Test Report

Test Report No.	: KES-RE-19T0342
Date of Issue	: September 27, 2019
Description of Product	: NETWORK CAMERA
Model No.	: QNV-6024RM
Variant Model	: -
Applicant	: Hanwha Techwin Co., Ltd.
Address	: 13488 6, Pangyo-ro, 319 Beon-gil, Bundang-gu, Seongnam-si, Gyeonggi-do, KOREA
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 50155:2017 Railway applications - Electronic equipment used on rolling stock

Test Date : September 16, 2019 – September 25, 2019

Tested by: Hyunseuk, 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, Yeoju-si, Gyeonggi-do, 12658, Korea
Tel : +82-31-883-5092 / Fax: +82-31-883-5169

This test report is not related to KS Q ISO/IEC 17025 and KOLAS.

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

TABLE OF CONTENTS

1. General information ····· 3

2. Information of E.U.T. ····· 3

3. Visual inspection ····· 4

4. Performance test ····· 4

5. Insulation test ····· 5

6. Low temperature start-up test ····· 7

7. Dry heat test ····· 11

8. Vibration and shock test ····· 15

9. Used instrument list ····· 28

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, Yeoju-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 : QNV-6024RM
3) Ratings : DC 48 V, 0.14 A
4) Serial No. : ZNTC70GM80001NR
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

3. Visual inspection : EN 50155:2017 (clause 13.4.1)

3.1 General

The Visual inspection test verifies the mechanical and appearance conformance of the Electronic Equipment. The Visual inspection shall be carried out before and after tests to check whether any damage or deterioration has occurred resulting from the tests.

3.2 Mechanical and appearance

Test Items	Test standard	Test result	Remarks
Mechanical and appearance	No mechanical damage or deterioration has occurred resulting from the tests, loosening of screw, etc.	Positive results (refer to the results and/or remarks of each tests)	-

4. Performance test : EN 50155:2017 (clause 13.4.2)

4.1 General

The performance test is carried out according to the Performance test specification and Performance test procedure written by the supplier. (E.U.T. shall continue to operate as intended during and after the test.)

4.2 Test result

Test Items	Test standard	Test result	Remarks
Performance test	Boot and video output shall operating normally	Positive results (refer to the results and/or remarks of each tests)	-

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. Insulation test : EN 50155:2017 (clause 13.4.9)

5.1 General

The aim of this test is to ensure that the mounting of components, their metal connections and casings, and the routing of wiring and printed board tracks, are not located too close to surrounding metal parts or fixings.
In addition the test will verify the design clearances of circuits with requirements for galvanic isolation.
The test shall be carried out on fully assembled parts of equipment, and/or complete equipments dependent upon the scope of supply.
Insulation test against mechanical earth is not required for equipotential area formed by ELV circuits that have internal electronic 0V potential electrically connected to the mechanical earth.
For subracks and printed board assemblies with exposed metal parts, frames or front panels, or metal fixings, which can either be touched or require galvanic isolation; then, the test shall be carried out between all the connections shorted together and these metal parts.

5.2 Insulation measurement test

The insulation resistance measurement test shall be carried out at 500 V DC and the values shall be recorded for all the equipotential areas defined for the insulation test. During the test, the equipment shall not be powered on.
The test shall then be repeated after the voltage withstand test.
The insulation of each equipotential area shall be tested and measured against mechanical earth and against all surrounding equipotential areas.
The insulation measurement shall be carried out after the voltage withstand test.
Significant difference shall be analysed and justified in the test report.
Test acceptance requirements:
The minimum value of the insulation resistance after the withstand test shall be higher than 20 MΩ.
The equipment shall work as intended and within its specified limits after the insulation test.

5.3 Voltage withstand test

The test shall be performed with AC (50 Hz or 60 Hz) or DC test voltage according to Table 1.
The test voltage shall be applied by gradually increasing the voltage amplitude to the test voltage, and maintained at the specified level for:
a) Type test: 1 min;
b) Routine test: 10 s.
Each equipotential area shall be defined and tested against mechanical earth and against all surrounding equipotential areas.
An insulation test is not required for internal electronic 0 V potential electrically connected to the mechanical earth.
Test acceptance requirements:
Neither disruptive discharge nor flashover shall occur.
After the withstand test, the equipment shall work as intended and within its specified limits.

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

Nominal battery voltage and/or I/O voltage	Test voltage
< 72 V DC or 50 V AC rms	500 V AC or 750 V DC
72 V DC ≤ V DC < 125 V DC or from 50 to 90 V AC rms	1 000 V AC or 1 500 V DC
125 V DC ≤ V DC < 315 V DC or from 90 to 225 V AC rms	1 500 V AC or 2 200 V DC

Table 1 — Test voltages of voltage withstand test

5.4 Insulation measurement test results

Test Items	Test standard	Test result	Remarks
Insulation measurement test	Carried out at 500 V d.c., There shall be no fundamental deterioration from the initial measurement.	Not applicable	ELV part (Input : DC 48 V)

5.5 Voltage withstand test results

Test Items	Test standard	Test result	Remarks
Voltage withstand test	AC 500 V, 60 Hz, 1 min, Neither disruptive discharge nor flashover shall occur.	Not applicable	ELV part (Input : DC 48 V)

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. Low temperature start-up test : EN 50155:2017 (clause 13.4.4)

-. Carried out according to EN 60068-2-1:2007

6.1 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

6.2 Table 1 – Operating temperature classes

Class	Equipment operating temperature range	Class	Equipment operating temperature range
OT1	-25 ℃ ~ 55 ℃	OT4	-40 ℃ ~ 70 ℃
OT2	-40 ℃ ~ 55 ℃	OT5	-25 ℃ ~ 85 ℃
OT3	-25 ℃ ~ 70 ℃	OT6	-40 ℃ ~ 85 ℃

6.3 Test instrument performance

Set point temperature control method	Temperature sensor detection and control
Air flow	High wind speed circulation
Air velocity and direction	6.88 m/s, north wind
Applied temperature change rate (slope)	Max. 1 K/min

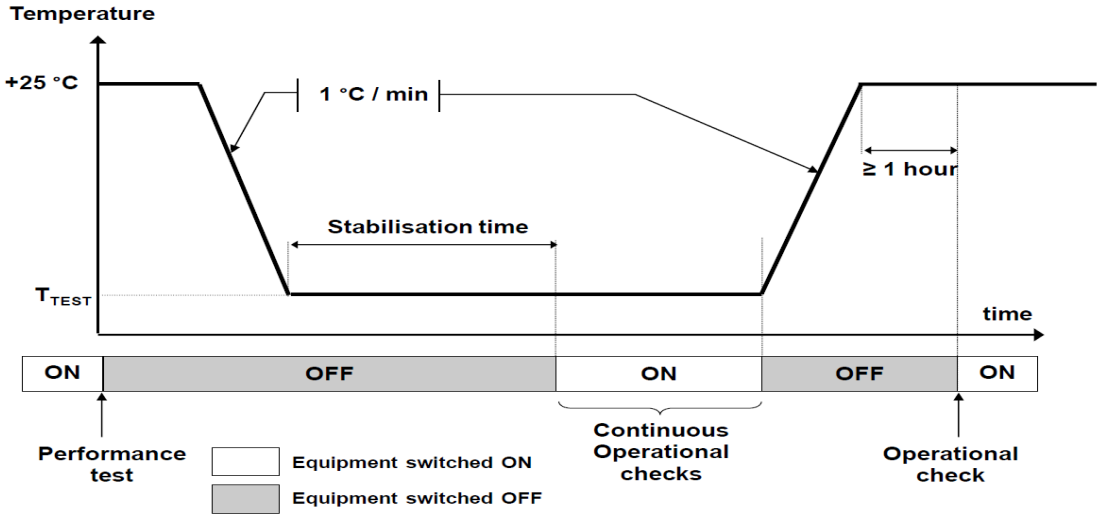
This report shall not be reproduced except in full, without the written approval of KES Co., Ltd.
The results shown in this test report refer only to the sample(s) tested unless otherwise stated.
The authenticity of the test report, contact shchoi@kes.co.kr

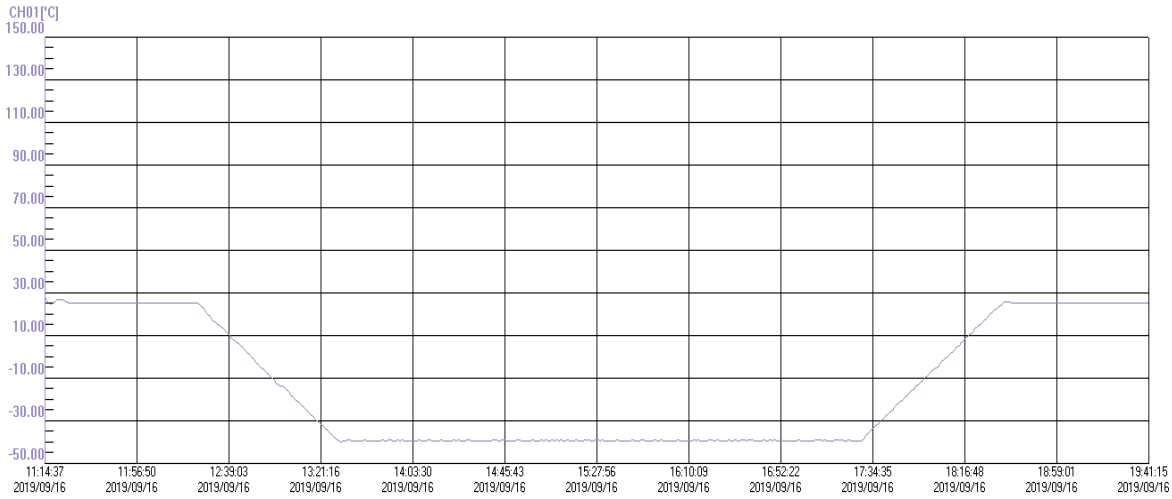
6.4 Test conditions

Item		Detailed description	Remarks
Test date		September 16, 2019	-
Environmental conditions		Temperature : (25.0 ± 10.0) ℃, Humidity : (50 ± 25) % R.H.	-
Power conditions		☐ Store (Power OFF) ☑ Action (Power ON)	During measurements
Operating temperature classes		☐ OT1 ☑ OT2 ☐ OT3 ☐ OT4 ☐ OT5 ☐ OT6	-40 ℃
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.	-
	Performance test	Normal operation check (Boot and video output shall operating normally)	-
Intermediate measurements	Visual inspection	Not applicable	-
	Performance test	Normal operation check (Boot and video output shall operating normally)	-
Recovery	Applicability	☐ No Regulations ☑ Regulations	-
	Condition	☑ Recovery from standard atmospheric conditions ☐ Etc :	Minimum 1 h
Final measurements	Visual inspection	Mechanical damage, loosening of screw, etc.	-
	Performance test	Normal operation check (Boot and video output shall operating normally)	-

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

6.5 Low temperature start-up test graph

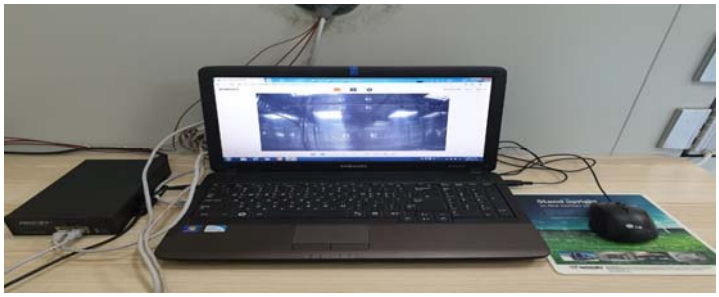
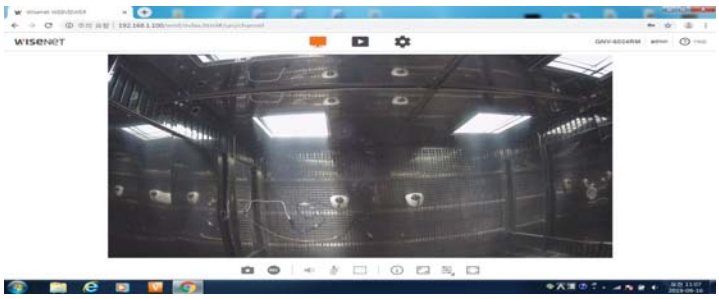
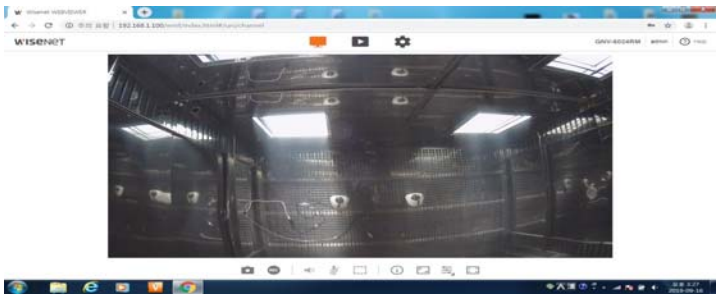
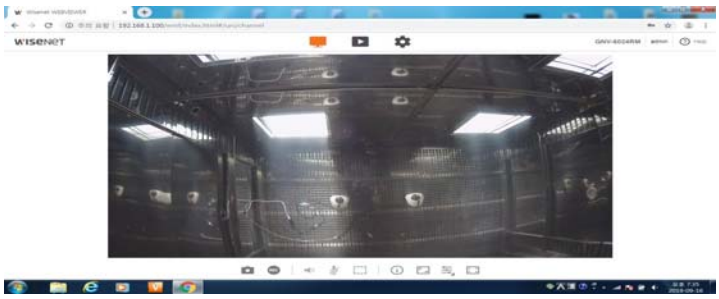




6.6 Test result

Test Items	Test standard	Test result	Remarks
Low temperature start-up test	According to EN 60068-2-1 (test Ad), it is allowed to stand at −40 ℃, 2 h, no abnormalities and no mechanical defects when the function test is confirmed at the initial, intermediate and final of the test	No abnormalities and no mechanical defects when the visual inspection and performance test was confirmed at the initial, intermediate and final of the test	–

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

Low temperature start-up test photos	Internal chamber		
	During the test		
	Normal operation check	Initial	
		Intermediate	
		Final	

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. Dry heat test : EN 50155:2017 (clause 13.4.5)

-. Carried out according to EN 60068-2-2:2007

7.1 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

7.2 Table 1 – Operating temperature classes

Class	Equipment operating temperature range	Class	Equipment operating temperature range
OT1	-25 ℃ ~ 55 ℃	OT4	-40 ℃ ~ 70 ℃
OT2	-40 ℃ ~ 55 ℃	OT5	-25 ℃ ~ 85 ℃
OT3	-25 ℃ ~ 70 ℃	OT6	-40 ℃ ~ 85 ℃

7.3 Table 2 – Switch-on extended Operating temperature classes

Class	Switch-on extended operating temperature	Thermal test cycle
ST0	No switch-on extended operating temperature	Test cycle A
ST1	OTx + 15 ℃	Test cycle B
ST2	OTx + 15 ℃	Test cycle C

7.4 Test instrument performance

Set point temperature control method	Temperature sensor detection and control
Air flow	High wind speed circulation
Air velocity and direction	6.99 m/s, north wind
Applied temperature change rate (slope)	Max. 1 K/min

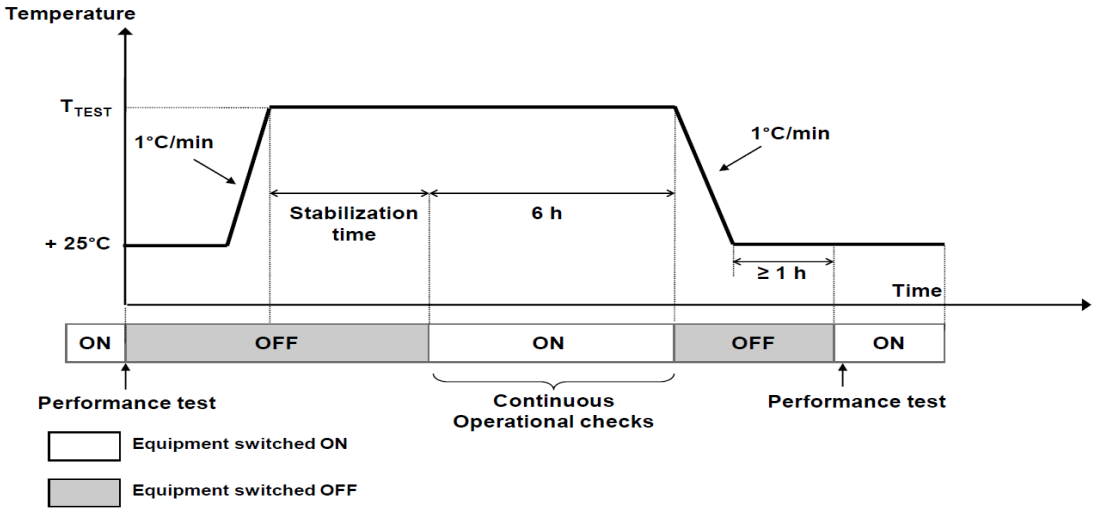
This report shall not be reproduced except in full, without the written approval of KES Co., Ltd.
The results shown in this test report refer only to the sample(s) tested unless otherwise stated.
The authenticity of the test report, contact shchoi@kes.co.kr

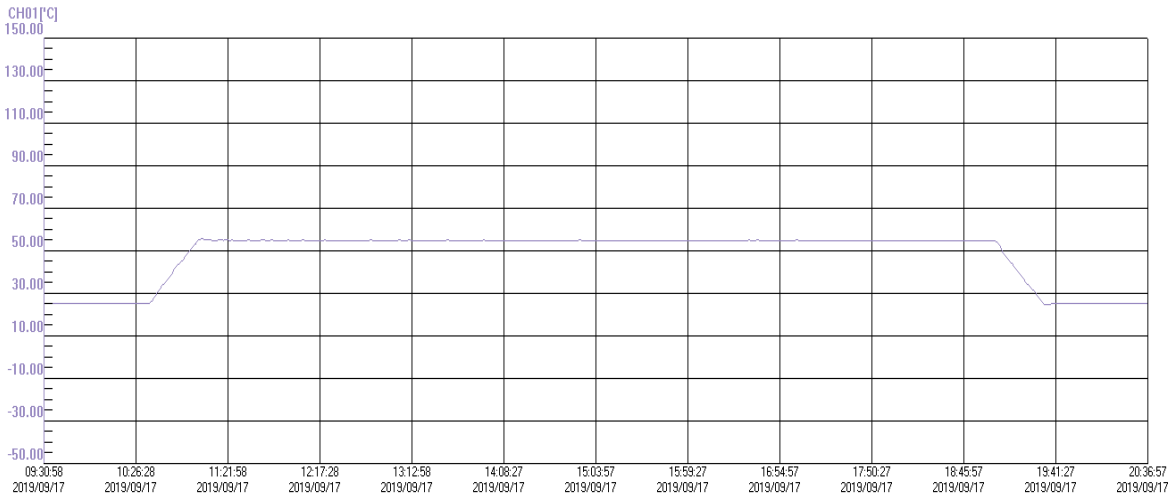
7.5 Test conditions

Item		Detailed description	Remarks
Test date		September 17, 2019	-
Environmental conditions		Temperature : (25.0 ± 10.0) ℃, Humidity : (50 ± 25) % R.H.	-
Power conditions		☐ Store (Power OFF) ☑ Action (Power ON)	During measurements
Operating temperature classes		☐ OT1 ☑ OT2 ☐ OT3 ☐ OT4 ☐ OT5 ☐ OT6	55 ℃
Switch-on extended Operating temperature classes		☑ ST0 ☐ ST1 ☐ ST2	Test cycle A
Specimen classification		☐ Non heat-dissipating specimens ☑ heat-dissipating specimens	-
Application testing		☐ Test Bb ☐ Test Bd ☑ Test Be	-
Severity	Temperature	☐ 1 000 ℃ ☐ 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	EN 50155
Initial measurements	Visual inspection	Mechanical damage, loosening of screw, etc.	-
	Performance test	Normal operation check (Boot and video output shall operating normally)	-
Intermediate measurements	Visual inspection	Not applicable	-
	Performance test	Normal operation check (Boot and video output shall operating normally)	-
Recovery	Applicability	☐ No Regulations ☑ Regulations	-
	Condition	☑ Recovery from standard atmospheric conditions ☐ Etc :	Minimum 1 h
Final measurements	Visual inspection	Mechanical damage, loosening of screw, etc.	-
	Performance test	Normal operation check (Boot and video output shall operating normally)	-

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

7.6 Dry heat test graph (Test cycle A)

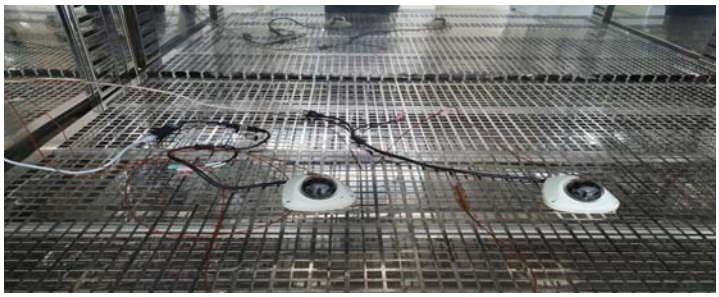
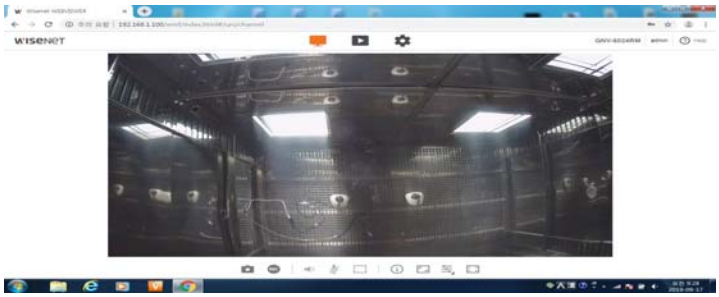
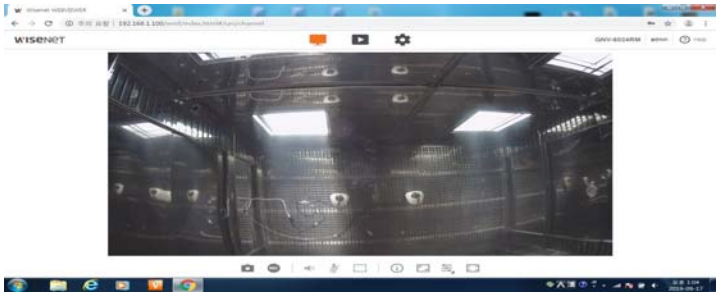
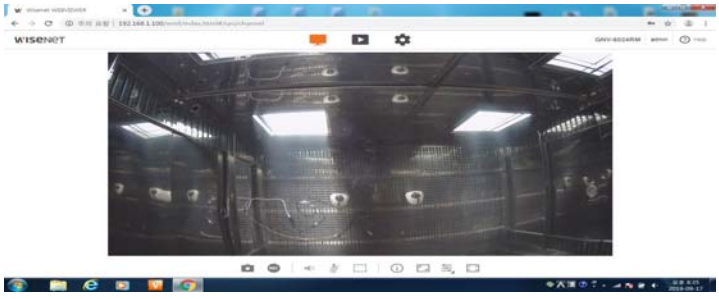




7.7 Test result

Test Items	Test standard	Test result	Remarks
Dry heat test	According to EN 60068-2-2 (test Be), it is allowed to stand at 55 ℃, 6 h, no abnormalities and no mechanical defects when the function test is confirmed at the initial, intermediate and final stages of the test	No abnormalities and no mechanical defects when the visual inspection and performance test was confirmed at the initial, intermediate and final of the test	–

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

Dry heat test photos	Internal chamber		
	During the test		
	Normal operation check	Initial	
		Intermediate	
		Final	

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. Vibration and shock tests : EN 50155:2017 (clause 13.4.11)

-. Carried out according to EN 61373:2010

8.1 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.

8.2 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.

8.3 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

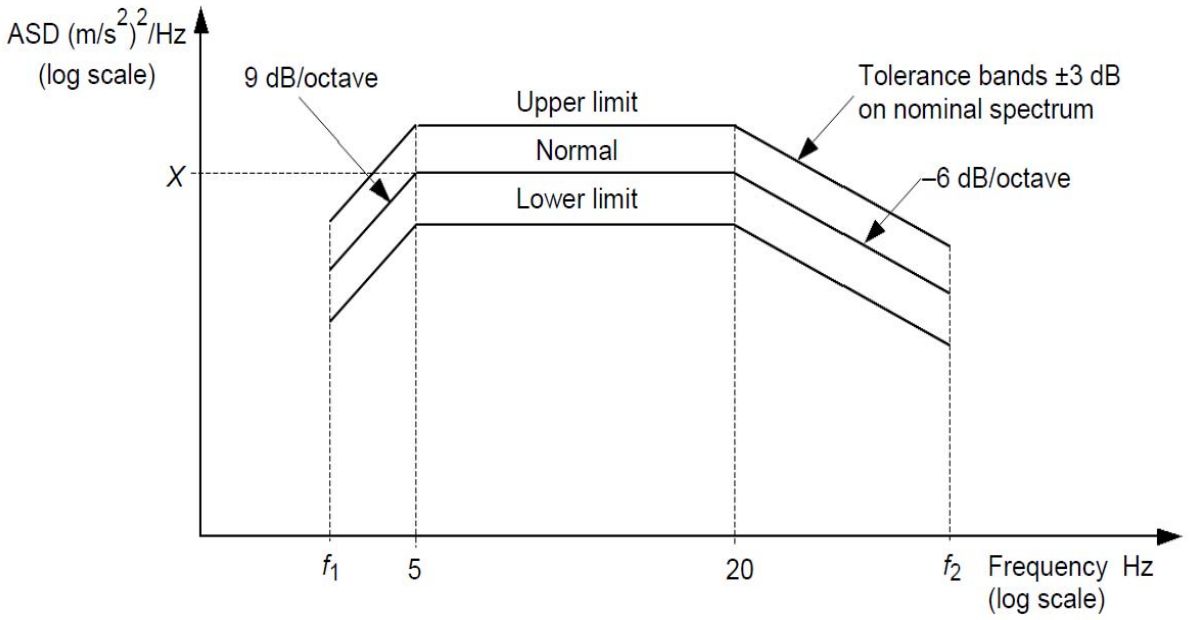
8.4 Simulated long-life testing

8.4.1 Test conditions

<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">September 23, 2019 - September 25, 2019</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 rowspan="6">Direction time and test level</td><td colspan="7"><table>
<tr><th colspan="2">Vertical (5 h)</th><th colspan="2">Transverse (5 h)</th><th colspan="2">Longitudinal (5 h)</th></tr>
<tr><th>Frequency [Hz]</th><th>ASD Levels [$m/s^2)^2/Hz$]</th><th>Frequency [Hz]</th><th>ASD Levels [$m/s^2)^2/Hz$]</th><th>Frequency [Hz]</th><th>ASD Levels [$m/s^2)^2/Hz$]</th></tr>
<tr><td>5</td><td>0.964</td><td>5</td><td>0.192</td><td>5</td><td>0.461</td></tr>
<tr><td>20</td><td>0.964</td><td>20</td><td>0.192</td><td>20</td><td>0.461</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">5.72 m/s^2 r.m.s</td><td colspan="2">2.55 m/s^2 r.m.s</td><td colspan="2">3.96 m/s^2 r.m.s</td></tr>
</table></td></tr>
<tr><td colspan="2">ASD spectrum</td><td colspan="4">Category 1 (☐ Class A ☑ Class B)</td><td>Refer to 8.4.2</td></tr>
<tr><td rowspan="2">Initial measurements</td><td>Visual inspection</td><td colspan="4">Mechanical damage, loosening of screw, etc.</td><td>-</td></tr>
<tr><td>Performance test</td><td colspan="4">Normal operation check
(Boot and video output shall operating normally)</td><td>-</td></tr>
<tr><td rowspan="2">Intermediate measurements</td><td>Visual inspection</td><td colspan="4">Not applicable</td><td>-</td></tr>
<tr><td>Performance test</td><td colspan="4">Not applicable</td><td>-</td></tr>
<tr><td rowspan="2">Final measurements</td><td>Visual inspection</td><td colspan="4">Mechanical damage, loosening of screw, etc.</td><td>-</td></tr>
<tr><td>Performance test</td><td colspan="4">Normal operation check
(Boot and video output shall operating normally)</td><td>-</td></tr>
</table>

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

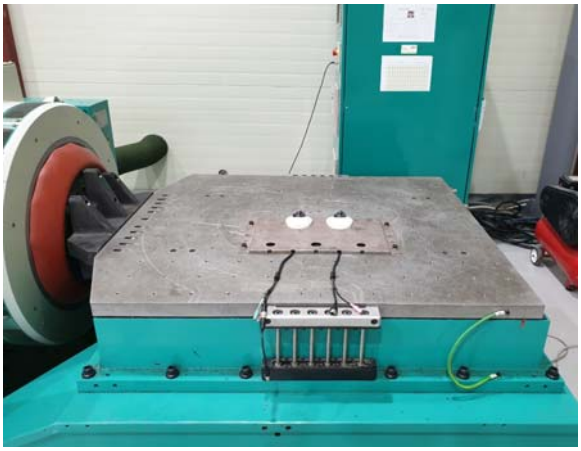
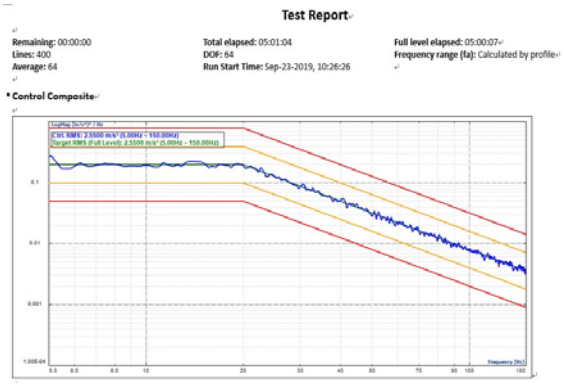
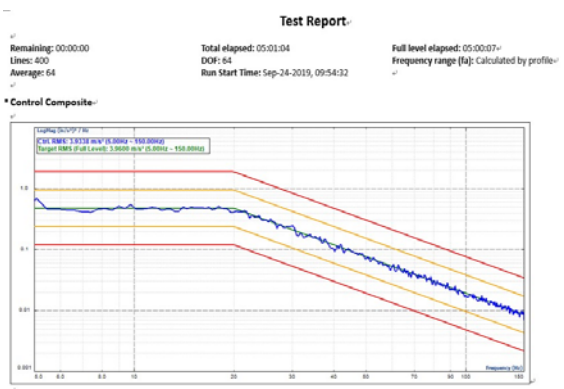
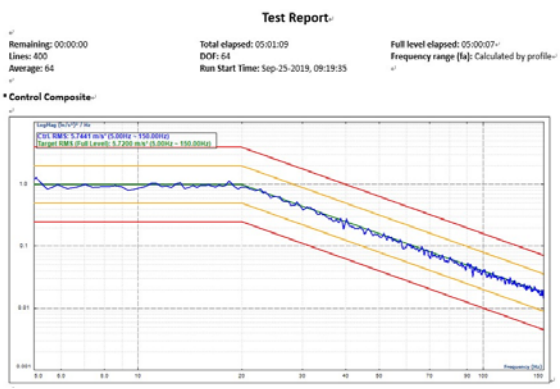
8.4.2 ASD spectrum (Category 1, Class B)



8.4.3 Test result

Test Items	Test standard	Test result	Remarks
Simulated long-life testing	According to EN 61373:2010, Clause 9 (Category 1, Class B). 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 visual inspection and performance test was confirmed at the initial and final of the test	-

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

X axes		September 23, 2019 / 10:26:26 
Y axes		September 24, 2019 / 09:54:32 
Z axes		September 25, 2019 / 09:19:35 

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

Simulated long-life testing - Normal operation check	X axes	Initial	
		Final	
	Y axes	Initial	
		Final	
	Z axes	Initial	
		Final	

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

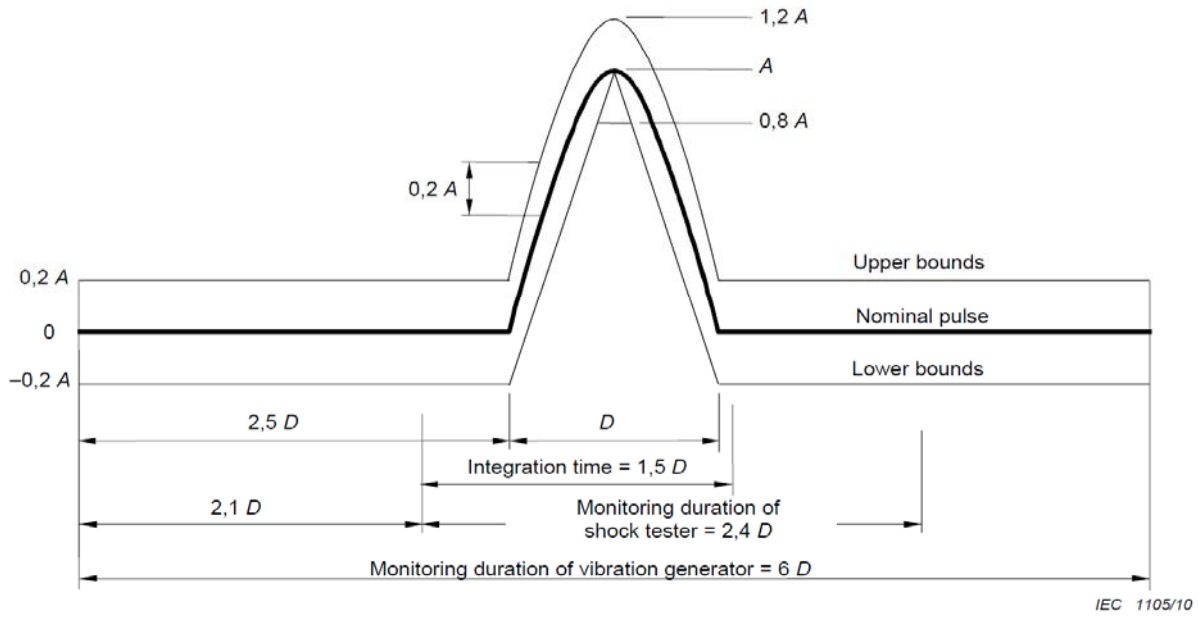
8.5 Shock testing

8.5.1 Test conditions

<table>
<tr><th colspan="2">Item</th><th colspan="4">Detailed description</th><th>Remarks</th></tr>
<tr><td colspan="2">Test date</td><td colspan="4">September 23, 2019 - September 25, 2019</td><td>-</td></tr>
<tr><td colspan="2">Environmental conditions</td><td colspan="4">Temperature : (25.0 ± 10.0) ℃,
Humidity : (50 ± 25) % R.H.</td><td>-</td></tr>
<tr><td colspan="2">Power conditions</td><td colspan="4">☑ Store (Power OFF) ☐ Action (Power ON)</td><td>-</td></tr>
<tr><td colspan="2">Categories</td><td colspan="4">☑ Category 1 (☐ Class A ☑ Class B)
☐ Category 2 ☐ Category 3</td><td>-</td></tr>
<tr><td colspan="2">Direction time and test level</td><td colspan="4"><table><tr><th></th><th>Vertical</th><th>Transverse</th><th>Longitudinal</th></tr><tr><td>Peak acceleration A (m/s^2)</td><td>30</td><td>30</td><td>50</td></tr><tr><td>Nominal duration D (ms)</td><td>30</td><td>30</td><td>30</td></tr><tr><td>Number of repetitions (+, -)</td><td>3 / 3</td><td>3 / 3</td><td>3 / 3</td></tr><tr><td>Wave form</td><td>Half sine wave</td><td>Half sine wave</td><td>Half sine wave</td></tr></table></td><td></td></tr>
<tr><td colspan="2">Allowable width of sine wave type</td><td colspan="4">Category 1 (☐ Class A ☑ Class B)</td><td>Refer to 8.5.2</td></tr>
<tr><td rowspan="2">Initial measurements</td><td>Visual inspection</td><td colspan="4">Mechanical damage, loosening of screw, etc.</td><td>-</td></tr>
<tr><td>Performance test</td><td colspan="4">Normal operation check
(Boot and video output shall operating normally)</td><td>-</td></tr>
<tr><td rowspan="2">Intermediate measurements</td><td>Visual inspection</td><td colspan="4">Not applicable</td><td>-</td></tr>
<tr><td>Performance test</td><td colspan="4">Not applicable</td><td>-</td></tr>
<tr><td rowspan="2">Final measurements</td><td>Visual inspection</td><td colspan="4">Mechanical damage, loosening of screw, etc.</td><td>-</td></tr>
<tr><td>Performance test</td><td colspan="4">Normal operation check
(Boot and video output shall operating normally)</td><td>-</td></tr>
</table>

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

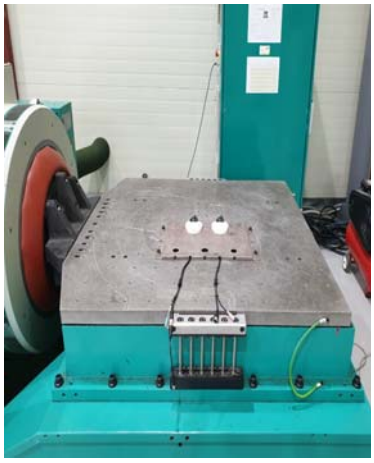
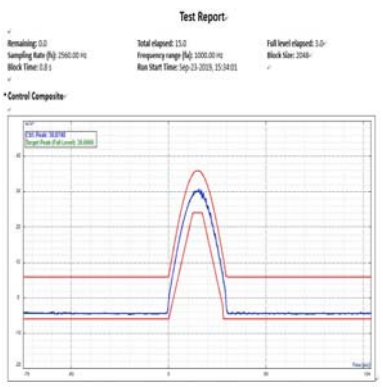
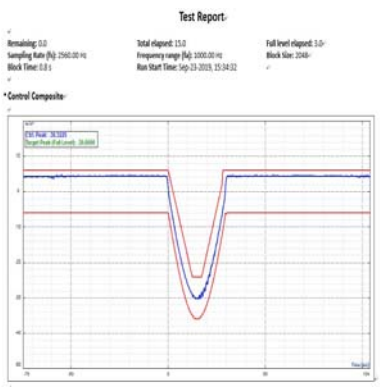
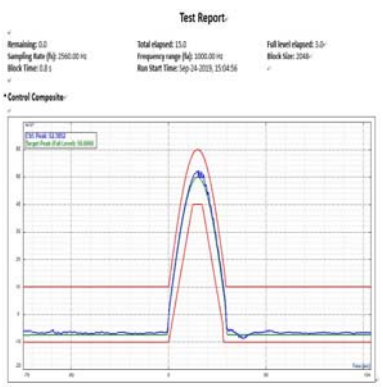
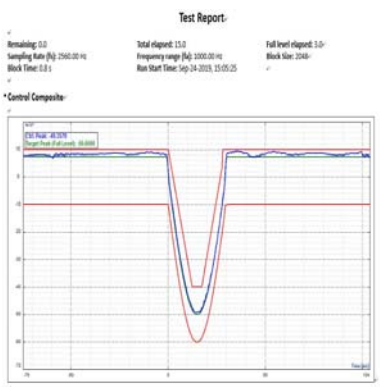
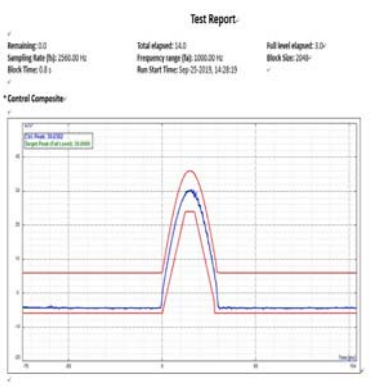
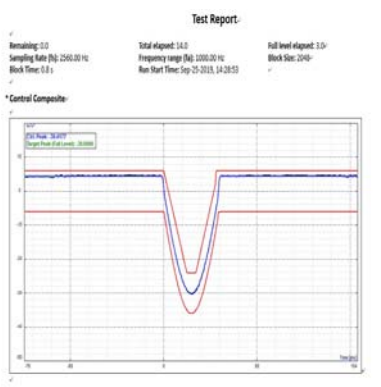
8.5.2 Allowable width of sine wave type



8.5.3 Test result

Test Items	Test standard	Test result	Remarks
Shock testing	According to EN 61373:2010, Clause 10 (Category 1, Class B). 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 visual inspection and performance test was confirmed at the initial and final of the test	-

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

X axes		September 23, 2019 / 15:34:01 	September 23, 2019 / 15:34:32 
Y axes		September 24, 2019 / 15:04:56 	September 24, 2019 / 15:05:25 
Z axes		September 25, 2019 / 14:28:19 	September 25, 2019 / 14:28:53 

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

Shock testing - Normal operation check	X axes	Initial	
		Final	
	Y axes	Initial	
		Final	
	Z axes	Initial	
		Final	

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

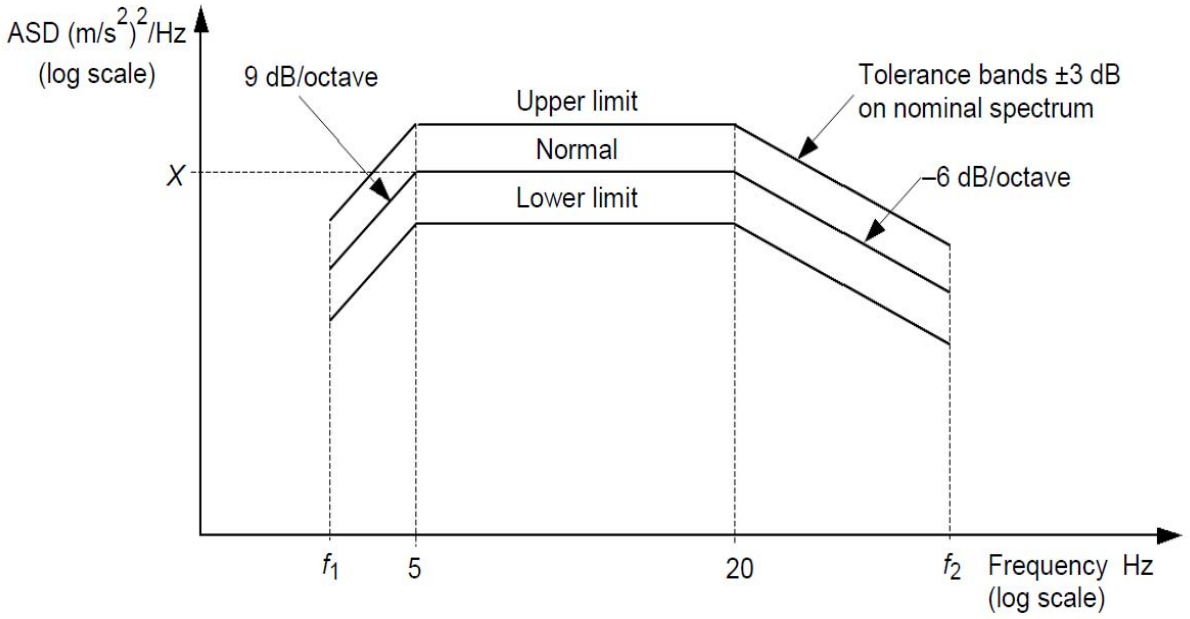
8.6 Functional random vibration test

8.6.1 Test conditions

<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">September 23, 2019 - September 25, 2019</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 rowspan="5">Direction time and test level</td><td colspan="7"><table>
<tr><th colspan="2">Vertical (15 min)</th><th colspan="2">Transverse (15 min)</th><th colspan="2">Longitudinal (15 min)</th></tr>
<tr><th>Frequency [Hz]</th><th>ASD Levels [$(m/s^2)^2/Hz$]</th><th>Frequency [Hz]</th><th>ASD Levels [$(m/s^2)^2/Hz$]</th><th>Frequency [Hz]</th><th>ASD Levels [$(m/s^2)^2/Hz$]</th></tr>
<tr><td>5</td><td>0.016 6</td><td>5</td><td>0.004 1</td><td>5</td><td>0.007 3</td></tr>
<tr><td>20</td><td>0.030 1</td><td>20</td><td>0.006 0</td><td>20</td><td>0.014 4</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">1.010 m/s^2 r.m.s</td><td colspan="2">0.450 m/s^2 r.m.s</td><td colspan="2">0.700 m/s^2 r.m.s</td></tr>
</table></td></tr>
<tr><td colspan="2">ASD spectrum</td><td colspan="4">Category 1 (☐ Class A ☑ Class B)</td><td>Refer to 8.6.2</td></tr>
<tr><td rowspan="2">Initial measurements</td><td>Visual inspection</td><td colspan="4">Mechanical damage, loosening of screw, etc.</td><td>-</td></tr>
<tr><td>Performance test</td><td colspan="4">Normal operation check
(Boot and video output shall operating normally)</td><td>-</td></tr>
<tr><td rowspan="2">Intermediate measurements</td><td>Visual inspection</td><td colspan="4">Mechanical damage, loosening of screw, etc.</td><td>-</td></tr>
<tr><td>Performance test</td><td colspan="4">Normal operation check
(Boot and video output shall operating normally)</td><td>-</td></tr>
<tr><td rowspan="2">Final measurements</td><td>Visual inspection</td><td colspan="4">Mechanical damage, loosening of screw, etc.</td><td>-</td></tr>
<tr><td>Performance test</td><td colspan="4">Normal operation check
(Boot and video output shall operating normally)</td><td>-</td></tr>
</table>

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

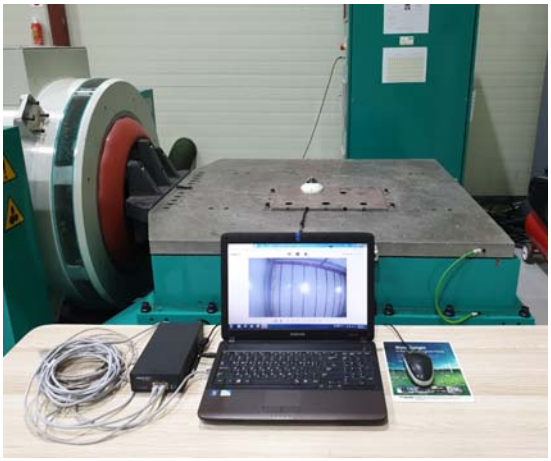
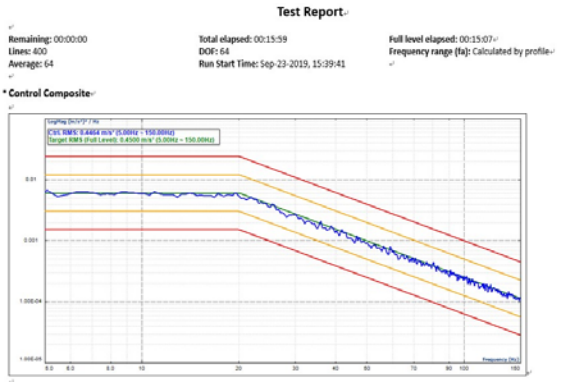
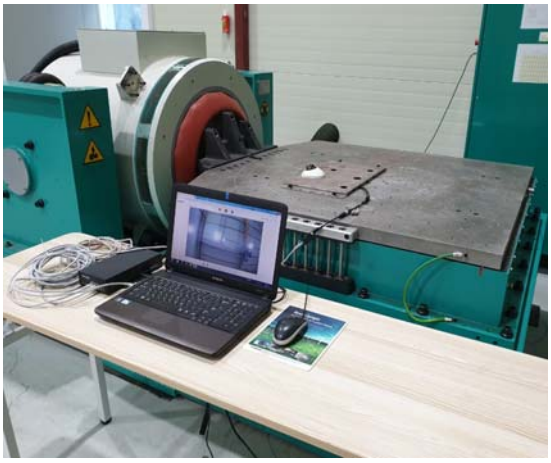
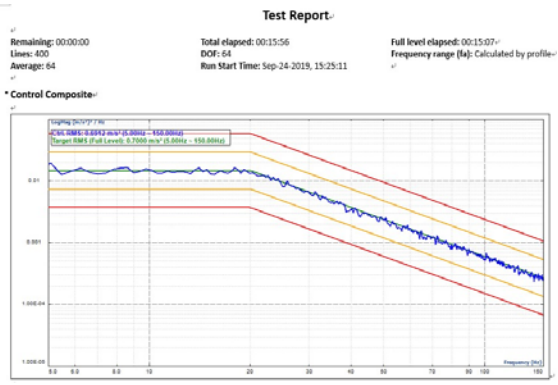
8.6.2 ASD spectrum (Category 1, Class B)



8.6.3 Test result

Test Items	Test standard	Test result	Remarks
Functional random vibration test	According to EN 61373:2010, Clause 8 (Category 1, Class B). 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 visual inspection and performance test was confirmed at the initial, intermediate and final of the test	-

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

X axes		September 23, 2019 / 15:39:41 
Y axes		September 24, 2019 / 15:25:11 
Z axes		September 25, 2019 / 14:41:46 

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

Functional random vibration test - Normal operation check	X axes	Initial	
		Final	
	Y axes	Initial	
		Final	
	Z axes	Initial	
		Final	

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

9. Used instrument list

No.	KES Management Number	Instrument Name	Mfr.	Model	Serial #	Date of Calibration	Calibration Valid Until	Calibration Cycle	Remark
1	KES-RE-107	Vibration Exciter	JINN Co., Ltd.	S701LS4-450M	20170523	2019.05.22	2020.05.22	1 year	-
2	KES-RE-109	Temp. & Humid. Chamber	SJ SCIENCE CO	SJ-TH-S150	SJ-TH -S150 -171205	2019.01.03	2020.01.03	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