



KES Co., Ltd.


3701, 40, Simin-daero 365beon-gil,
Dongan-gu, Anyang-si, Gyeonggi-do, 14057, Korea
Tel: +82-31-425-6200 / Fax: +82-31-424-0450
www.kes.co.kr


Report No.:
KES-RE-18T0047-R1
Page (1) of (27)

Test Report

Test Report No. : KES-RE-18T0047-R1
Date of Issue : October 31, 2018
Description of Product : Network Camera
Model No. : XNV-6013M
Variant Model : -
Applicant : Hanwha Techwin Co., Ltd.
Address : 51542 1204, Changwon-daero, Seongsan-gu, Changwon-si, Gyeongsangnam-do
Manufacturer : Hanwha Techwin Co., Ltd.
Address : 51542 1204, Changwon-daero, Seongsan-gu, Changwon-si, Gyeongsangnam-do
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 : March. 20. 2018 — March. 29. 2018

Tested by: 
Hyun seuk, Oh
Test Engineer

Reviewed by: 
Kang sun, Lee
Technical Manager



Testing Laboratories for Safety and RF Compliance
C-3701, 40, Simin-daero 365beon-gil, Dongan-gu, Anyang-si, Gyeonggi-do, 14057, Korea
Tel: +82-31-425-6200 / Fax: +82-31-424-0450

Testing Laboratories for EMI and EMS Compliance
473-21, Gayeo-ro, Yeosu-si, Gyeonggi-do, 12658, Korea
Tel : +82-31-883-5092 / Fax: +82-31-883-5169

This report shall not be reproduced except in full, without the written approval of KES Co., Ltd.
The results shown in this test report refer only to the sample(s) tested unless otherwise stated.
The authenticity of the test report, contact shchoi@kes.co.kr



KES Co., Ltd.

3701, 40, Simin-daero 365beon-gil,
Dongan-gu, Anyang-si, Gyeonggi-do, 14057, Korea
Tel: +82-31-425-6200 / Fax: +82-31-424-0450
www.kes.co.kr

Report No.:
KES-RE-18T0047-R1
Page (2) of (27)

Revision history

Rev. No.	Date	Test Report No.	Revision History
-	March 30, 2018	KES-RE-18T0047	Issued
1	October 31, 2018	KES-RE-18T0047-R1	Change of Power Conditions during temperature test (4. Cooling test, 5. Dry heat test (T2), 6. Dry heat test (TX))

This report shall not be reproduced except in full, without the written approval of KES Co., Ltd.

The results shown in this test report refer only to the sample(s) tested unless otherwise stated.

The authenticity of the test report, contact shchoi@kes.co.kr



KES Co., Ltd.

3701, 40, Simin-daero 365beon-gil,
Dongan-gu, Anyang-si, Gyeonggi-do, 14057, Korea
Tel: +82-31-425-6200 / Fax: +82-31-424-0450
www.kes.co.kr

Report No.:
KES-RE-18T0047-R1
Page (3) of (27)

TABLE OF CONTENTS

1	General information	3
2	Information of E.U.T	3
3	Shock and vibration tests	4
4	Cooling test	14
5	Dry heat test (T2)	18
6	Dry heat test (TX)	22
7	Used instrument list	26

This report shall not be reproduced except in full, without the written approval of KES Co., Ltd.

The results shown in this test report refer only to the sample(s) tested unless otherwise stated.

The authenticity of the test report, contact shchoi@kes.co.kr

1. General information

1.1 Introduction

Company Name	KES Co., Ltd.
Name of President / CEO	Young, Kim
Address	C-3701, Simin-daero 365-40, Dongan-gu, Anyang-si, Gyeonggi-do, 14057, Korea
Tel	+82-31-425-6200
Fax	+82-31-424-0450
E-mail	kes@kes.co.kr

1.2 Laboratory

Address	C-3701, Simin-daero 365-40, Dongan-gu, Anyang-si, Gyeonggi-do, 14057, Korea 473-21, Gayeo-ro, Yeosu-si, Gyeonggi-do, 12658, Korea
Tel	+82-31-425-6200
Fax	+82-31-424-0450

2. Information of E.U.T

- 1) Product : Network Camera
- 2) Model : XNV-6013M
- 3) Ratings : DC 12 V, 6 W
- 4) Serial No. : -
- 5) Use of report : For quality management



This report shall not be reproduced except in full, without the written approval of KES Co., Ltd.

The results shown in this test report refer only to the sample(s) tested unless otherwise stated.

The authenticity of the test report, contact shchoi@kes.co.kr



KES Co., Ltd.

3701, 40, Simin-daero 365beon-gil,
Dongan-gu, Anyang-si, Gyeonggi-do, 14057, Korea
Tel: +82-31-425-6200 / Fax: +82-31-424-0450
www.kes.co.kr

Report No.:
KES-RE-18T0047-R1
Page (5) of (27)

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.

This report shall not be reproduced except in full, without the written approval of KES Co., Ltd.
The results shown in this test report refer only to the sample(s) tested unless otherwise stated.
The authenticity of the test report, contact shchoi@kes.co.kr



KES Co., Ltd.

3701, 40, Simin-daero 365beon-gil,
Dongan-gu, Anyang-si, Gyeonggi-do, 14057, Korea
Tel: +82-31-425-6200 / Fax: +82-31-424-0450
www.kes.co.kr

Report No.:
KES-RE-18T0047-R1
Page (6) of (27)

4) Simulated long-life test conditions

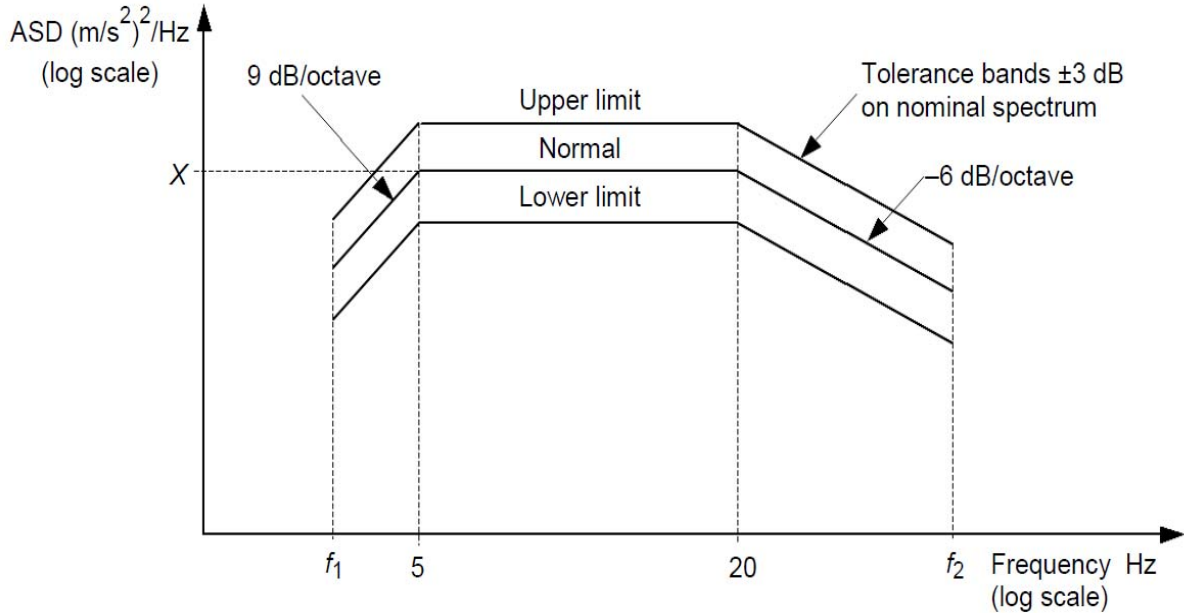
Item		Detailed description				Remarks	
Test date		March 27, 2018 – March 29, 2018				-	
Environmental conditions		Temperature : (25.0 ± 10.0) °C, Humidity : (50 ± 25) % R.H.				-	
Power conditions		<input checked="" type="checkbox"/> Store (Power OFF) <input type="checkbox"/> Action (Power ON)				-	
Categories		<input checked="" type="checkbox"/> Category 1 (<input checked="" type="checkbox"/> Class A <input type="checkbox"/> Class B) <input type="checkbox"/> Category 2 <input type="checkbox"/> Category 3				-	
Direction time and test level	Vertical (5 h)		Transverse (5 h)		Longitudinal (5 h)		
	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	0.532	5	0.131	5	0.234	
	20	0.532	20	0.131	20	0.234	
	150	-6 dB/oct	150	-6 dB/oct	150	-6 dB/oct	
	4.25 m/s ² r.m.s		2.09 m/s ² r.m.s		2.83 m/s ² r.m.s		
ASD spectrum		Category 1 (<input checked="" type="checkbox"/> Class A <input type="checkbox"/> Class B)				Refer to 3. 5)	
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				-	

This report shall not be reproduced except in full, without the written approval of KES Co., Ltd.

The results shown in this test report refer only to the sample(s) tested unless otherwise stated.

The authenticity of the test report, contact shchoi@kes.co.kr

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	-

<p>X axes</p>		<p>March 28, 2018 / 09:09:55</p> <p>Test Report-</p> <p>Remaining: 00:00:00 Total elapsed: 05:01:14 Full level elapsed: 05:00:07- Lines: 400 DOF: 64 Frequency range [Hz]: Calculated by profile- Average: 64 Run Start Time: Mar-28-2018, 09:09:55</p> <p>Control Composite-</p>
<p>Y axes</p>		<p>March 29, 2018 / 09:08:03</p> <p>Test Report-</p> <p>Remaining: 00:00:00 Total elapsed: 05:01:17 Full level elapsed: 05:00:07- Lines: 400 DOF: 64 Frequency range [Hz]: Calculated by profile- Average: 64 Run Start Time: Mar-29-2018, 09:08:03</p> <p>Control Composite-</p>
<p>Z axes</p>		<p>March 27, 2018 / 09:31:58</p> <p>Test Report-</p> <p>Remaining: 00:00:00 Total elapsed: 05:01:14 Full level elapsed: 05:00:07- Lines: 400 DOF: 64 Frequency range [Hz]: Calculated by profile- Average: 64 Run Start Time: Mar-27-2018, 09:31:58</p> <p>Control Composite-</p>

This report shall not be reproduced except in full, without the written approval of KES Co., Ltd.
 The results shown in this test report refer only to the sample(s) tested unless otherwise stated.
 The authenticity of the test report, contact shchoi@kes.co.kr

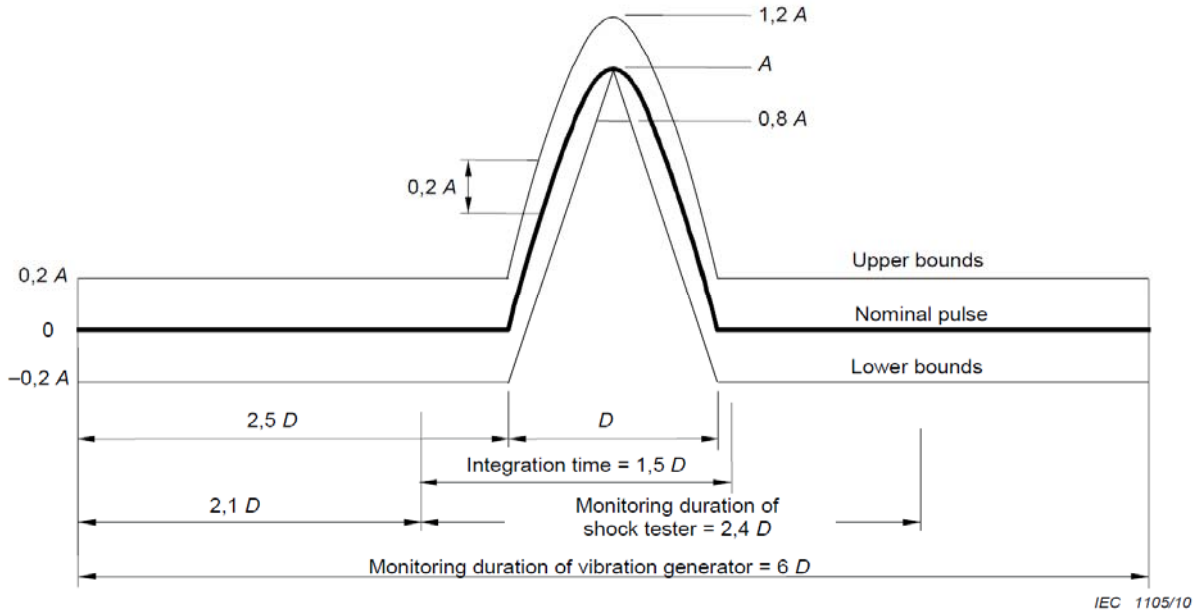


7) Shock testing conditions

Item	Detailed description			Remarks
Test date	March 27, 2018 – March 29, 2018			-
Environmental conditions	Temperature : (25.0 ± 10.0) °C, Humidity : (50 ± 25) % R.H.			-
Power conditions	<input checked="" type="checkbox"/> Store (Power OFF) <input type="checkbox"/> Action (Power ON)			-
Categories	<input checked="" type="checkbox"/> Category 1 (<input checked="" type="checkbox"/> Class A <input type="checkbox"/> Class B) <input type="checkbox"/> Category 2 <input type="checkbox"/> Category 3			-
Direction time and test level		Vertical	Transverse	Longitudinal
	Peak acceleration A (m/s²)	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 (<input checked="" type="checkbox"/> Class A <input type="checkbox"/> 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		-

This report shall not be reproduced except in full, without the written approval of KES Co., Ltd.
 The results shown in this test report refer only to the sample(s) tested unless otherwise stated.
 The authenticity of the test report, contact shchoi@kes.co.kr

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	-

<p>X axes</p>		<p>March 28, 2018 / 14:22:45</p> <p>Test Report</p> <p>Remaining: 0.0 Total elapsed: 15.0 Full level elapsed: 1.0 Sampling Rate [Hz]: 2560.00 Frequency range [Hz]: 1000.00 Block Size: 2048 Block Time: 0.8 s Run Start Time: Mar-28-2018, 14:22:45</p> <p>* Control Composite:</p>	<p>March 28, 2018 / 14:23:21</p> <p>Test Report</p> <p>Remaining: 0.0 Total elapsed: 15.0 Full level elapsed: 1.0 Sampling Rate [Hz]: 2560.00 Frequency range [Hz]: 1000.00 Block Size: 2048 Block Time: 0.8 s Run Start Time: Mar-28-2018, 14:23:21</p> <p>* Control Composite:</p>
<p>Y axes</p>		<p>March 29, 2018 / 14:10:48</p> <p>Test Report</p> <p>Remaining: 0.0 Total elapsed: 15.0 Full level elapsed: 1.0 Sampling Rate [Hz]: 2560.00 Frequency range [Hz]: 1000.00 Block Size: 2048 Block Time: 0.8 s Run Start Time: Mar-29-2018, 14:10:48</p> <p>Control Composite:</p>	<p>March 29, 2018 / 14:11:32</p> <p>Test Report</p> <p>Remaining: 0.0 Total elapsed: 15.0 Full level elapsed: 1.0 Sampling Rate [Hz]: 2560.00 Frequency range [Hz]: 1000.00 Block Size: 2048 Block Time: 0.8 s Run Start Time: Mar-29-2018, 14:11:32</p> <p>Control Composite:</p>
<p>Z axes</p>		<p>March 27, 2018 / 15:06:23</p> <p>Test Report</p> <p>Remaining: 0.0 Total elapsed: 15.0 Full level elapsed: 1.0 Sampling Rate [Hz]: 2560.00 Frequency range [Hz]: 1000.00 Block Size: 2048 Block Time: 0.8 s Run Start Time: Mar-27-2018, 15:06:23</p> <p>* Control Composite:</p>	<p>March 27, 2018 / 15:07:17</p> <p>Test Report</p> <p>Remaining: 0.0 Total elapsed: 15.0 Full level elapsed: 1.0 Sampling Rate [Hz]: 2560.00 Frequency range [Hz]: 1000.00 Block Size: 2048 Block Time: 0.8 s Run Start Time: Mar-27-2018, 15:07:17</p> <p>* Control Composite:</p>

This report shall not be reproduced except in full, without the written approval of KES Co., Ltd.

The results shown in this test report refer only to the sample(s) tested unless otherwise stated.

The authenticity of the test report, contact shchoi@kes.co.kr



KES Co., Ltd.

3701, 40, Simin-daero 365beon-gil,
Dongan-gu, Anyang-si, Gyeonggi-do, 14057, Korea
Tel: +82-31-425-6200 / Fax: +82-31-424-0450
www.kes.co.kr

Report No.:
KES-RE-18T0047-R1
Page (12) of (27)

10) Functional random test conditions

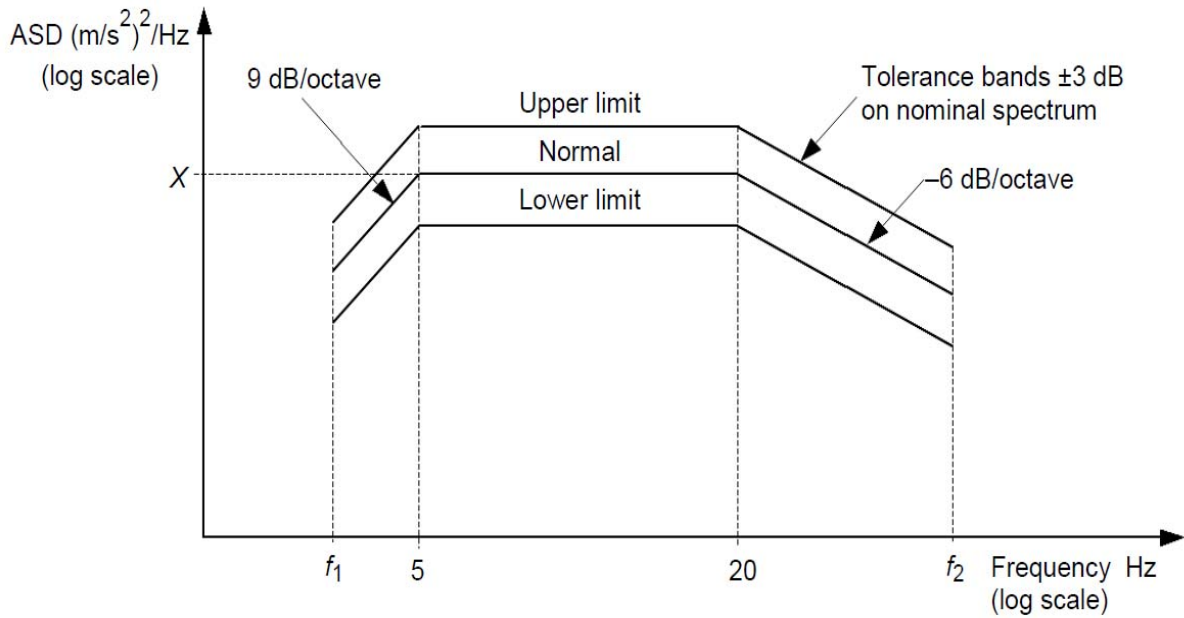
Item		Detailed description				Remarks
Test date		March 27, 2018 – March 29, 2018				-
Environmental conditions		Temperature : (25.0 ± 10.0) °C, Humidity : (50 ± 25) % R.H.				-
Power conditions		<input type="checkbox"/> Store (Power OFF) <input checked="" type="checkbox"/> Action (Power ON)				-
Categories		<input checked="" type="checkbox"/> Category 1 (<input checked="" type="checkbox"/> Class A <input type="checkbox"/> Class B) <input type="checkbox"/> Category 2 <input type="checkbox"/> Category 3				-
Direction time and test level	Vertical (15 min)		Transverse (15 min)		Longitudinal (15 min)	
	Frequency [Hz]	ASD Levels [m/s ² /Hz]	Frequency [Hz]	ASD Levels [m/s ² /Hz]	Frequency [Hz]	ASD Levels [m/s 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 (<input checked="" type="checkbox"/> Class A <input type="checkbox"/> 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				-

This report shall not be reproduced except in full, without the written approval of KES Co., Ltd.

The results shown in this test report refer only to the sample(s) tested unless otherwise stated.

The authenticity of the test report, contact shchoi@kes.co.kr

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	-

<p>X axes</p>		<p>March 28, 2018 / 15:34:38</p> <p>Test Report-</p> <p>Remaining: 00:00:00 Total elapsed: 00:11:12 Full level elapsed: 00:10:07- Lines: 400 DOF: 64 Frequency range (f_{aj}): Calculated by profile- Average: 64 Run Start Time: Mar-28-2018, 15:34:38</p> <p>Control Composite-</p>
<p>Y axes</p>		<p>March 29, 2018 / 14:15:12</p> <p>Test Report-</p> <p>Remaining: 00:00:00 Total elapsed: 00:11:07 Full level elapsed: 00:10:07- Lines: 400 DOF: 64 Frequency range (f_{aj}): Calculated by profile- Average: 64 Run Start Time: Mar-29-2018, 14:15:12</p> <p>Control Composite-</p>
<p>Z axes</p>		<p>March 27, 2018 / 16:23:30</p> <p>Test Report-</p> <p>Remaining: 00:00:00 Total elapsed: 00:10:56 Full level elapsed: 00:10:07- Lines: 400 DOF: 64 Frequency range (f_{aj}): Calculated by profile- Average: 64 Run Start Time: Mar-27-2018, 16:23:30</p> <p>Control Composite-</p>

This report shall not be reproduced except in full, without the written approval of KES Co., Ltd.
 The results shown in this test report refer only to the sample(s) tested unless otherwise stated.
 The authenticity of the test report, contact shchoi@kes.co.kr

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 °C ~ 40 °C	-25 °C ~ 55 °C	15 °C	-25 °C ~ 70 °C
T2	-40 °C ~ 35 °C	-40 °C ~ 55 °C	15 °C	-40 °C ~ 70 °C
T3	-25 °C ~ 45 °C	-25 °C ~ 70 °C	15 °C	-25 °C ~ 85 °C
TX	-40 °C ~ 50 °C	-40 °C ~ 70 °C	15 °C	-40 °C ~ 85 °C

3) Test instrument performance

Set point temperature control method	Temperature sensor detection and control
Air flow	High wind speed circulation
Air velocity and direction	7.29 m/s, north wind
Applied temperature change rate (slope)	Max. 1 K/min

This report shall not be reproduced except in full, without the written approval of KES Co., Ltd.

The results shown in this test report refer only to the sample(s) tested unless otherwise stated.

The authenticity of the test report, contact shchoi@kes.co.kr



KES Co., Ltd.

3701, 40, Simin-daero 365beon-gil,
Dongan-gu, Anyang-si, Gyeonggi-do, 14057, Korea
Tel: +82-31-425-6200 / Fax: +82-31-424-0450
www.kes.co.kr

Report No.:
KES-RE-18T0047-R1
Page (16) of (27)

4) Test conditions

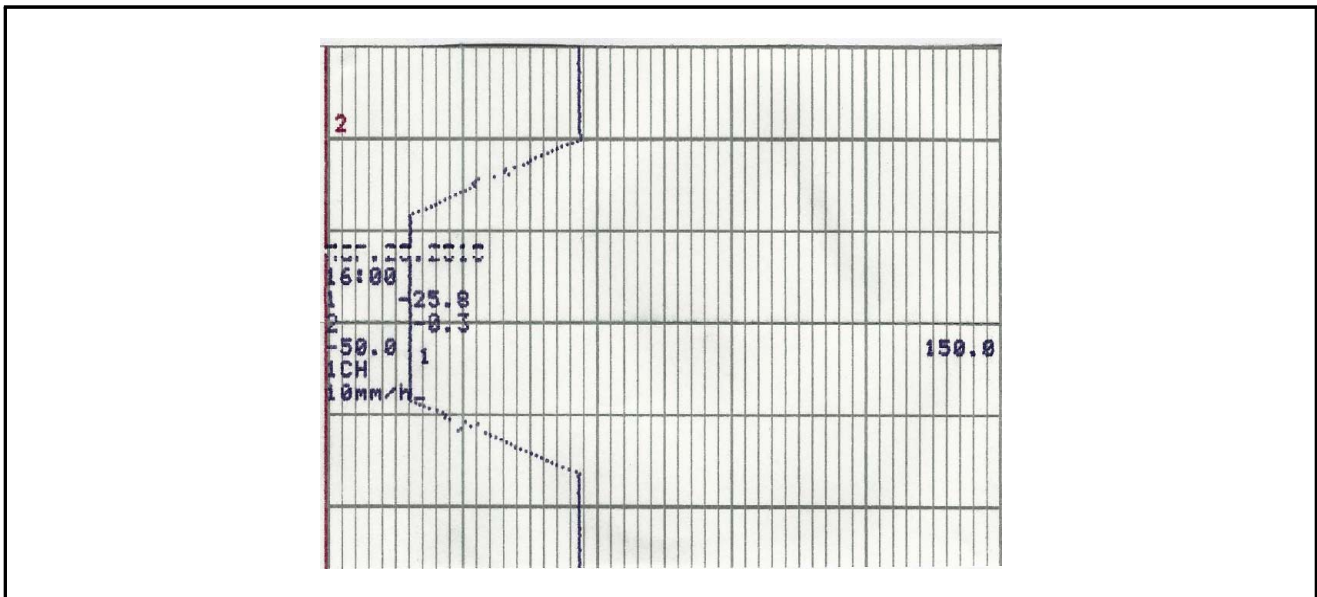
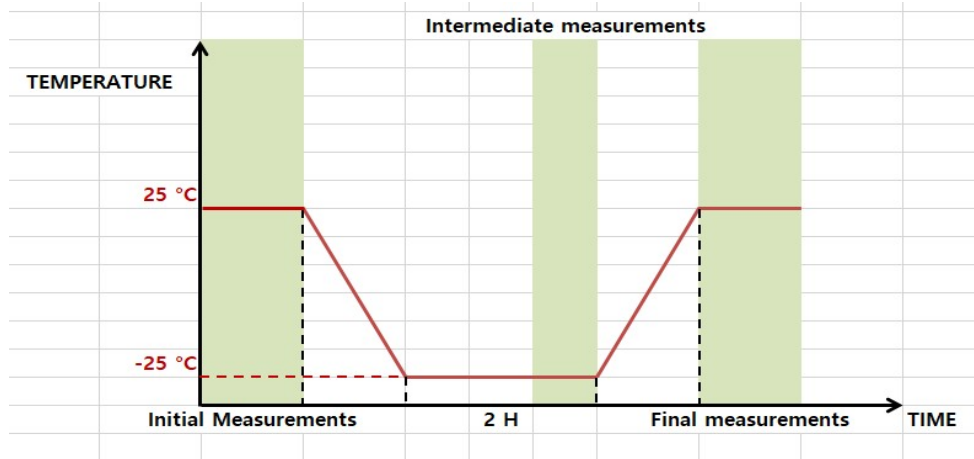
Item		Detailed description	Remarks
Test date		March 20, 2018	-
Environmental conditions		Temperature : (25.0 ± 10.0) °C, Humidity : (50 ± 25) % R.H.	-
Power conditions		<input type="checkbox"/> Store (Power OFF) <input checked="" type="checkbox"/> Action (Power ON)	During measurements
Categories		Class T3, Column 1	Refer to 4. 2)
Specimen classification		<input type="checkbox"/> Non heat-dissipating specimens <input checked="" type="checkbox"/> heat-dissipating specimens	-
Application testing		<input type="checkbox"/> Test Ab <input checked="" type="checkbox"/> Test Ad <input type="checkbox"/> Test Ae	-
Severity	Temperature	<input type="checkbox"/> -65 °C <input type="checkbox"/> -55 °C <input type="checkbox"/> -50 °C <input type="checkbox"/> -40 °C <input type="checkbox"/> -33 °C <input checked="" type="checkbox"/> -25 °C <input type="checkbox"/> -20 °C <input type="checkbox"/> -10 °C <input type="checkbox"/> -5 °C <input type="checkbox"/> +5 °C	Tolerance ± 2 K
	Duration	<input checked="" type="checkbox"/> 2 h <input type="checkbox"/> 16 h <input type="checkbox"/> 72 h <input type="checkbox"/> 96 h <input type="checkbox"/> Etc	EN 50155
Pre conditioning	Applicability	<input checked="" type="checkbox"/> No Regulations <input type="checkbox"/> 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	<input type="checkbox"/> No Regulations <input checked="" type="checkbox"/> Regulations	-
	Condition	<input checked="" type="checkbox"/> Recovery from standard atmospheric conditions <input type="checkbox"/> Etc :	Minimum 1 hour
Final measurements	Visual inspection	Mechanical damage, loosening of screw, etc.	-
	Functional test	Normal operation check	-

This report shall not be reproduced except in full, without the written approval of KES Co., Ltd.

The results shown in this test report refer only to the sample(s) tested unless otherwise stated.

The authenticity of the test report, contact shchoi@kes.co.kr

5) Cooling test graph





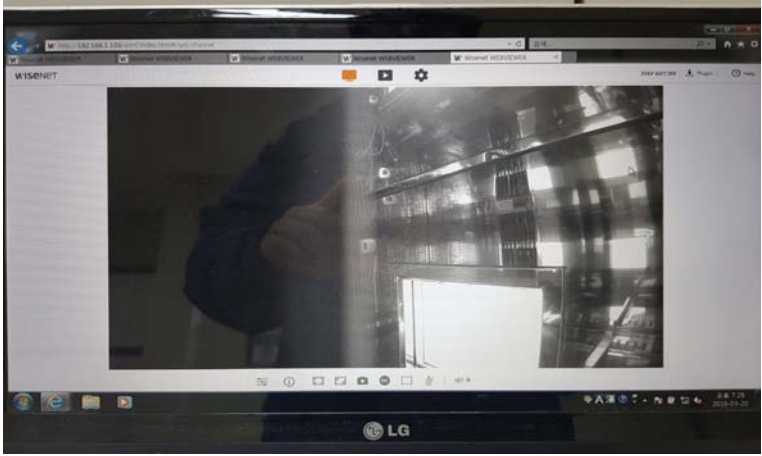
6) Test result

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 -25 °C, 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	-

This report shall not be reproduced except in full, without the written approval of KES Co., Ltd.

The results shown in this test report refer only to the sample(s) tested unless otherwise stated.

The authenticity of the test report, contact shchoi@kes.co.kr

	<p>Internal chamber</p>	
<p>Cooling test</p>	<p>During the test</p>	
	<p>Normal operation check</p>	

This report shall not be reproduced except in full, without the written approval of KES Co., Ltd.

The results shown in this test report refer only to the sample(s) tested unless otherwise stated.

The authenticity of the test report, contact shchoi@kes.co.kr

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 °C ~ 40 °C	-25 °C ~ 55 °C	15 °C	-25 °C ~ 70 °C
T2	-40 °C ~ 35 °C	-40 °C ~ 55 °C	15 °C	-40 °C ~ 70 °C
T3	-25 °C ~ 45 °C	-25 °C ~ 70 °C	15 °C	-25 °C ~ 85 °C
TX	-40 °C ~ 50 °C	-40 °C ~ 70 °C	15 °C	-40 °C ~ 85 °C

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

This report shall not be reproduced except in full, without the written approval of KES Co., Ltd.

The results shown in this test report refer only to the sample(s) tested unless otherwise stated.

The authenticity of the test report, contact shchoi@kes.co.kr



KES Co., Ltd.

3701, 40, Simin-daero 365beon-gil,
Dongan-gu, Anyang-si, Gyeonggi-do, 14057, Korea
Tel: +82-31-425-6200 / Fax: +82-31-424-0450
www.kes.co.kr

Report No.:
KES-RE-18T0047-R1
Page (20) of (27)

4) Test conditions

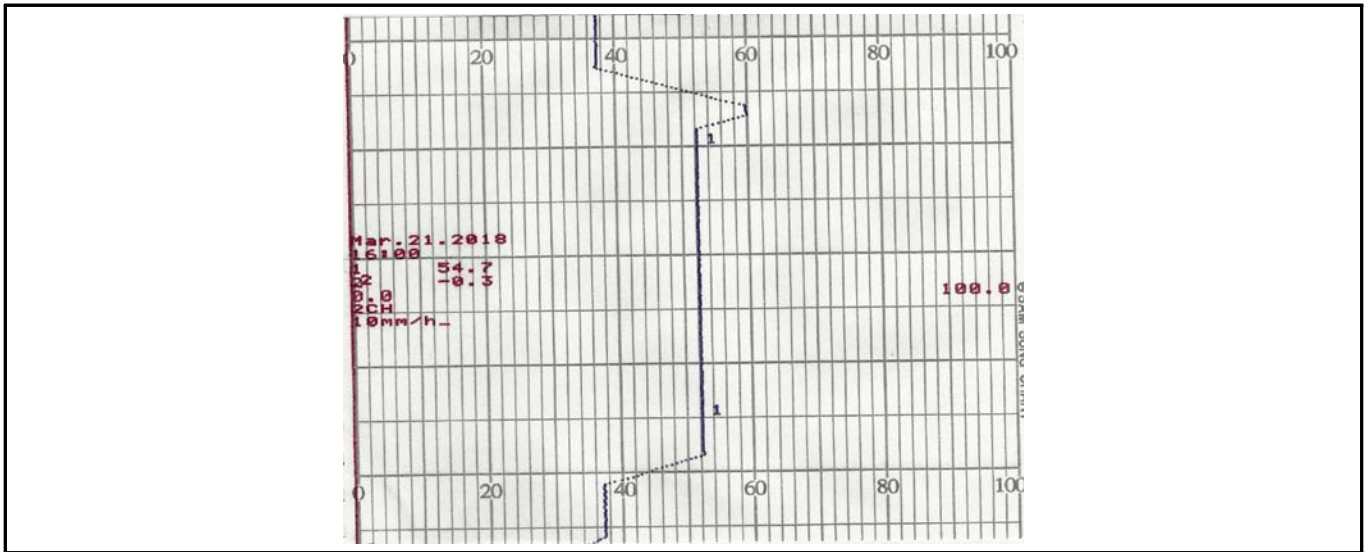
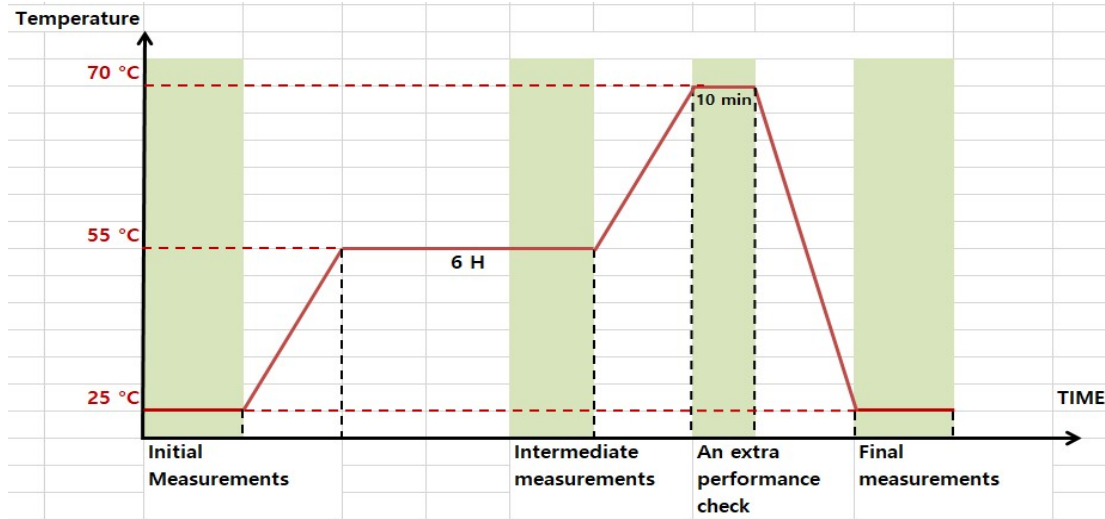
Item		Detailed description	Remarks
Test date		March 21, 2018	-
Environmental conditions		Temperature : (25.0 ± 10.0) °C, Humidity : (50 ± 25) % R.H.	-
Power conditions		<input type="checkbox"/> Store (Power OFF) <input checked="" type="checkbox"/> Action (Power ON)	During measurements
Categories		Class T2, Column 2	Refer to 5. 2)
Specimen classification		<input type="checkbox"/> Non heat-dissipating specimens <input checked="" type="checkbox"/> heat-dissipating specimens	-
Application testing		<input type="checkbox"/> Test Bb <input checked="" type="checkbox"/> Test Bd <input type="checkbox"/> Test Be	-
Severity	Temperature	<input type="checkbox"/> 1000 °C <input type="checkbox"/> 800 °C <input type="checkbox"/> 630 °C <input type="checkbox"/> 500 °C <input type="checkbox"/> 400 °C <input type="checkbox"/> 315 °C <input type="checkbox"/> 250 °C <input type="checkbox"/> 175 °C <input type="checkbox"/> 155 °C <input type="checkbox"/> 125 °C <input type="checkbox"/> 100 °C <input type="checkbox"/> 85 °C <input checked="" type="checkbox"/> 70 °C <input type="checkbox"/> 65 °C <input type="checkbox"/> 60 °C <input checked="" type="checkbox"/> 55 °C <input type="checkbox"/> 50 °C <input type="checkbox"/> 45 °C <input type="checkbox"/> 40 °C <input type="checkbox"/> 35 °C <input type="checkbox"/> 30 °C	Tolerance ± 2 K
	Duration	<input type="checkbox"/> 2 h <input type="checkbox"/> 16 h <input type="checkbox"/> 72 h <input type="checkbox"/> 96 h <input type="checkbox"/> 168 h <input type="checkbox"/> 240 h <input type="checkbox"/> 336 h <input type="checkbox"/> 1 000 h <input checked="" type="checkbox"/> 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 °C, 10 min, Normal operation check	-
Recovery	Applicability	<input type="checkbox"/> No Regulations <input checked="" type="checkbox"/> Regulations	-
	Condition	<input checked="" type="checkbox"/> Recovery from standard atmospheric conditions <input type="checkbox"/> Etc :	Minimum 1 hour
Final measurements	Visual inspection	Mechanical damage, loosening of screw, etc.	-
	Functional test	Normal operation check	-

This report shall not be reproduced except in full, without the written approval of KES Co., Ltd.

The results shown in this test report refer only to the sample(s) tested unless otherwise stated.

The authenticity of the test report, contact shchoi@kes.co.kr

5) Dry heat test graph





6) Test result

Test Items	Test standard	Test result	Remarks
Dry heat test (T2)	According to EN 60068-2-2 Dry heat test method, it is allowed to stand at 55 °C, 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	-

This report shall not be reproduced except in full, without the written approval of KES Co., Ltd.

The results shown in this test report refer only to the sample(s) tested unless otherwise stated.

The authenticity of the test report, contact shchoi@kes.co.kr

	<p>Internal chamber</p>	
<p>Dry heat test (T2)</p>	<p>During the test</p>	
	<p>Normal operation check</p>	

This report shall not be reproduced except in full, without the written approval of KES Co., Ltd.

The results shown in this test report refer only to the sample(s) tested unless otherwise stated.

The authenticity of the test report, contact shchoi@kes.co.kr



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 °C ~ 40 °C	-25 °C ~ 55 °C	15 °C	-25 °C ~ 70 °C
T2	-40 °C ~ 35 °C	-40 °C ~ 55 °C	15 °C	-40 °C ~ 70 °C
T3	-25 °C ~ 45 °C	-25 °C ~ 70 °C	15 °C	-25 °C ~ 85 °C
TX	-40 °C ~ 50 °C	-40 °C ~ 70 °C	15 °C	-40 °C ~ 85 °C

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

This report shall not be reproduced except in full, without the written approval of KES Co., Ltd.

The results shown in this test report refer only to the sample(s) tested unless otherwise stated.

The authenticity of the test report, contact shchoi@kes.co.kr



KES Co., Ltd.

3701, 40, Simin-daero 365beon-gil,
Dongan-gu, Anyang-si, Gyeonggi-do, 14057, Korea
Tel: +82-31-425-6200 / Fax: +82-31-424-0450
www.kes.co.kr

Report No.:
KES-RE-18T0047-R1
Page (24) of (27)

4) Test conditions

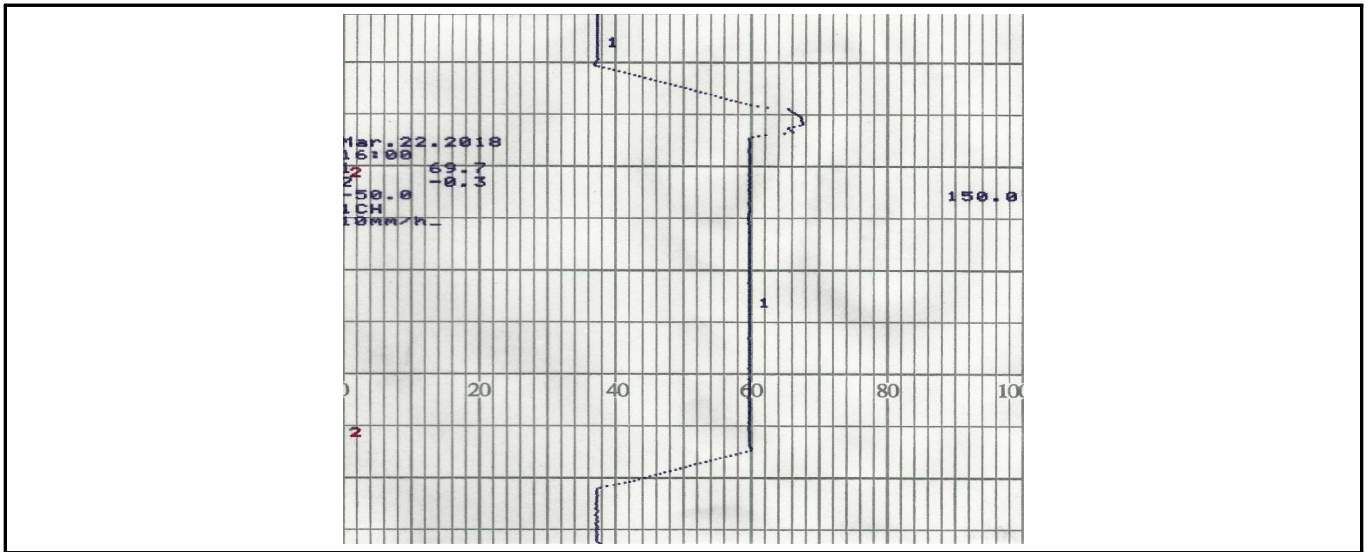
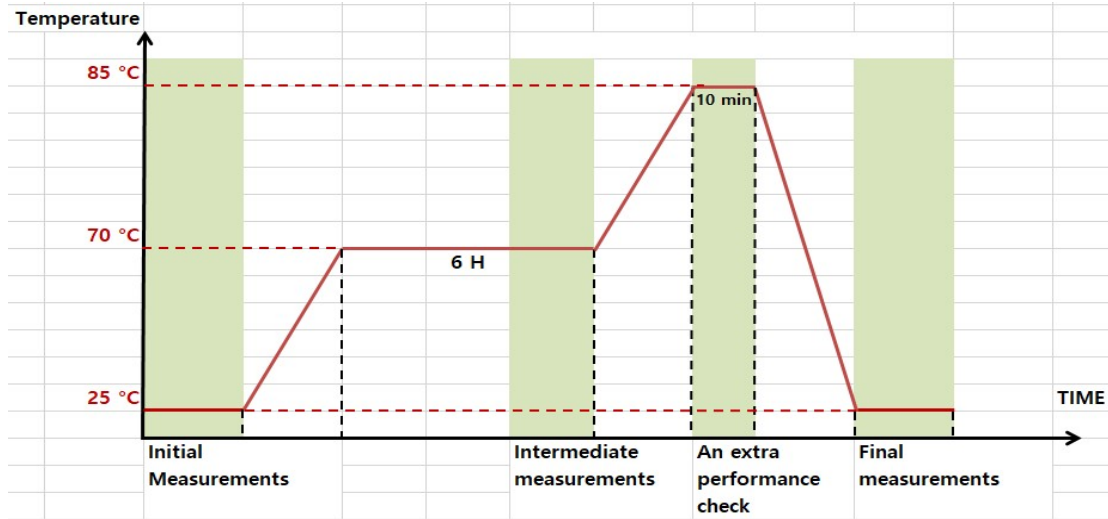
Item		Detailed description	Remarks
Test date		March 22, 2018	-
Environmental conditions		Temperature : (25.0 ± 10.0) °C, Humidity : (50 ± 25) % R.H.	-
Power conditions		<input type="checkbox"/> Store (Power OFF) <input checked="" type="checkbox"/> Action (Power ON)	During measurements
Categories		Class TX, Column 2	Refer to 6. 2)
Specimen classification		<input type="checkbox"/> Non heat-dissipating specimens <input checked="" type="checkbox"/> heat-dissipating specimens	-
Application testing		<input type="checkbox"/> Test Bb <input checked="" type="checkbox"/> Test Bd <input type="checkbox"/> Test Be	-
Severity	Temperature	<input type="checkbox"/> 1000 °C <input type="checkbox"/> 800 °C <input type="checkbox"/> 630 °C <input type="checkbox"/> 500 °C <input type="checkbox"/> 400 °C <input type="checkbox"/> 315 °C <input type="checkbox"/> 250 °C <input type="checkbox"/> 175 °C <input type="checkbox"/> 155 °C <input type="checkbox"/> 125 °C <input type="checkbox"/> 100 °C <input checked="" type="checkbox"/> 85 °C <input checked="" type="checkbox"/> 70 °C <input type="checkbox"/> 65 °C <input type="checkbox"/> 60 °C <input type="checkbox"/> 55 °C <input type="checkbox"/> 50 °C <input type="checkbox"/> 45 °C <input type="checkbox"/> 40 °C <input type="checkbox"/> 35 °C <input type="checkbox"/> 30 °C	Tolerance ± 2 K
	Duration	<input type="checkbox"/> 2 h <input type="checkbox"/> 16 h <input type="checkbox"/> 72 h <input type="checkbox"/> 96 h <input type="checkbox"/> 168 h <input type="checkbox"/> 240 h <input type="checkbox"/> 336 h <input type="checkbox"/> 1 000 h <input checked="" type="checkbox"/> 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 °C, 10 min, Normal operation check	-
Recovery	Applicability	<input type="checkbox"/> No Regulations <input checked="" type="checkbox"/> Regulations	-
	Condition	<input checked="" type="checkbox"/> Recovery from standard atmospheric conditions <input type="checkbox"/> Etc :	-
Final measurements	Visual inspection	Mechanical damage, loosening of screw, etc.	Minimum 1 hour
	Functional test	Normal operation check	-

This report shall not be reproduced except in full, without the written approval of KES Co., Ltd.

The results shown in this test report refer only to the sample(s) tested unless otherwise stated.

The authenticity of the test report, contact shchoi@kes.co.kr


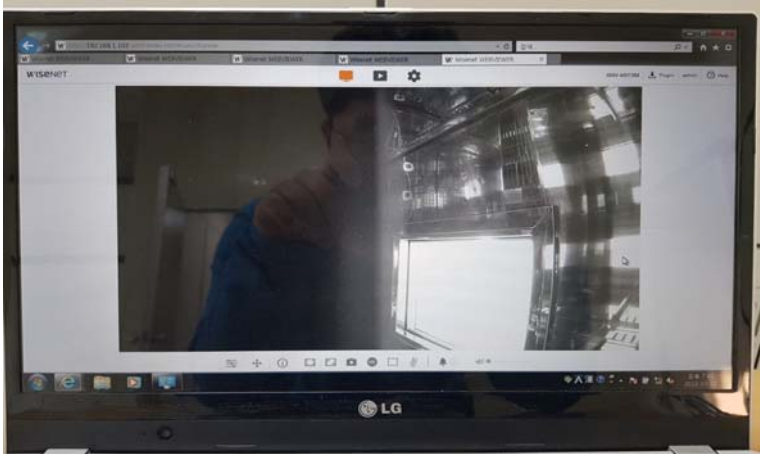
5) Dry heat test graph



6) Test result

Test Items	Test standard	Test result	Remarks
Dry heat test (TX)	According to EN 60068-2-2 Dry heat test method, it is allowed to stand at 70 °C, 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	-

This report shall not be reproduced except in full, without the written approval of KES Co., Ltd.
 The results shown in this test report refer only to the sample(s) tested unless otherwise stated.
 The authenticity of the test report, contact shchoi@kes.co.kr

	<p>Internal chamber</p>	
<p>Dry heat test (TX)</p>	<p>During the test</p>	
	<p>Normal operation check</p>	

This report shall not be reproduced except in full, without the written approval of KES Co., Ltd.

The results shown in this test report refer only to the sample(s) tested unless otherwise stated.

The authenticity of the test report, contact shchoi@kes.co.kr



KES Co., Ltd.

3701, 40, Simin-daero 365beon-gil,
Dongan-gu, Anyang-si, Gyeonggi-do, 14057, Korea
Tel: +82-31-425-6200 / Fax: +82-31-424-0450
www.kes.co.kr

Report No.:
KES-RE-18T0047-R1
Page (27) of (27)

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-069	Extended Range DC Power Supply	TAKASAGO	EX-750L2	4053700 30236	2017.05.22	2018.05.22	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 -

This report shall not be reproduced except in full, without the written approval of KES Co., Ltd.

The results shown in this test report refer only to the sample(s) tested unless otherwise stated.

The authenticity of the test report, contact shchoi@kes.co.kr