Test Report

Test Report No.	: KES-RE-18T0255
Date of Issue	: September 11, 2018
Description of Product	: PoE Switch
Model No.	: SPN-10080P
Variant Model	: -
Applicant	: Hanwha Techwin Co., Ltd.
Address	: 51542 1204, Changwon-daero, Seongsan-gu, Changwon-si, Gyeongsangnam-do
Manufacturer 1	: D-TECH CO., LTD.
Address	: 173-25, Saneop-ro, Gwonseon-gu, suwon-si, Gyeonggi-do, Korea (Suwon Industrial Complex)
Manufacturer 2	: HANWHA TECHWIN(TIANJIN) CO., LTD.
Address	: No.11 Weiliu Rd, Micro-Electronic Industrial park, TEDA, Tianjin, 300385, People's Republic of China
Manufacturer 3	: HANWHA TECHWIN SECURITY VIETNAM CO., LTD.
Address	: Lot O-2, Que Vo Industial Zone extended area, Nam Son commune, Bac Ninh city, Bac Ninh province, Vietnam
Applicable Regulation	: EN 50155 : 2007 Railway applications - Electronic equipment used on rolling stock EN 61373 : 2010 Railway applications - Rolling stock equipment - Shock and vibration tests

Test Date : February. 07. 2018 – September. 07. 2018

Tested by: Byung min, Lee
Test Engineer

Reviewed by: Kang sun, Lee
Technical Manager

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1. General information

1.1 Introduction

Company Name	KES Co., Ltd.
Name of President / CEO	Young, Kim
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Tel	+82-31-425-6200
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1.2 Laboratory

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Tel	+82-31-425-6200
Fax	+82-31-424-0450

2. Information of E.U.T

1) Product : PoE Switch
2) Model : SPN-10080P
3) Ratings : DC (9 ~ 36) V, 11 A
4) Use of report : For quality management

3. Shock and vibration tests :

EN 61373 : 2010 Railway applications − Rolling stock equipment − Shock and vibration tests

1) Scope

This International Standard specifies the requirements for testing items of equipment intended for use on railway vehicles which are subsequently subjected to vibrations and shock owing to the nature of railway operational environment. To gain assurance that the quality of the equipment is acceptable, it has to withstand tests of reasonable duration that simulate the service conditions seen throughout its expected life.
Simulated long-life testing can be achieved in a number of ways each having their associated advantages and disadvantages, the following being the most common:
a) amplification: where the amplitudes are increased and the time base decreased;
b) time compression: where the amplitude history is retained and the time base is decreased (increase of the frequency);
c) decimation: where time slices of the historical data are removed when the amplitudes are below a specified threshold value.

2) Purpose and choice of the tests

Symbol	Test description
Category 1 Body mounted	Class A Cubicles, subassemblies, equipment and components mounted directly on or under the car body.
	Class B Anything mounted inside an equipment case which is in turn mounted directly on or under the car body. NOTE 1 Class B should be used when it is not clear where the equipment is to be located.
Category 2 Bogie mounted	Cubicles, subassemblies, equipment and components which are to be mounted on the bogie of a railway vehicle
Category 3 Axle mounted	Subassemblies, equipment and components or assemblies which are to be mounted on the wheelset assembly of a railway vehicle.

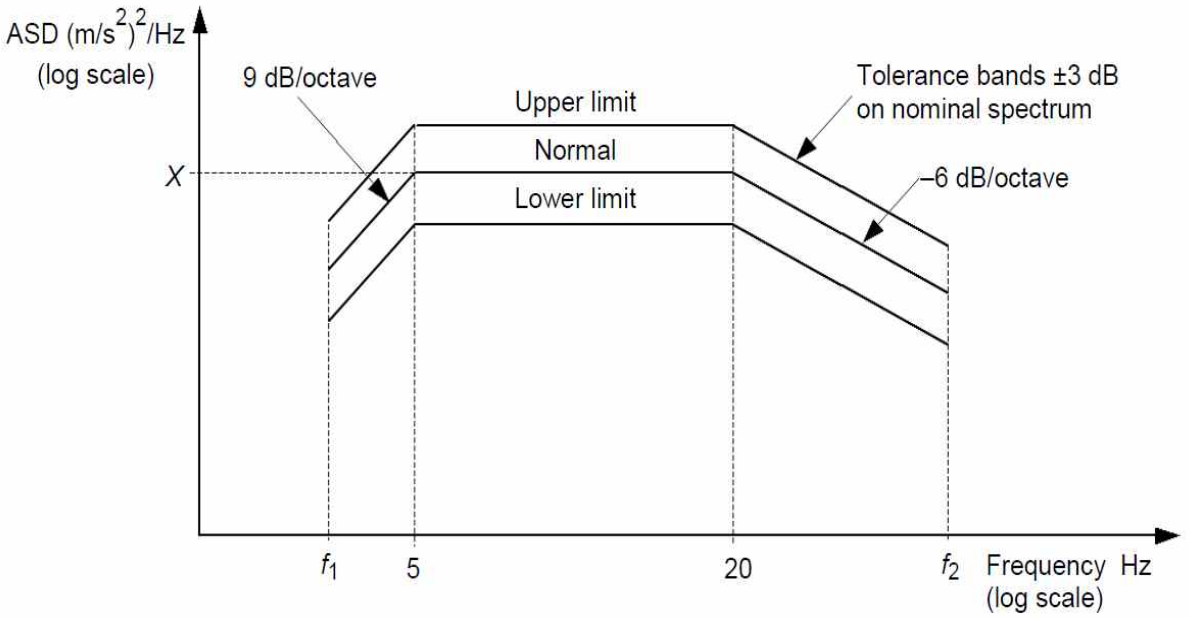
3) General

This standard is intended to highlight any weakness/error which may result in problems as a consequence of operation under environments where vibration and shock are known to occur in service on a railway vehicle. This is not intended to represent a full life test. However, the test conditions are sufficient to provide some reasonable degree of confidence that the equipment will survive the specified life under service conditions.

4) Simulated long-life test

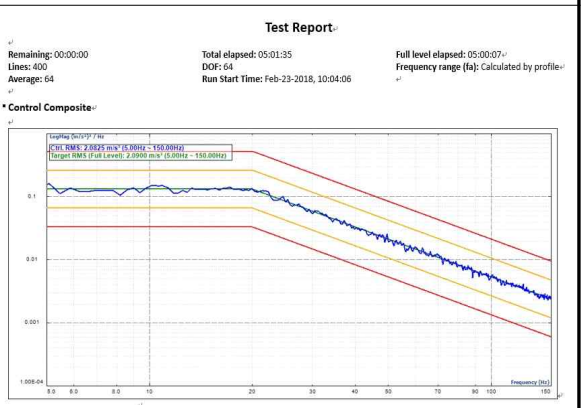
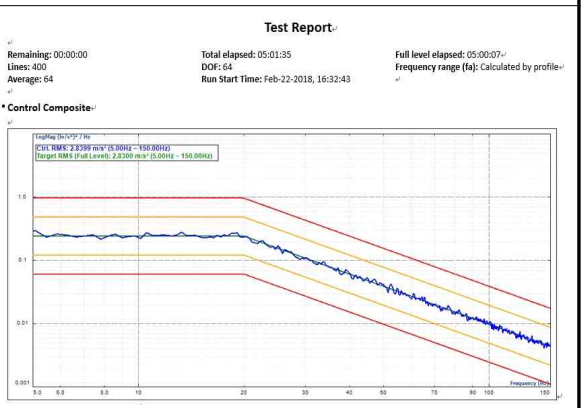
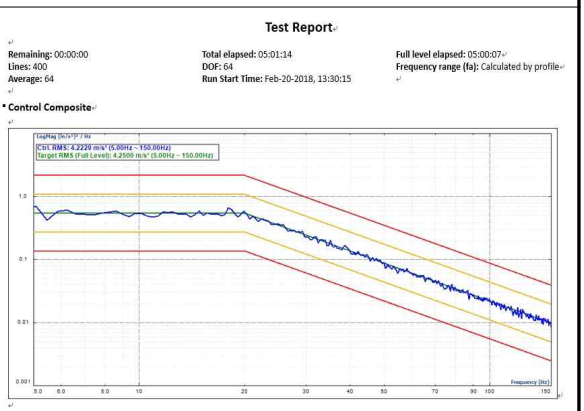
<table>
<tr><th colspan="2">Item</th><th colspan="6">Detailed description</th><th>Remarks</th></tr>
<tr><td colspan="2">Test date</td><td colspan="6">February 20, 2018 - February 23, 2018</td><td>-</td></tr>
<tr><td colspan="2">Environmental conditions</td><td colspan="6">Temperature : (25.0 ± 10.0)℃,
Humidity : (50 ± 25) % R.H.</td><td>-</td></tr>
<tr><td colspan="2">Power conditions</td><td colspan="6">■ Store (Power OFF) □ Action (Power ON)</td><td>-</td></tr>
<tr><td colspan="2">Categories</td><td colspan="6">■ Category 1 (■ Class A □ Class B)
□ Category 2 □ Category 3</td><td>-</td></tr>
<tr><td colspan="2" rowspan="5">Direction time and test level</td><td colspan="2">Vertical (5 h)</td><td colspan="2">Transverse (5 h)</td><td colspan="2">Longitudinal (5 h)</td><td rowspan="5"></td></tr>
<tr><td>Frequency [Hz]</td><td>ASD Levels [m/s²)²/Hz]</td><td>Frequency [Hz]</td><td>ASD Levels [m/s²)²/Hz]</td><td>Frequency [Hz]</td><td>ASD Levels [m/s²)²/Hz]</td></tr>
<tr><td>5</td><td>0.532</td><td>5</td><td>0.131</td><td>5</td><td>0.234</td></tr>
<tr><td>20</td><td>0.532</td><td>20</td><td>0.131</td><td>20</td><td>0.234</td></tr>
<tr><td>150</td><td>-6 dB/oct</td><td>150</td><td>-6 dB/oct</td><td>150</td><td>-6 dB/oct</td></tr>
<tr><td colspan="2">4.25 m/s² r.m.s</td><td colspan="2">2.09 m/s² r.m.s</td><td colspan="2">2.83 m/s² r.m.s</td></tr>
<tr><td colspan="2">ASD spectrum</td><td colspan="6">Category 1 (■ Class A □ Class B)</td><td>Refer to 3.5)</td></tr>
<tr><td rowspan="2">Initial measurements</td><td>Visual inspection</td><td colspan="6">Mechanical damage, loosening of screw, etc.</td><td>-</td></tr>
<tr><td>Functional test</td><td colspan="6">Normal operation check</td><td>-</td></tr>
<tr><td rowspan="2">Intermediate measurements</td><td>Visual inspection</td><td colspan="6">Not-Applicable</td><td>-</td></tr>
<tr><td>Functional test</td><td colspan="6">Not-Applicable</td><td>-</td></tr>
<tr><td rowspan="2">Final measurements</td><td>Visual inspection</td><td colspan="6">Mechanical damage, loosening of screw, etc.</td><td>-</td></tr>
<tr><td>Functional test</td><td colspan="6">Normal operation check</td><td>-</td></tr>
</table>

5) Category 1 – Class A, ASD spectrum



6) Simulated long-life test result

Test Items	Test standard	Test result	Remarks
Simulated long-life test	Simulated long-life test at increased random vibration level according to Category 1, Class A test method. There should be no abnormalities and no mechanical defects when checking the performance test at the initial and final of the test.	No abnormalities and no mechanical defects when the performance test was confirmed at the initial and final of the test	–

X axes		February 23, 2018 / 10:04:06 
Y axes		February 22, 2018 / 16:32:43 
Z axes		February 20, 2018 / 13:30:15 

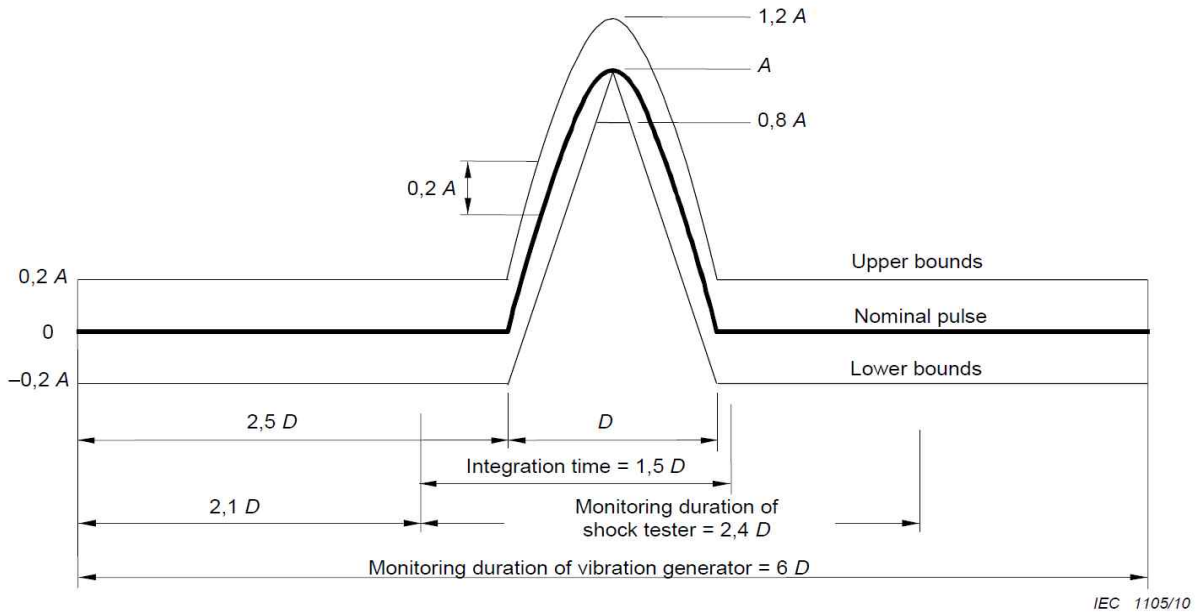
7) Shock testing

Item	Detailed description	Remarks
Test date	February 21, 2018 - February 23, 2018	-
Environmental conditions	Temperature : (25.0 ± 10.0)℃, Humidity : (50 ± 25) % R.H.	-
Power conditions	■ Store (Power OFF) ☐ Action (Power ON)	-
Categories	■ Category 1 (■ Class A ☐ Class B) ☐ Category 2 ☐ Category 3	-

Direction time and test level		Vertical	Transverse	Longitudinal
	Peak acceleration A (m/s^2)	30	30	50
	Nominal duration D (ms)	30	30	30
	Number of repetitions (+, -)	3 / 3	3 / 3	3 / 3
	Wave form	Half sine wave	Half sine wave	Half sine wave

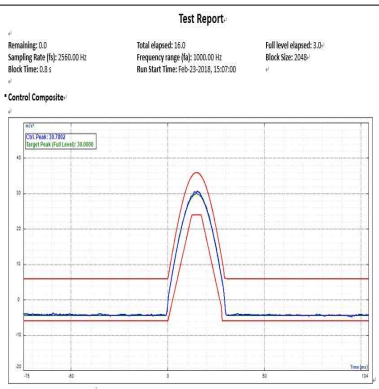
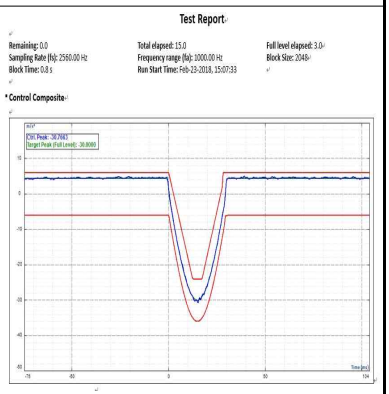
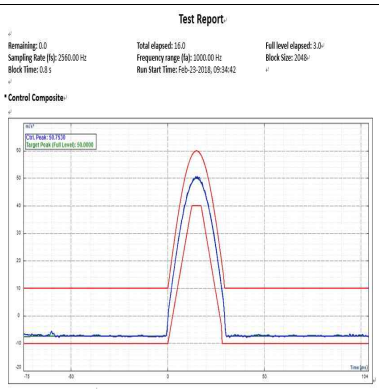
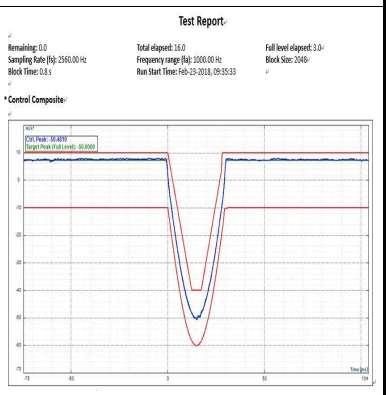
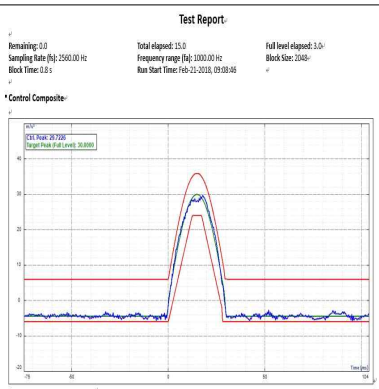
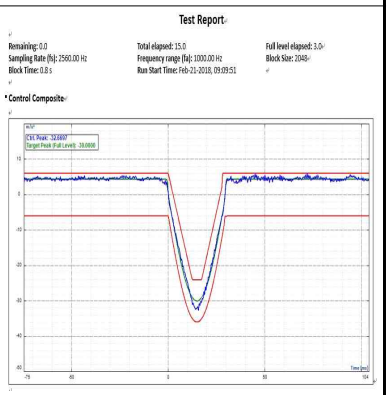
Allowable width of sine wave type		Category 1 (■ Class A ☐ Class B)	Refer to 3.8)
Initial measurements	Visual inspection	Mechanical damage, loosening of screw, etc.	-
	Functional test	Normal operation check	-
Intermediate measurements	Visual inspection	Not-Applicable	-
	Functional test	Not-Applicable	-
Final measurements	Visual inspection	Mechanical damage, loosening of screw, etc.	-
	Functional test	Normal operation check	-

8) Allowable width of sine wave type



9) Shock test result

Test Items	Test standard	Test result	Remarks
Shock test	Vertical, transverse, and longitudinal shock tests According to Category 1, Class A test method There should be no abnormalities and no mechanical defects when checking the performance test at the initial and final of the test.	No abnormalities and no mechanical defects when the performance test was confirmed at the initial and final of the test	–

X axes		February 23, 2018 / 15:07:00 	February 23, 2018 / 15:07:33 
Y axes		February 23, 2018 / 09:34:42 	February 23, 2018 / 09:35:33 
Z axes		February 21, 2018 / 09:08:46 	February 21, 2018 / 09:09:51 

10) Functional random test

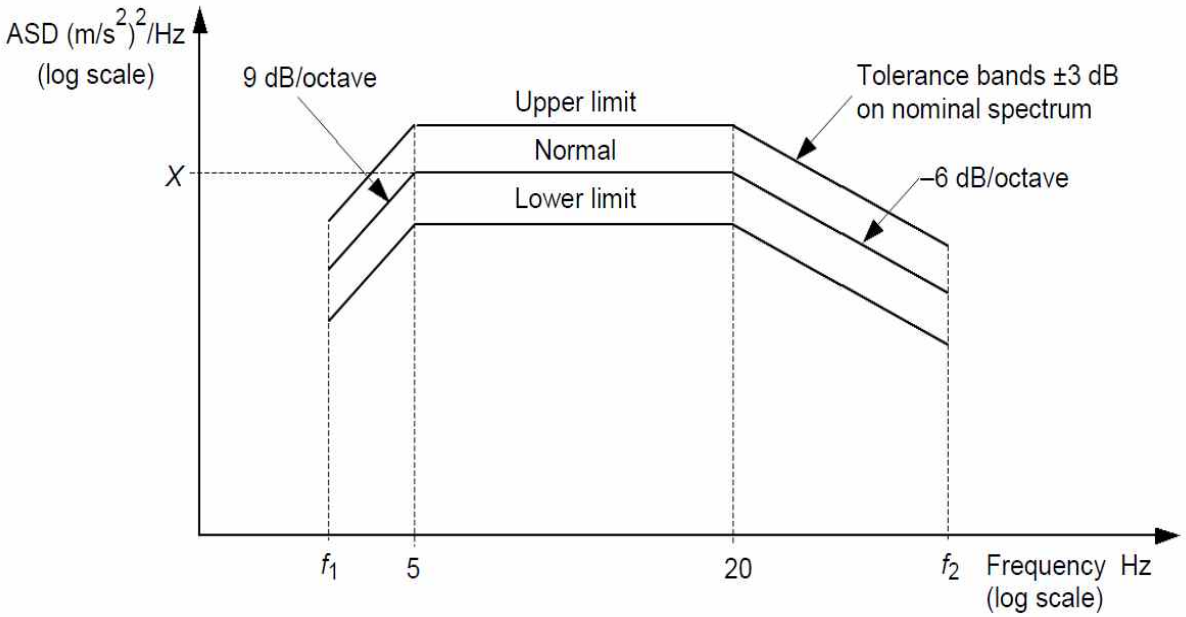
Item	Detailed description	Remarks
Test date	February 21, 2018 - February 23, 2018	-
Environmental conditions	Temperature : (25.0 ± 10.0)℃, Humidity : (50 ± 25) % R.H.	-
Power conditions	☐ Store (Power OFF) ■ Action (Power ON)	-
Categories	■ Category 1 (■ Class A ☐ Class B) ☐ Category 2 ☐ Category 3	-

Direction time and test level

Vertical (15 min)		Transverse (15 min)		Longitudinal (15 min)	
Frequency [Hz]	ASD Levels [$(m/s^2)^2/Hz$]	Frequency [Hz]	ASD Levels [$(m/s^2)^2/Hz$]	Frequency [Hz]	ASD Levels [$(m/s^2)^2/Hz$]
5	0.016 6	5	0.004 1	5	0.007 3
20	0.016 6	20	0.004 1	20	0.007 3
150	-6 dB/oct	150	-6 dB/oct	150	-6 dB/oct
0.750 m/s^2 r.m.s		0.370 m/s^2 r.m.s		0.500 m/s^2 r.m.s	

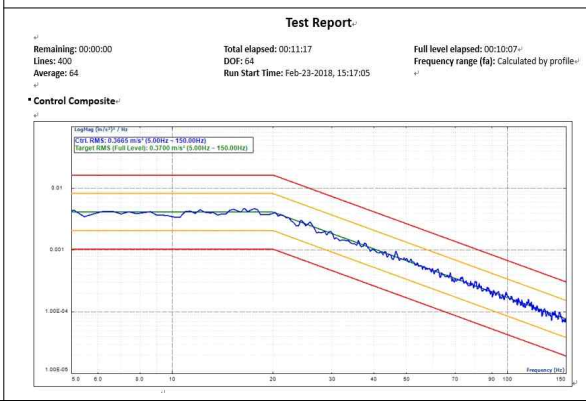
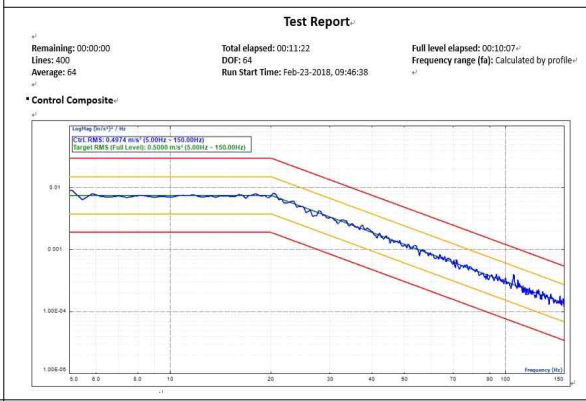
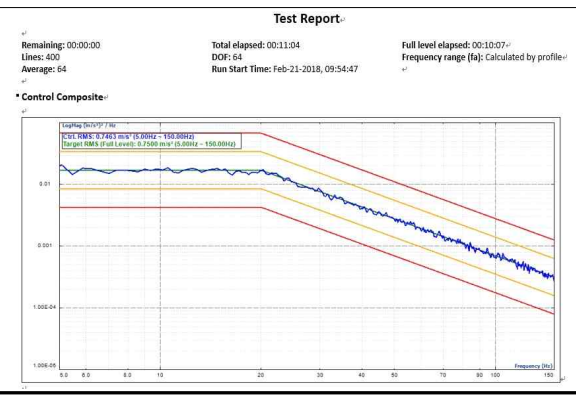
ASD spectrum		Category 1 (■ Class A ☐ Class B)	Refer to 3.11)
Initial measurements	Visual inspection	Mechanical damage, loosening of screw, etc.	-
	Functional test	Normal operation check	-
Intermediate measurements	Visual inspection	Mechanical damage, loosening of screw, etc.	-
	Functional test	Normal operation check	-
Final measurements	Visual inspection	Mechanical damage, loosening of screw, etc.	-
	Functional test	Normal operation check	-

11) Category 1 – Class A, ASD spectrum



12) Functional random test result

Test Items	Test standard	Test result	Remarks
Functional random test	Vertical, transverse, and longitudinal functional random test according to Category 1, Class A test method There should be no abnormalities and no mechanical defects when checking the performance test at the initial and final of the test.	No abnormalities and no mechanical defects when the performance test was confirmed at the initial and final of the test	–

X axes		February 23, 2018 / 15:17:05 
Y axes		February 23, 2018 / 09:46:38 
Z axes		February 21, 2018 / 09:54:47 

4. Cooling test : EN 50155:2007 (clause 12.2.3)

1) Test description and symbol

Standard	Symbol	Test description
EN 60068-2-1	Ab	Cold for non heat-dissipating specimens with gradual change of temperature
	Ad	Cold for heat-dissipating specimens with gradual change of temperature that are powered after initial temperature stabilization
	Ae	Cold for heat-dissipating specimens with gradual change of temperature that are required to be powered throughout the test

2) Table 1 - Ambient temperature

Class	Column 1	Column 2	Column 3	Column 4
	Ambient temperature outside vehicle	**Internal cubicle temperature**	**Internal cubicle overtemperature during 10 min**	**Air temperature surrounding the printed board assembly**
T1	-25 ℃ ~ 40 ℃	-25 ℃ ~ 55 ℃	15 ℃	-25 ℃ ~ 70 ℃
T2	-40 ℃ ~ 35 ℃	-40 ℃ ~ 55 ℃	15 ℃	-40 ℃ ~ 70 ℃
T3	-25 ℃ ~ 45 ℃	-25 ℃ ~ 70 ℃	15 ℃	-25 ℃ ~ 85 ℃
TX	-40 ℃ ~ 50 ℃	-40 ℃ ~ 70 ℃	15 ℃	-40 ℃ ~ 85 ℃

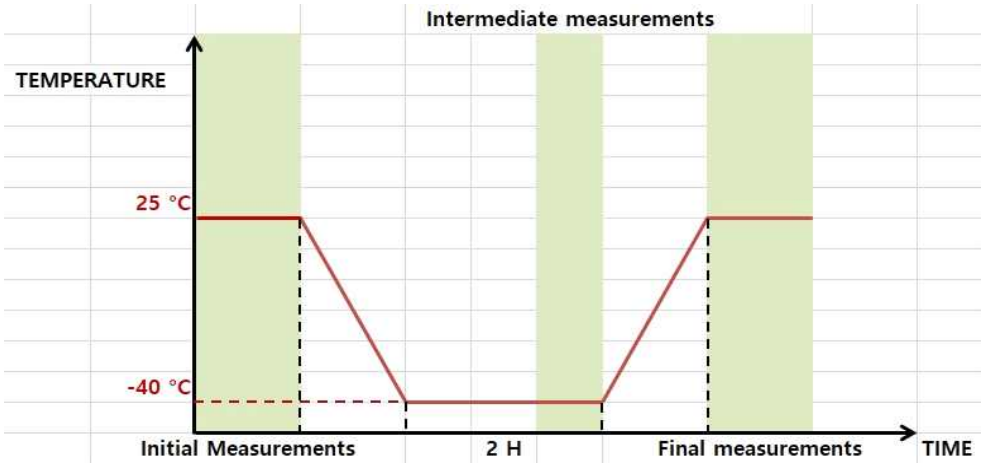
3) Test instrument performance

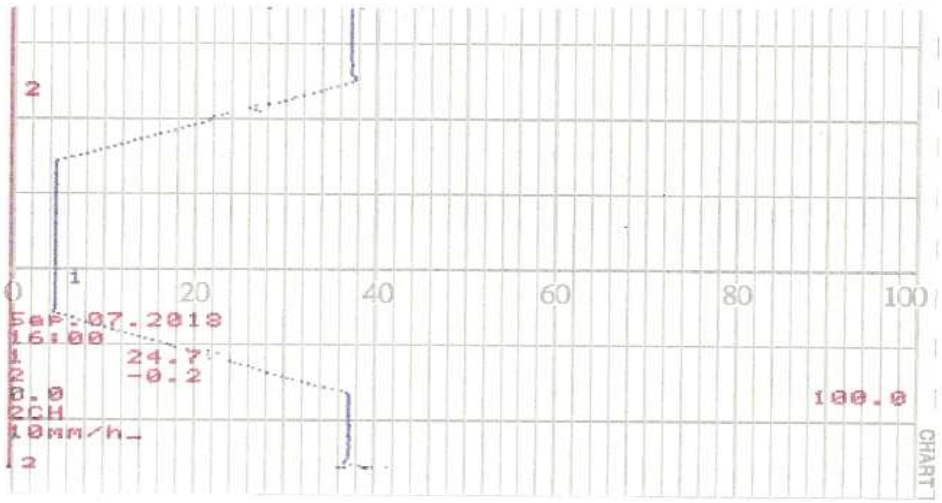
Set point temperature control method	Temperature sensor detection and control
Air flow	High wind speed circulation
Air velocity and direction	7.45 m/s, north wind
Applied temperature change rate (slope)	Max. 1 K/min

4) Test conditions

Item		Detailed description	Remarks
Test date		September 07, 2018	-
Environmental conditions		Temperature : (25.0 ± 10.0)℃, Humidity : (50 ± 25) % R.H.	-
Power conditions		■ Store (Power OFF) ☐ Action (Power ON)	-
Categories		Class T3, Column 1	Refer to 4.2)
Specimen classification		☐ Non heat-dissipating specimens ■ heat-dissipating specimens	-
Application testing		☐ Test Ab ■ Test Ad ☐ Test Ae	-
Severity	**Temperature**	☐ -65 ℃ ☐ -55 ℃ ☐ -50 ℃ ■ -40 ℃ ☐ -33 ℃ ☐ -25 ℃ ☐ -20 ℃ ☐ -10 ℃ ☐ -5 ℃ ☐ +5 ℃	Tolerance ± 2 K
	Duration	■ 2 h ☐ 16 h ☐ 72 h ☐ 96 h ☐ Etc	EN 50155
Pre conditioning	**Applicability**	■ No Regulations ☐ Regulations	-
	Contents	–	-
Initial measurements	**Visual inspection**	Mechanical damage, loosening of screw, etc.	-
	Functional test	Normal operation check	-
Intermediate measurements	**Visual inspection**	Not-Applicable	-
	Functional test	Normal operation check	-
Recovery	**Applicability**	☐ No Regulations ■ Regulations	-
	Condition	■ Recovery from standard atmospheric conditions ☐ Etc :	Minimum 1 hour
Final measurements	**Visual inspection**	Mechanical damage, loosening of screw, etc.	-
	Functional test	Normal operation check	-

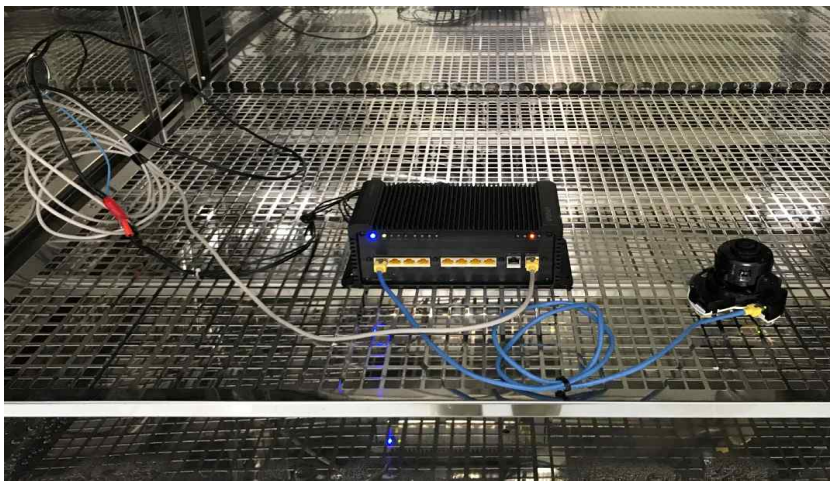
5) Cooling test graph





6) Test result

Test Items	Test standard	Test result	Remarks
Cooling test	According to EN 60068-2-1 cold resistance test method, it is allowed to stand at -40 ℃, 2 hours, no abnormalities and no mechanical defects when the function test is confirmed at the initial, intermediate and final of the test	When the function test was carried out no abnormality and no mechanical defect	-

Cooling test	Internal chamber	
	During the test	
	Normal operation check	

5. Dry heat test (T2) : EN 50155:2007 (clause 12.2.4)

1) Test description and symbol

Standard	Symbol	Test description
EN 60068-2-2	Bb	Dry heat for non heat-dissipating specimens with gradual change of temperature
	Bd	Dry heat for heat-dissipating specimens with gradual change of temperature that are not powered during the conditioning period
	Be	Dry heat for heat-dissipating specimens with gradual change of temperature that are required to be powered throughout the test

2) Table 1 – Ambient temperature

Class	Column 1	Column 2	Column 3	Column 4
	Ambient temperature outside vehicle	**Internal cubicle temperature**	**Internal cubicle overtemperature during 10 min**	**Air temperature surrounding the printed board assembly**
T1	-25 ℃ ~ 40 ℃	-25 ℃ ~ 55 ℃	15 ℃	-25 ℃ ~ 70 ℃
T2	-40 ℃ ~ 35 ℃	-40 ℃ ~ 55 ℃	15 ℃	-40 ℃ ~ 70 ℃
T3	-25 ℃ ~ 45 ℃	-25 ℃ ~ 70 ℃	15 ℃	-25 ℃ ~ 85 ℃
TX	-40 ℃ ~ 50 ℃	-40 ℃ ~ 70 ℃	15 ℃	-40 ℃ ~ 85 ℃

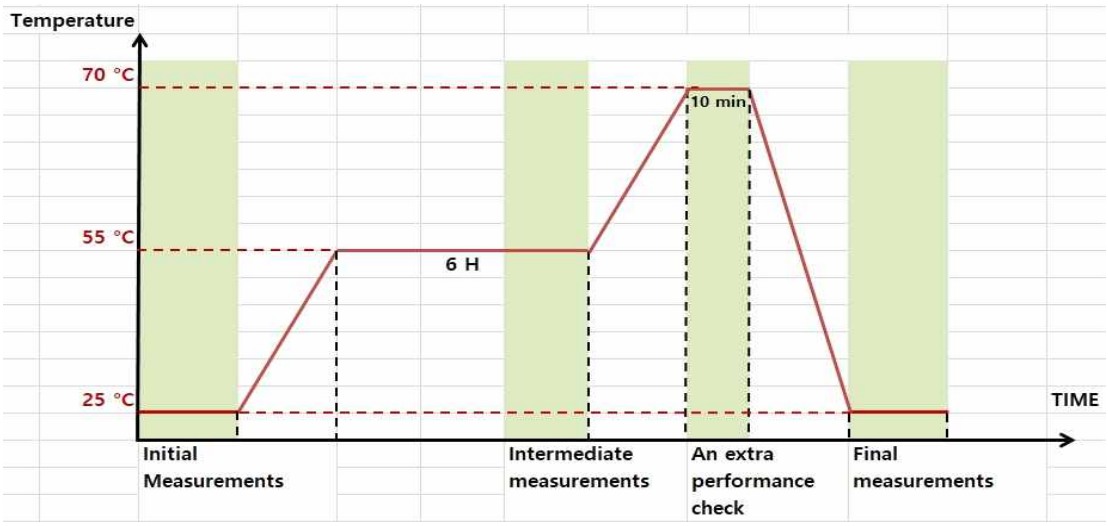
3) Test instrument performance

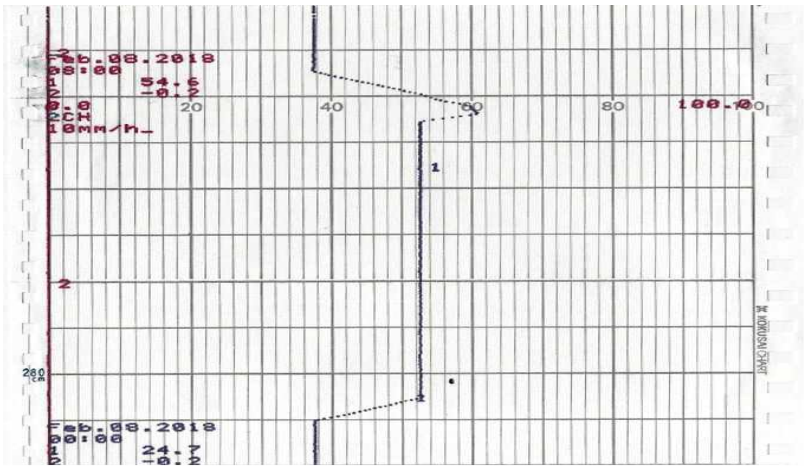
Set point temperature control method	Temperature sensor detection and control
Air flow	High wind speed circulation
Air velocity and direction	7.41 m/s, north wind
Applied temperature change rate (slope)	Max. 1 K/min

4) Test conditions

Item		Detailed description	Remarks
Test date		February 08, 2018 ~ February 08, 2018	-
Environmental conditions		Temperature : (25.0 ± 10.0)℃, Humidity : (50 ± 25) % R.H.	-
Power conditions		■ Store (Power OFF) ☐ Action (Power ON)	-
Categories		Class T2, Column 2	Refer to 5.2)
Specimen classification		☐ Non heat-dissipating specimens ■ heat-dissipating specimens	-
Application testing		☐ Test Bb ■ Test Bd ☐ Test Be	-
Severity	**Temperature**	☐ 1000 ℃ ☐ 800 ℃ ☐ 630 ℃ ☐ 500 ℃ ☐ 400 ℃ ☐ 315 ℃ ☐ 250 ℃ ☐ 175 ℃ ☐ 155 ℃ ☐ 125 ℃ ☐ 100 ℃ ☐ 85 ℃ ■ 70 ℃ ☐ 65 ℃ ☐ 60 ℃ ■ 55 ℃ ☐ 50 ℃ ☐ 45 ℃ ☐ 40 ℃ ☐ 35 ℃ ☐ 30 ℃	Tolerance ± 2 K
	Duration	☐ 2 h ☐ 16 h ☐ 72 h ☐ 96 h ☐ 168 h ☐ 240 h ☐ 336 h ☐ 1 000 h ■ Etc : 6 h + 10 min	EN 50155
Initial measurements	**Visual inspection**	Mechanical damage, loosening of screw, etc.	-
	Functional test	Normal operation check	-
Intermediate measurements	**Visual inspection**	Not-Applicable	-
	Functional test	Normal operation check	-
An extra performance check	**Functional test**	70 ℃, 10 min, Normal operation check	-
Recovery	**Applicability**	☐ No Regulations ■ Regulations	-
	Condition	■ Recovery from standard atmospheric conditions ☐ Etc :	Minimum 1 hour
Final measurements	**Visual inspection**	Mechanical damage, loosening of screw, etc.	-
	Functional test	Normal operation check	-

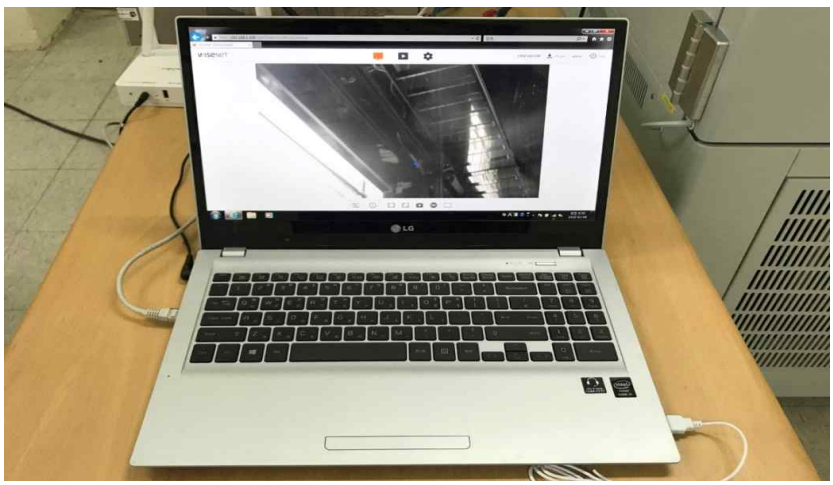
5) Dry heat test graph





6) Test result

Test Items	Test standard	Test result	Remarks
Dry heat test	According to EN 60068-2-2 Dry heat test method, it is allowed to stand at 55 ℃, 6 hours, no abnormalities and no mechanical defects when the function test is confirmed at the initial, intermediate and final stages of the test	When the function test was carried out no abnormality and no mechanical defect	-

Dry heat test (T2)	Internal chamber	
	During the test	
	Normal operation check	

6. Dry Heat Test (TX) : EN 50155:2007 (clause 12.2.4)

1) Test description and symbol

Standard	Symbol	Test description
EN 60068-2-2	Bb	Dry heat for non heat-dissipating specimens with gradual change of temperature
	Bd	Dry heat for heat-dissipating specimens with gradual change of temperature that are not powered during the conditioning period
	Be	Dry heat for heat-dissipating specimens with gradual change of temperature that are required to be powered throughout the test

2) Table 1 - Ambient temperature

Class	Column 1	Column 2	Column 3	Column 4
	Ambient temperature outside vehicle	**Internal cubicle temperature**	**Internal cubicle overtemperature during 10 min**	**Air temperature surrounding the printed board assembly**
T1	-25 ℃ ~ 40 ℃	-25 ℃ ~ 55 ℃	15 ℃	-25 ℃ ~ 70 ℃
T2	-40 ℃ ~ 35 ℃	-40 ℃ ~ 55 ℃	15 ℃	-40 ℃ ~ 70 ℃
T3	-25 ℃ ~ 45 ℃	-25 ℃ ~ 70 ℃	15 ℃	-25 ℃ ~ 85 ℃
TX	-40 ℃ ~ 50 ℃	-40 ℃ ~ 70 ℃	15 ℃	-40 ℃ ~ 85 ℃

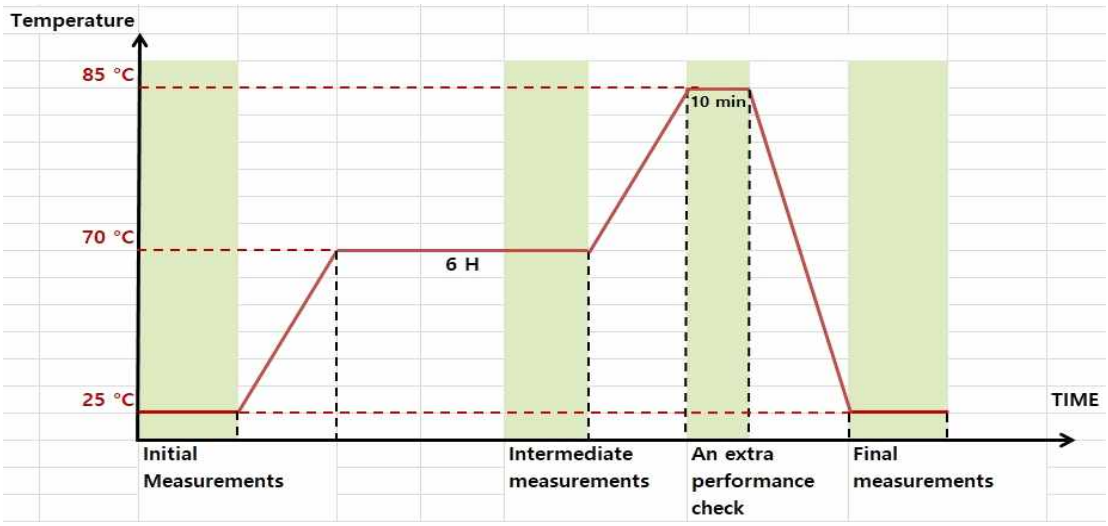
3) Test instrument performance

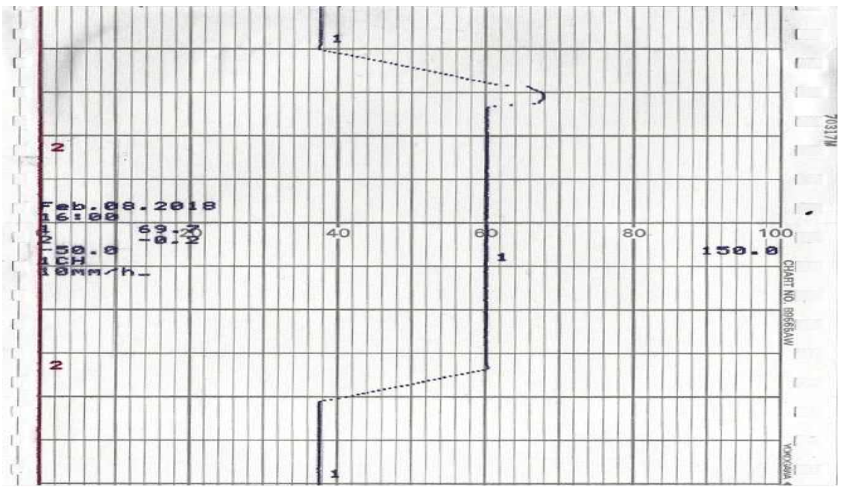
Set point temperature control method	Temperature sensor detection and control
Air flow	High wind speed circulation
Air velocity and direction	7.41 m/s, north wind
Applied temperature change rate (slope)	Max. 1 K/min

4) Test conditions

Item		Detailed description	Remarks
Test date		February 08, 2018 ~ February 08, 2018	-
Environmental conditions		Temperature : (25.0 ± 10.0)℃, Humidity : (50 ± 25) % R.H.	-
Power conditions		■ Store (Power OFF) ☐ Action (Power ON)	-
Categories		Class TX, Column 2	Refer to 6.2)
Specimen classification		☐ Non heat-dissipating specimens ■ heat-dissipating specimens	-
Application testing		☐ Test Bb ■ Test Bd ☐ Test Be	-
Severity	**Temperature**	☐ 1000 ℃ ☐ 800 ℃ ☐ 630 ℃ ☐ 500 ℃ ☐ 400 ℃ ☐ 315 ℃ ☐ 250 ℃ ☐ 175 ℃ ☐ 155 ℃ ☐ 125 ℃ ☐ 100 ℃ ■ 85 ℃ ■ 70 ℃ ☐ 65 ℃ ☐ 60 ℃ ☐ 55 ℃ ☐ 50 ℃ ☐ 45 ℃ ☐ 40 ℃ ☐ 35 ℃ ☐ 30 ℃	Tolerance ± 2 K
	Duration	☐ 2 h ☐ 16 h ☐ 72 h ☐ 96 h ☐ 168 h ☐ 240 h ☐ 336 h ☐ 1 000 h ■ Etc : 6 h + 10 min	EN 50155
Initial measurements	**Visual inspection**	Mechanical damage, loosening of screw, etc.	-
	Functional test	Normal operation check	-
Intermediate measurements	**Visual inspection**	Not-Applicable	-
	Functional test	Normal operation check	-
An extra performance check	**Functional test**	85 ℃, 10 min, Normal operation check	
Recovery	**Applicability**	☐ No Regulations ■ Regulations	-
	Condition	■ Recovery from standard atmospheric conditions ☐ Etc :	Minimum 1 hour
Final measurements	**Visual inspection**	Mechanical damage, loosening of screw, etc.	-
	Functional test	Normal operation check	-

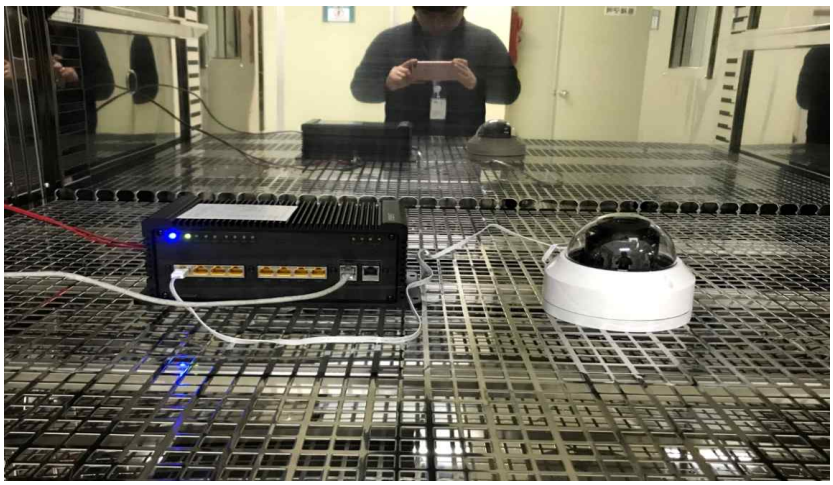
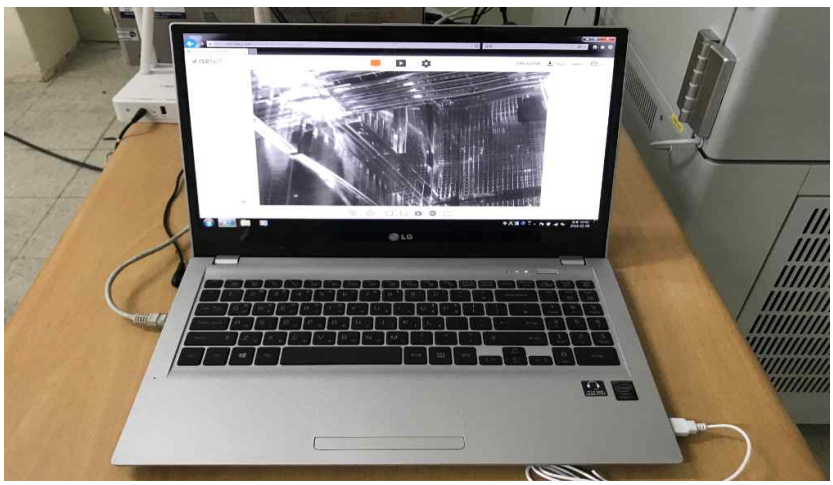
5) Dry heat test graph





6) Test result

Test Items	Test standard	Test result	Remarks
Dry heat test	According to EN 60068-2-2 Dry heat test method, it is allowed to stand at 70 ℃, 6 hours, no abnormalities and no mechanical defects when the function test is confirmed at the initial, intermediate and final stages of the test	When the function test was carried out no abnormality and no mechanical defect	-

Dry heat test (TX)	Internal chamber	
	During the test	
	Normal operation check	

7. Used instrument list

No	KES Management Number	Instrument Name	Mfr.	Model	Serial #	Date of Calibration	Calibration Valid Until	Calibration Cycle	Remark
1	KES-RE-052	Extended Range DC Power Supply	TAKASAGO	ZX-400L	428700080135	2018.01.15	2019.01.15	1 year	-
2	KES-RE-107	Vibration Exciter	JINN Co., LTD	S701LS4-450M	20170523	2017.07.14	2018.07.14	1 year	-
3	KES-RE-109	Temp. & Humid. Chamber	SJ SCIENCE CO	SJ-TH-S150	SJ-TH-S150-171205	2018.01.03	2019.01.03	1 year	-

- The end of test report -