7350A	0335817	N/A	N/A
EN61K-4-3 (Railway)	Signal Generator 07	R&S	SMB100A	107780	12/26/2023	12/26/2024
EN61K-4-4 EN61K-4-5 (Railway)	Signal Generator 10	EMC Partner	IMU3000	1547	09/07/2023	09/07/2024
EN61K-4-4 EN61K-4-5 (Railway)	CDN-A	EMC Partner	CDN-A-6-125	109037-3199	04/22/2024	04/22/2025
EN61K-4-6 (Railway)	CDN M2+M3 05	FRANKONI A	CDN M2+M3	A2210235/2013	03/19/2024	03/19/2025
EN61K-4-6 (Railway)	Coaxial Cable 4-6 02-1			4-6 02-1	N/A	N/A
EN61K-4-6 (Railway)	Conducted Immunity Test System 02	Frankonia	CIT-10-75-DC	126B1301/2014	03/15/2024	03/15/2025
EN61K-4-8 (Railway)	Magnetic Field Test Generator 02	PIC	PMF-1000	ANT150701	09/06/2023	09/06/2024
EN61K-4-29 (Railway)	Multifunction AC/DC Power Source	EMTEST	Netwave 7-400	P1453146268	11/24/2023	05/24/2025

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

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

Test Item	Filename	Version
EN IEC 61000-4-3	i2	529b
EN 61000-4-4	TEM A3000	v4.6.1
EN 61000-4-5	EMC Partner	1.69
EN 61000-4-6	i2	529b
EN 61000-4-8	N/A	

Site	Filename	Version
Conduction/Radiation	EZ EMC	ISL-03A2

5.2 Appendix B: Uncertainty of Measurement

The laboratory measurement uncertainty accordance with refers to CISPR 16-4-2. If U_{lab} is less than or equal to U_{cispr} in Table 1, then the test report may either state the value of U_{lab} or state that U_{lab} is less than U_{cispr}.

The coverage factor k = 2 yields approximately a 95 % level of confidence.

<Conduction 03>

AMN: ± 2.9 dB

<Chamber 02 (10m)>

Horizontal

30MHz~200MHz: ± 4.5 dB

200MHz~1000MHz: ± 4.3 dB

Vertical

30MHz~200MHz: ± 4.9 dB

200MHz~1000MHz: ± 4.7 dB

<Immunity 02>

Test item	Uncertainty	Test item	Uncertainty
EN 61000-4-2 (ESD)		EN 61000-4-6 (CS)	
Rise time tr	≤ 11%	CDN	1.9dB
Peak current I _p	≤ 5.9%	EM Clamp	3.4dB
current at 30 ns	≤ 6.0%	EN 61000-4-8 (Magnetic)	5.6%
current at 60 ns	≤ 5.9%		
EN IEC 61000-4-3 (RS)	2.7dB		
EN 61000-4-4 (EFT)			
voltage rise time (tr)	7.2%		
peak voltage value (VP)	6.3%		
voltage pulse width (t _w)	5.1%		
EN 61000-4-5 (Surge)			
open-circuit voltage front time	12%		
open-circuit voltage peak value	8.7%		
open-circuit voltage duration (T _d)	0.55%		

5.3 Appendix C: Photographs of EUT

Please refer to the File of **ISL-24LE0443P-MA**

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