

**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-EM-21T0340

Page (1) of (33)

EMC TEST REPORT

Test Report No. : KES-EM-21T0340

Date of Issue : May. 06, 2021

Product name : DVR

Model/Type No. : HRX-1632

Variant Model : -

Applicant : Hanwha Techwin Co., Ltd.

Applicant Address : 6, Pangyo-ro 319Beon-gil, Bundang-gu, Seongnam-si,
Gyeonggi-do, Republic of Korea

Manufacturer : 1. HANWHA TECHWIN SECURITY VIETNAM CO.,LTD.
2. D-TECH CO.,LTD.

Manufacturer Address : 1. Lot O-2, Que Vo Industrial Zone extended area,
Nam Son commune, Bac Ninh city, Bac Ninh province, Vietnam
2. 173-25, Saneop-ro, Gwonseon-gu, Suwon-si, Gyeonggi- do,
Korea (Suwon Industrial Complex)

Equipment authorization : **Supplier's Declaration of Conformity**

Date of Receipt : Apr. 09, 2021

Test date : Apr. 22, 2021 ~ Apr. 23, 2021

Test Results : ☒ **In Compliance** ☐ **Not in Compliance**

Tested by

Ki Man, Kim
EMC Test Engineer

Reviewed by

Dong-Hun, Jang
EMC Technical Manager

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

**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-EM-21T0340

Page (2) of (33)

REPORT REVISION HISTORY

Date	Test Report No.	Revision History
May. 06, 2021	KES-EM-21T0340	Issued

This report shall not be reproduced except in full, without the written approval of KES Co., Ltd. This document may be altered or revised by KES Co., Ltd. personnel only, and shall be noted in the revision section of the document. Any alteration of this document not carried out by KES Co., Ltd. will constitute fraud and shall nullify the document.

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-EM-21T0340

Page (3) of (33)

TABLE OF CONTENTS

1.0	General Product Description.....	4
1.1	Test Voltage & Frequency	6
1.2	Variant Model Differences	6
1.3	Device Modifications	6
1.4	Equipment Under Test.....	6
1.5	Support Equipments	7
1.6	External I/O Cabling	9
1.7	EUT Operating Mode(s)	10
1.8	Configuration.....	11
1.9	Remarks when standards applied	12
1.10	Calibration Details of Equipment Used for Measurement.....	12
1.11	Test Facility	12
1.12	Laboratory Accreditations and Listings	12
2.0	Test Regulations.....	13
2.1	Conducted Emissions at Mains Power Ports.....	15
2.2	Radiated Electric Field Emissions(Below 1 GHz)	16
2.3	Radiated Electric Field Emissions(Above 1 GHz)	17
APPENDIX A – TEST DATA.....		18
Conducted Emissions at Mains Power Ports.....		18
Radiated Electric Field Emissions(Below 1 GHz)		20
Radiated Electric Field Emissions(Above 1 GHz)		21
Test Setup Photos and Configuration		22
Conducted Emissions at Mains Power Ports.....		22
Radiated Electric Field Emissions(Below 1 GHz)		23
Radiated Electric Field Emissions(Above 1 GHz)		24
EUT External Photographs		25
EUT Internal Photographs		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



1.0 General Product Description

Main Specifications of EUT are:

Analog camera	Inputs	16CH(1Vp-p 75ohm, BNC)
	Signal Type	AHD(4MP, 1080p, 720p) HDTVI(4MP, 1080p, 720p) HDCVI(4MP, 1080p, 720p) CVBS(NTSC/PAL)
Network camera	Inputs	Max 16CH
	Resolution	8MP ~ CIF
	Protocols	SUNAPI(Wisenet), ONVIF
Live	Local Display	1x HDMI, 1x VGA (Dual monitor)
	Multi Screen Display	[Local monitor] 1, 2H, 2V, 3V, 4, 6(1+5), 8(1+7), 9, 13, 16, 20(5x4) / Auto sequence, [Web] 1 / 4 / 9 / sequence
	Resolution	[Analog Camera(NTSC/PAL)] - 4MP(30/25fps), 2MP(30/25fps), 1MP(30/25fps), 960H(or 720H)(30/25fps) * per CH [Network Camera] - Typ. 2MP(480fps)
Performance		
Operating System	Embedded	Linux
Record	Compression	H.265, H.264, MJPEG
	Record Rate(Analog)	Analog Camera(NTSC/PAL) (Main Stream) 4M 7/7fps CH, 2M 15/15fps/CH, 720p 30/25fps/CH, under 960H 30/25fps/CH (Sub Stream) 720p or higher : 640x360 full fps/CH, SD signal : upto SD full fps/CH * The maximum recording frame rate depends on the frame rate of the input camera.
	Recording Bandwidth	Max. 70Mbps
	Resolution	4MP ~ CIF
Event	Mode	Manual, Schedule (Continuous/Event), Event(Pre/Post), Dual Track
	Event Trigger	Alarm Input Analog Camera : Video Loss, Motion Detection, Tampering Network Camera : Camera Event (Sensor, MD, Video analytics), VA event (Tampering, Enter / Exit, Passing, Virtual-line, DisAppear, Face Detection, Audio detection), Defocus camera event
	Event Action	E-mail, PTZ preset, Alarm out, Buzzer, Monitor out
Search & Play	Playback Bandwidth	Max. 32Mbps (16CH simultaneously)
	Resolution	4MP ~ CIF
	Playback Control	Fast Forward/Backward (x2,x4,x8,x16,x32,x64, x128, x256) Slow Forward/Backward (x1/2,x1/4,x1/8) ※Move one step up/down
Storage	Supported HDD	Up to 6TB
	HDD Slot	SATA 4ea(Max. 24TB)
	External	None
	RAID	None
Backup	File backup	BU, EXE(Include Player), AVI(Webviewer only)
Network		
Protocol		TCP/IP, UDP/IP, RTP (UDP), RTP (TCP), RTSP, NTP, HTTP, DHCP (Server, Client), PPPoE, SMTP, ICMP, IGMP, ARP, DNS, DDNS, uPnP, HTTPS, SNMP, ONVIF (Profile-S), SUNAPI(Server, Client)
DDNS		Wisenet DDNS
Transmission speed		Analog Camera (Main Stream) 4M 7/7fps, 2M 15/15fps, 720p 30/25fps, 960H/640H 30/25fps (NTSC/PAL per CH) (Sub Stream) 720p or higher : 640x360 full fps/CH, SD signal : upto SD full fps/CH
Audio	Input/Output	16 Line in (Built in 4 Line, Option : Audio Extension Cable) / 1Line line out
	Compression	G.711 (N/W Cam G.711, 726)
	Audio Communication	2-Way
Max Remote Users		Search(3), Live Unicast(10), Multicast(20)
Security		IP address filtering, User access log, 802.1x Authentication, Encryption (ID/PW, Recording, Transmission, Backup) Device Certificate(Hanwha Techwin Root CA)
Web viewer	Supported OS	Window 10, Mac OS X (10.15 or above)
	Supported browser	Google Chrome 88 or above, MS Edge 88 or above, Safari 13 or above *support Plug-in free Web
Viewer Software		SSM, Webviewer, SmartViewer, Wisenet Mobile Viewer Support SDK/CGI(SUNAPI) for integration to 3rd party VMS
Functions		
Camera Setup	Register	Auto, Manual
	Item	None
PTZ	Control	Via GUI, Webviewer, SSM, SmartViewer, Wisenet Mobile Viewer, System Controller
	Preset	300 presets
Smart phone	Support Model	iOS, Android
	Protocol Support	RTP, RTSP, HTTP, CGI(SUNAPI)
	Control	Live(16ch) : Multi-Profile Support Playback(4Ch Multi Playback, Max 2MP) Event push
	Max. Remote Users	Search(3), Live Unicast(10)
Easy configuration		Setup Wizard (Language Date/Time, Password, Network, Auto Camera Configuration), P2P (QR code)
Coaxial Control		CVBS(Pelco-C)/AHD/CVI/TVI

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-EM-21T0340
Page (5) of (33)

Interface		
Front	Indicator	LED(Status indicator) : Power(1), HDD Action(1), Alarm(1), Record(1), Network(1), Backup(1)
Reset		Switch(1EA)
HDD Key Lock		None
HDMI		1EA
VGA		1EA
BNC		16CH In / 1CH Out(Spot Output)
Audio		Out(1EA, RCA, Line)
Ethernet		RJ-45(10/100/1000BASE-T)
Alarm		In 16EA, Out 4EA - Relay Out1(NO/NC/COM) - Relay Out2~4(NO/COM)
USB		2EA(Front USB2.0, Rear USB 3.0)
Serial(Protocols)		RS-485/422 (Samsung-T/Pelco-D/Pelco-p) * for PTZ
Power inlet		1EA AC
System		
Log	Log List	Max. 20,000 (System Log, Event Log each)
Power Management	Shutdown Delay	None
	Startup Delay	None
Language		English, French, German, Italian, Spanish, Russian, Turkish, Polish, Dutch, Swedish, Czech, Portuguese, Danish, Rumanian, Serbian, Croatian, Hungarian, Greek, Norwegian, Finnish, Korean, Chinese, Japanese, Thai
Environmental		
Operating Temperature		0°C to +40°C(+32°F to +104°F)
Operating Humidity		20% ~ 85% RH
Certification		UL, CE, FCC, KC
Electrical		
Power Input		100~240 VAC±10%, 50/60 Hz
Power Consumption		Max. 120W (6T HDD 4ea)
PoE Budget		None
Mechanical		
Color / Material		Black / Metal
Dimension (WxHxD)		440 x 88 x 384.8mm(17.32" x 3.46" x 15.15")
Weight		Approx. 5.4Kg (4TB HDD 1ea)

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-EM-21T0340

Page (6) of (33)

1.1 Test Voltage & Frequency

Unless indicated otherwise on the individual data sheet or test results, the test voltage and frequency was as indicated below.

☒ AC 120 V, 60 Hz

1.2 Variant Model Differences

Not applicable

1.3 Device Modifications

Not applicable

1.4 Equipment Under Test

Description	Model Number	Serial Number	Manufacturer	Remarks
DVR	HRX-1632	-	HANWHA TECHWIN SECURITY VIETNAM CO.,LTD.	EUT
mouse	MOKJUO	-	Primax Electronics Ltd.	-
SMPS	FSAK250J	-	Channel Well Technology (Guangzhou) Co., Ltd.	-
HDD	WD40PURX- 64N96Y0	-	Western Digital	4 TB

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-EM-21T0340

Page (7) of (33)

1.5 Support Equipments

Description	Model Number	Serial Number	Manufacturer	Remarks
Adaptor1	2ACB022F	-	Channel Well Technology(Guangzhou) Co., Ltd.	-
Adaptor2	2ACB022F	-	Channel Well Technology(Guangzhou) Co., Ltd.	-
Adaptor3	2ACB022F	-	Channel Well Technology(Guangzhou) Co., Ltd.	-
Adaptor4	2ACB022F	-	Channel Well Technology(Guangzhou) Co., Ltd.	-
Camera1	HCD-7030RA	-	HANWHA TECHWIN SECURITY VIETNAM CO.,LTD.	-
Camera2	SCD-6083RN	-	HANWHA TECHWIN SECURITY VIETNAM CO.,LTD.	-
Video splitter1	SPE-410	-	HANWHA TECHWIN SECURITY VIETNAM CO.,LTD.	-
Video splitter2	SPE-410	-	HANWHA TECHWIN SECURITY VIETNAM CO.,LTD.	-
Notebook	LG15N54	410NZGK015231	LG	-
Notebook Adaptor	ADP-90WH B	84ZW19F1663	DELTA ELECTRONICS(JIANGSU) LTD.	-
Alarm1	-	-	-	-
Alarm2	-	-	-	-
Monitor1	SMT-2233	ZC6U67VH50019 4D	Weihai Daewoo Electronics Co., Ltd.	-
Monitor2	23MA53D	303KKMH9Z019	LG	-
Monitor2 Adaptor	PSAB-L205A	EAY62850201	LG Innotek Yantai Co. Ltd.	-
Monitor3	LT23C350	009MHYCH10638 8P	SAMSUNG	-
Monitor3 Adaptor	A4514_DDY	CN07BN44-00593BD07G690 189	SAMSUNG ELECTRONIC JAPAN Co., Ltd.	-

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-EM-21T0340

Page (8) of (33)

Description	Model Number	Serial Number	Manufacturer	Remarks
Smartphone	LG-SU760	108KPQJ0186212	LG	-
Speaker	E5	-	PreSonus®	-
Controller	SPC-1010	C50E67WG10100 F	SamSung Techwin Co.,Ltd.	-
Controller Adaptor	RS-AB1000	-	Dongguan JinhuaSheng Power Technology Co.,Ltd.	-
USB Memory	-	-	Sandisk	32 GB

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



1.6 External I/O Cabling

Start		END		Cable Spec.	
Description	I/O Port	Description	I/O Port	Length	Shield
DVR (EUT)	RJ-45	Notebook	RJ-45	3.5	U
	Alarm OUT	Alarm1	Alarm IN	3.0	U
	Alarm IN	Alarm2	Alarm OUT	3.0	U
	2 PIN	Controller	2 PIN	3.0	U
	Audio OUT	Speaker	Audio OUT	1.4	U
	Audio IN	Smartphone	Audio IN	1.6	U
	USB	USB Memory	USB	-	-
	BNC	Video splitter1	BNC	0.8	S
	BNC		BNC	0.8	S
	BNC		BNC	0.8	S
	BNC		BNC	0.8	S
	BNC		BNC	0.8	S
	BNC		BNC	0.8	S
	BNC		BNC	0.8	S
	BNC		BNC	0.8	S
	BNC	Video splitter2	BNC	0.8	S
	BNC		BNC	0.8	S
	BNC		BNC	0.8	S
	BNC		BNC	0.8	S
	BNC		BNC	0.8	S
	BNC		BNC	0.8	S
	BNC		BNC	0.8	S
	BNC		BNC	0.8	S

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-EM-21T0340

Page (10) of (33)

Start		END		Cable Spec.	
Description	I/O Port	Description	I/O Port	Length	Shield
DVR (EUT)	BNC	Monitor1	BNC	3.0	S
	HDMI	Monitor2	HDMI	1.6	S
	D-sub	Monitor3	D-sub	1.5	S
	USB	mouse (EUT)	USB	1.8	U
	External Ground	Ground	External Ground	2.0	U
Video splitter1	BNC	Camera1	BNC	1.5	U
Video splitter2	BNC	Camera2	BNC	1.5	U

* Unshielded=U, Shielded=S

1.7 EUT Operating Mode(s)

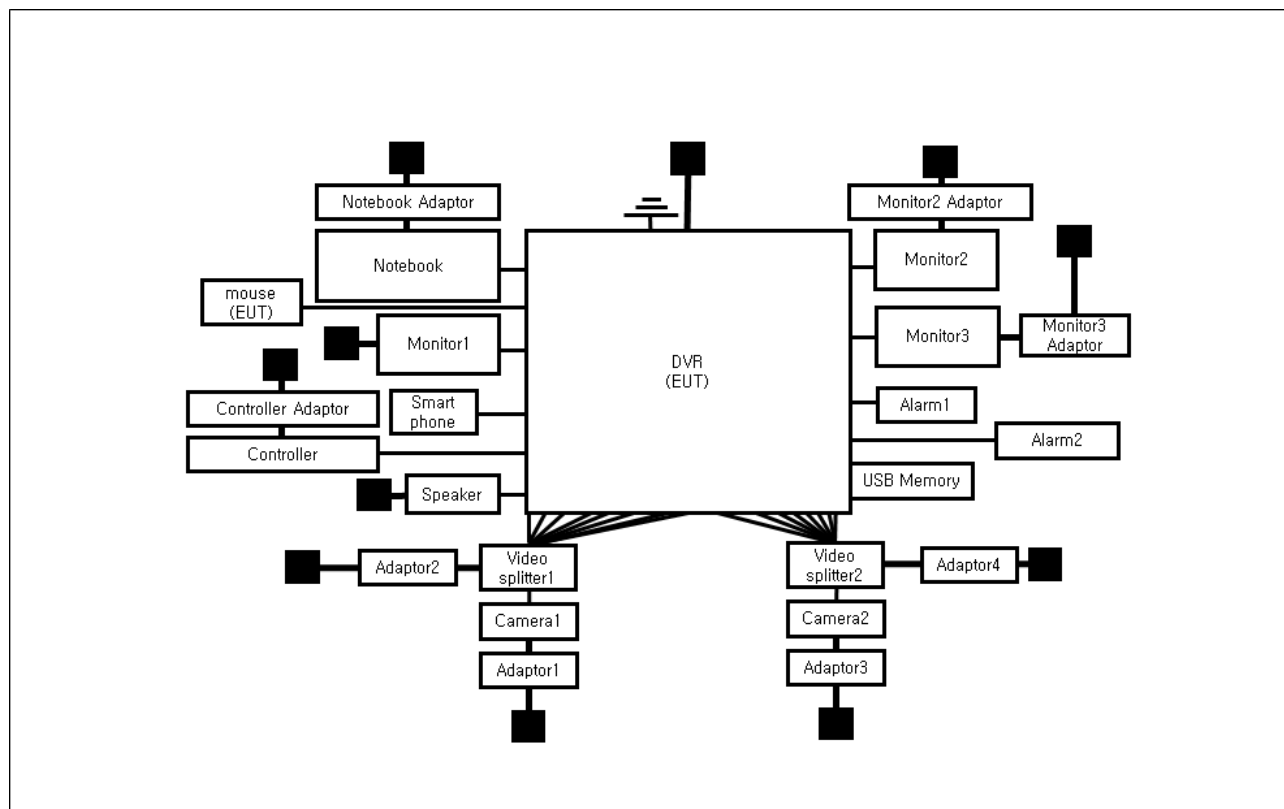
Test Mode	operating
Operation	the test was conducted while checking the camera video output from the laptop and making sure that they operate normally while performing a ping test.

EUT Test operating S/W		
Name	Version	Manufacture Company
Web Viewer	-	Hanwha Techwin Co., Ltd.

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

1.8 Configuration

■ AC Main
 □ DC Main



1.9 Remarks when standards applied

N/A

1.10 Calibration Details of Equipment Used for Measurement

Test equipment and test accessories are calibrated on regular basis. The maximum time between calibrations is one year or what is recommended by the manufacturer, whichever is less.

1.11 Test Facility

The measurement facility is located at 473-21 Gayeo-ro, Yeosu-si, Gyeonggi-do, 12658, Korea. The sites are constructed in conformance with the requirements of ANSI C63.4:2014 and CISPR 16-1-4:2019

1.12 Laboratory Accreditations and Listings

Country	Agency	Scope of Accreditation	Logo
KOREA	RRA	EMI (3 m & 10 m Semi-Anechoic Chamber , 10 m Open Area and conducted test site) EMS (ESD, RS, EFT/Burst, Surge, CS, Magnetic, Dips and interruptions)	 KR0100
International	KOLAS	EMI (3 m & 10 m Semi-Anechoic Chamber , and conducted test site) EMS (ESD, RS, EFT/Burst, Surge, CS, Magnetic, Dips and interruptions)	 KT489
USA	FCC	3 m & 10 m Semi-Anechoic Chamber, 10 m Open Area and Conducted test site to perform FCC Part 15/18 measurements.	 KR0100
Canada	ISED	3 m & 10 m Semi-Anechoic Chamber and Conducted test site	 23298-1
JAPAN	VCCI	Mains Ports Conducted Interference Measurement, Telecommunication Ports Conducted Disturbance Measurement and Radiation 10 meter site, Facility for measuring radiated disturbance above 1 GHz	 R-20056, C-20036, T-20040, G-20057
Europe	TÜV SÜD	EMI (3 m & 10 m Semi-Anechoic Chamber , 10 m Open Area and conducted test site) EMS (ESD, RS, EFT/Burst, Surge, CS, Magnetic, Dips and interruptions)	 CARAT 001633 0004



2.0 Test Regulations

The emissions tests were performed according to following regulations:

☐ **EMC – Directive 2014/30/EU**

☐ EN 61000-6-3:2011

☐ EN 61000-6-1:2007

☐ EN 61000-6-4:2007 +A1:2011

☐ EN 61000-6-2:2005

☐ EN 55011:2007 +A1:2010

☐ Group 1
☐ Class A

☐ Group 2
☐ Class B

☐ EN 55014-1:2006 +A2:2011

☐ EN 55014-2:1997 +A2:2008

☐ EN 55015:2013

☐ EN 55032:2015

☐ Class A

☐ Class B

☐ EN 55024:2010

☐ EN 50130-4:2011 +A1:2014

☐ EN 61000-3-2:2014

☐ EN 61000-3-3:2013

☐ EN 61326-1:2013



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-EM-21T0340

Page (14) of (33)

-
- | | | |
|--|---|----------------------------------|
| ☐ VCCI-CISPR 32:2016 | ☐ Class A | ☐ Class B |
| ☐ AS/NZS CISPR32:2015 | ☐ Class A | ☐ Class B |
| ☒ 47 CFR Part 15, Subpart B | | |
| ☐ CISPR 22:2009 +A1:2010 | ☐ Class A | ☐ Class B |
| ☒ ANSI C63.4-2017 | ☒ Class A | ☐ Class B |
| ☐ IC Regulation ICES-003 Issue 7 | | |
| ☐ CAN/CSA CISPR 32:17 | ☐ Class A | ☐ Class B |
| ☐ ANSI C63.4-2017 | ☐ Class A | ☐ Class B |
| ☐ RE- Directive 2014/53/EU | | |
| ☐ EN 301 489-1 V2.2.3 | | |
| ☐ Equipment for fixed use | | |
| ☐ Equipment for vehicular use | | |
| ☐ Equipment for portable use | | |
| ☐ EN 301 489-3 V1.6.1 | | |
| ☐ EN 301 489-17 V2.2.1 | | |
| ☐ EN 60945:2002 | | |

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-EM-21T0340

Page (15) of (33)

2.1 Conducted Emissions at Mains Power Ports

Test Date

Apr. 22, 2021

Test Location

Electro wave Shieldroom #6

Test Equipment

Used	Description	Model Number	Manufacturer	Serial Number	Cal. Due
☒	EMI Test S/W	EMC32	R & S	9.12.00	-
☒	EMI TEST RECEIVER	ESR3	R & S	101783	01, 15, 2022
☒	LISN	ENV216	R & S	101787	12, 29, 2021
☒	LISN	ESH2-Z5	R & S	100450	12, 29, 2021
☒	PULSE LIMITER	ESH3-Z2	R & S	101915	12, 29, 2021

Test Conditions

Temperature: (24,5 ± 0,1) °C

Relative Humidity: (45,7 ± 0,2) % R.H.

Frequency Range of Measurement

150 kHz to 30 MHz

Instrument Settings

IF Band Width: 9 kHz

Test Results

The requirements are:

- ☒ PASS
☐ NOT PASS
☐ NOT APPLICABLE

RemarksSee Appendix A for test data.

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-EM-21T0340

Page (16) of (33)

2.2 Radiated Electric Field Emissions(Below 1 GHz)

Test Date

Apr. 22, 2021

Test Location☐ OPEN AREA TEST SITE #2☒ SEMI ANECHOIC CHAMBER #4(10m)**Test Equipment**

Used	Description	Model Number	Manufacturer	Serial Number	Cal. Due
☒	EMI Test S/W	EP5/RE	TOYO Corporation	6.0.0	-
☒	EMI TEST RECEIVER	ESU26	R & S	100551	04, 01, 2022
☒	AMPLIFIER	SCU 01	R & S	100603	11, 25, 2021
☒	TRILOG-BROADBAND ANTENNA	VULB9163	Schwarzbeck	715	12, 08, 2022
☒	ATTENUATOR	8491A	HP	32173	03, 10, 2022

Test Conditions

Temperature: (24,3 ± 0,2) °C

Relative Humidity: (45,9 ± 0,2) % R.H.

Frequency Range of Measurement

30 MHz to 1 GHz

Instrument Settings

IF Band Width: 120 kHz

Test Results

The requirements are:

- ☒ PASS
☐ NOT PASS
☐ NOT APPLICABLE

RemarksSee Appendix A for test data.

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-EM-21T0340

Page (17) of (33)

2.3 Radiated Electric Field Emissions(Above 1 GHz)

Test Date

Apr. 23, 2021

Test Location

SEMI ANECHOIC CHAMBER #4(10m)

Test Equipment

Used	Description	Model Number	Manufacturer	Serial Number	Cal. Due
☒	EMI Test S/W	EP5/RE	TOYO Corporation	6.0.0	-
☒	EMI TEST RECEIVER	ESU26	R & S	100551	04, 01, 2022
☒	PREAMPLIFIER	8449B	AGILENT	3008A01742	12, 29, 2021
☐	ATTENUATOR	8491A	HP	35496	03, 10, 2022
☒	HORN ANTENNA	BBHA 9120D	SCHWARZBECK	9120D-1802	12, 14, 2021

Test Conditions

Temperature: (24,9 ± 0,2) °C

Relative Humidity: (45,8 ± 0,3) % R.H.

Frequency Range of Measurement

1 GHz to 5 GHz

Instrument Settings

IF Band Width: 1 MHz

Test Results

The requirements are:

☒ PASS☐ NOT PASS☐ NOT APPLICABLE**Remarks**See Appendix A for test data.

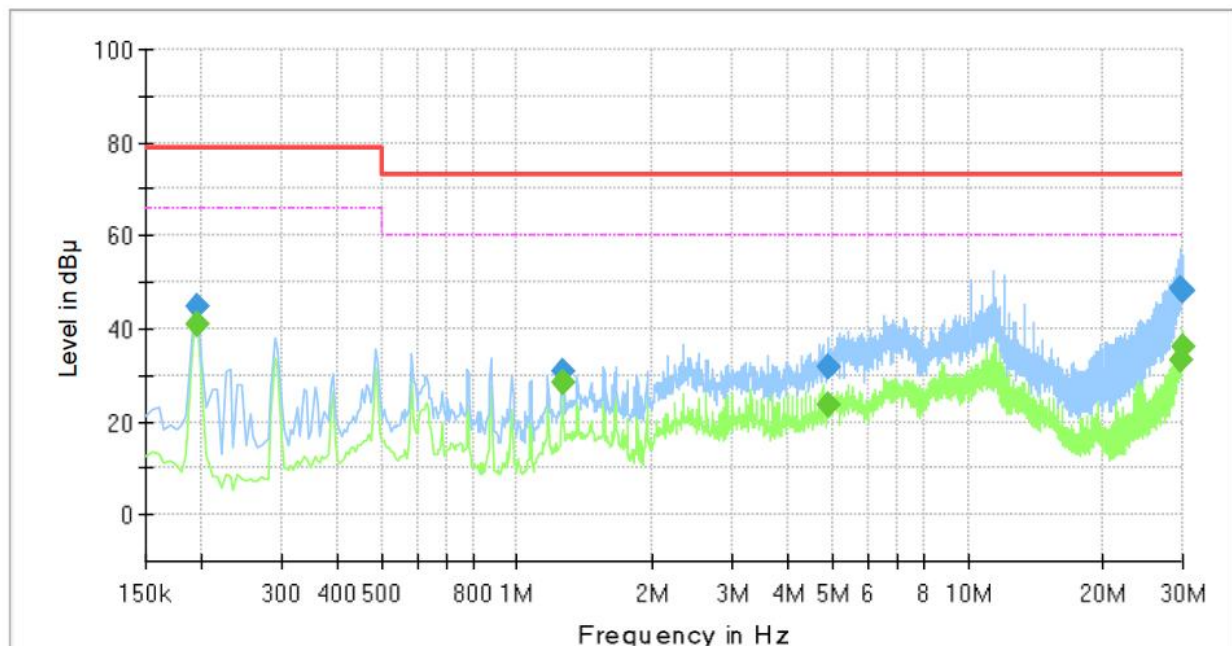
This report shall not be reproduced except in full, without the written approval of KES Co., Ltd.
The results shown in this test report refer only to the sample(s) tested unless otherwise stated.
The authenticity of the test report, contact shchoi@kes.co.kr

APPENDIX A – TEST DATA

Conducted Emissions at Mains Power Ports HOT LINE

Common Information

Test Description:	Conducted Emission
Model No.:	HRX-1632
Phase:	L1
Mode:	
Operator Name:	KES



Final Result

Frequency (MHz)	QuasiPeak (dBμV)	CAverage (dBμV)	Limit (dBμV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.195000	---	41.13	66.00	24.87	1000.0	9.000	L1	19.4
0.195000	44.68	---	79.00	34.32	1000.0	9.000	L1	19.4
1.265000	---	28.32	60.00	31.68	1000.0	9.000	L1	20.1
1.265000	31.05	---	73.00	41.95	1000.0	9.000	L1	20.1
4.915000	---	23.43	60.00	36.57	1000.0	9.000	L1	19.7
4.915000	31.81	---	73.00	41.19	1000.0	9.000	L1	19.7
29.820000	---	33.33	60.00	26.67	1000.0	9.000	L1	20.4
29.820000	48.76	---	73.00	24.24	1000.0	9.000	L1	20.4
29.950000	---	36.26	60.00	23.74	1000.0	9.000	L1	20.4
29.950000	47.91	---	73.00	25.09	1000.0	9.000	L1	20.4

NEUTRAL LINE

Common Information

Test Description:

Conducted Emission

Model No.:

HRX-1632

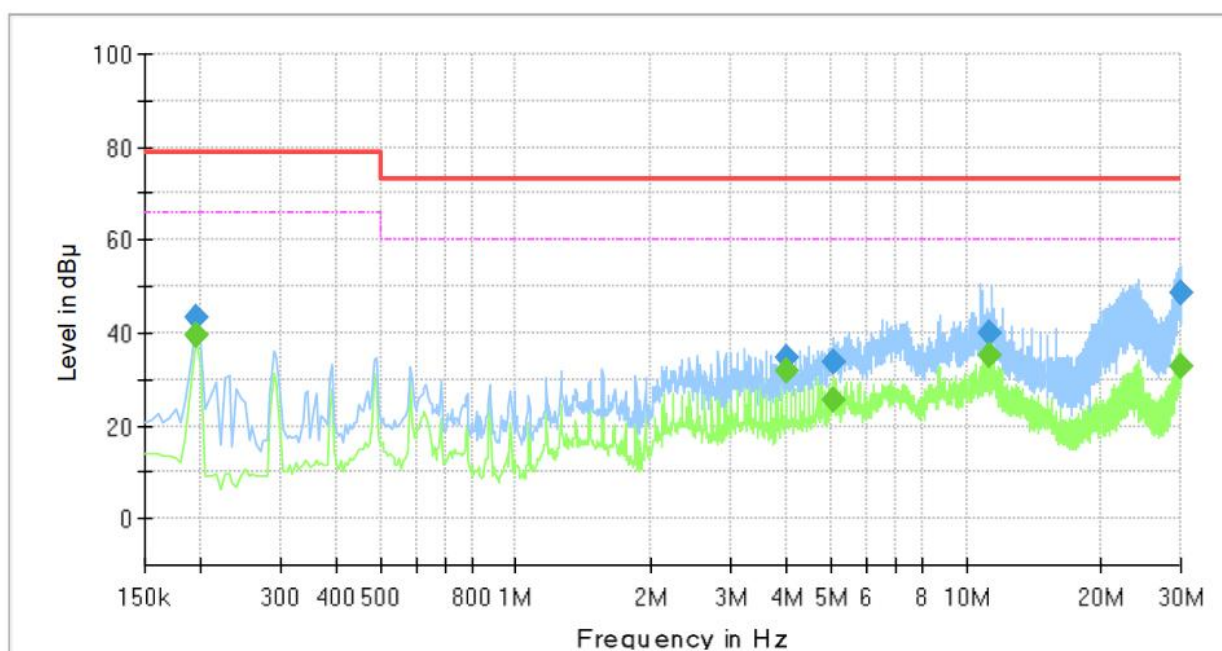
Phase:

N

Mode:

Operator Name:

KES



Final Result

Frequency (MHz)	QuasiPeak (dBμV)	CAverage (dBμV)	Limit (dBμV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.195000	---	39.64	66.00	26.36	1000.0	9.000	N	19.4
0.195000	43.12	---	79.00	35.88	1000.0	9.000	N	19.4
3.985000	---	31.90	60.00	28.10	1000.0	9.000	N	19.9
3.985000	34.66	---	73.00	38.34	1000.0	9.000	N	19.9
5.070000	---	25.77	60.00	34.23	1000.0	9.000	N	19.6
5.070000	33.54	---	73.00	39.46	1000.0	9.000	N	19.6
11.275000	---	35.34	60.00	24.66	1000.0	9.000	N	19.9
11.275000	40.08	---	73.00	32.92	1000.0	9.000	N	19.9
29.990000	---	32.77	60.00	27.23	1000.0	9.000	N	20.4
29.990000	48.39	---	73.00	24.61	1000.0	9.000	N	20.4

◆ Calculation

$$\text{QuasiPeak [dBuV]} / \text{CAverage [dBuV]} = \text{Reading Value [dBuV]} + \text{Corr. [dB]}$$

QuasiPeak / CAverage : The Final Value

Reading Value : Not shown in the table.

Corr. : Correction values (LISN FACTOR + (Cable Loss + Pulse Limiter FACTOR))

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

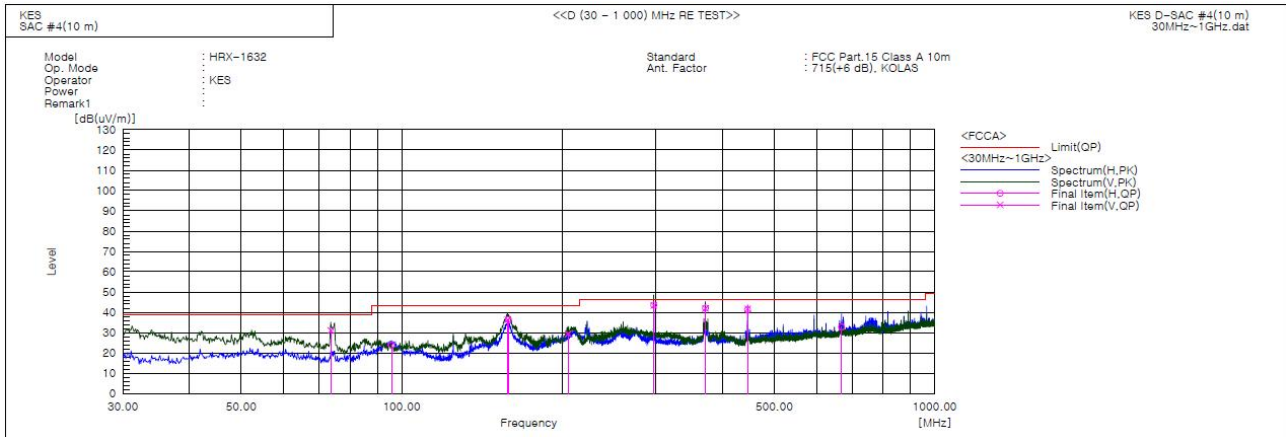


KES Co., Ltd.

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-EM-21T0340
Page (20) of (33)

Radiated Electric Field Emissions(Below 1 GHz)



Final Result

No.	Frequency [MHz]	(P)	Reading QP [dB(uV)]	c.f [dB(1/m)]	Result QP [dB(uV/m)]	Limit QP [dB(uV/m)]	Margin QP [dB]	Height [cm]	Angle [deg]	Remark
1	73.650	V	57.5	-26.4	31.1	39.0	7.9	150.0	343.0	
2	95.718	H	47.2	-23.4	23.8	43.5	19.7	400.0	164.0	
3	158.040	V	61.0	-24.6	36.4	43.5	7.1	150.0	177.0	
4	158.646	H	60.9	-24.6	36.3	43.5	7.2	400.0	44.0	
5	205.206	V	50.0	-20.6	29.4	43.5	14.1	150.0	215.0	
6	296.993	V	61.4	-18.0	43.4	46.5	3.1	150.0	109.0	
7	296.993	H	61.6	-18.0	43.6	46.5	2.9	400.0	135.0	
8	371.198	H	57.0	-14.9	42.1	46.5	4.4	200.0	107.0	
9	371.319	V	56.8	-14.9	41.9	46.5	4.6	150.0	200.0	
10	445.524	V	55.0	-13.3	41.7	46.5	4.8	150.0	168.0	
11	445.524	H	54.6	-13.3	41.3	46.5	5.2	200.0	40.0	
12	668.260	H	40.3	-7.6	32.7	46.5	13.8	400.0	345.0	

◆ Calculation – SAC #4(10 m)

Result(QP) [dB(μV/m)] = (Reading(QP)[dB(μV)] + c.f[dB(1/m)])

Margin(QP)[dB] = Limit[dB(μV/m)] - Result(QP) [dB(μV/m)]

Reading(QP) : Reading value, Result(QP) : Reading value + Factor value

Limit(QP) : Limit value, c.f : (ANT Factor + Cable Loss - Preamplifier Factor), Margin: Margin value



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-EM-21T0340

Page (21) of (33)

Radiated Electric Field Emissions(Above 1 GHz)



Final Result

No.	Frequency [MHz]	(P)	Reading PK [dB(uV)]	Reading CAV [dB(uV)]	c.f [dB(1/m)]	Result PK [dB(uV/m)]	Result CAV [dB(uV/m)]	Limit PK [dB(uV/m)]	Limit AV [dB(uV/m)]	Margin PK [dB]	Margin CAV [dB]	Height [cm]	Angle [deg]	Remark
1	1113.615	H	57.6	44.3	-4.7	52.9	39.6	80.0	60.0	27.1	20.4	115.0	118.0	
2	1427.500	H	54.3	39.4	-2.9	51.4	36.5	80.0	60.0	28.6	23.5	197.0	171.0	
3	1429.500	V	51.7	41.2	-2.9	48.8	38.3	80.0	60.0	31.2	21.7	145.0	90.0	
4	1588.835	V	61.1	37.2	-2.1	59.0	35.1	80.0	60.0	21.0	24.9	111.0	103.0	
5	1611.295	H	59.6	37.2	-2.0	57.6	35.2	80.0	60.0	22.4	24.8	109.0	71.0	
6	1873.000	V	53.9	40.3	-0.8	53.1	39.5	80.0	60.0	26.9	20.5	389.0	275.0	
7	1992.500	H	51.6	39.2	-0.3	51.3	38.9	80.0	60.0	28.7	21.1	394.0	171.0	
8	2081.000	V	52.2	40.9	0.2	52.4	41.1	80.0	60.0	27.6	18.9	117.0	228.0	
9	2412.500	V	51.6	36.6	1.9	53.5	38.5	80.0	60.0	26.5	21.5	119.0	90.0	
10	3031.000	V	46.8	31.9	4.6	51.4	36.5	80.0	60.0	28.6	23.5	397.0	275.0	
11	3418.000	H	44.8	32.0	5.7	50.5	37.7	80.0	60.0	29.5	22.3	198.0	346.0	
12	4598.500	H	41.9	29.0	10.9	52.8	39.9	80.0	60.0	27.2	20.1	107.0	237.0	

◆ Calculation

Result(PK/CAV) [dB(uV/m)] = (Reading(PK/CAV)[dB(uV)] + c.f[dB(1/m)]

Margin(PK/CAV)[dB] = Limit[dB(uV/m)] - Result(PK/CAV) [dB(uV/m)]

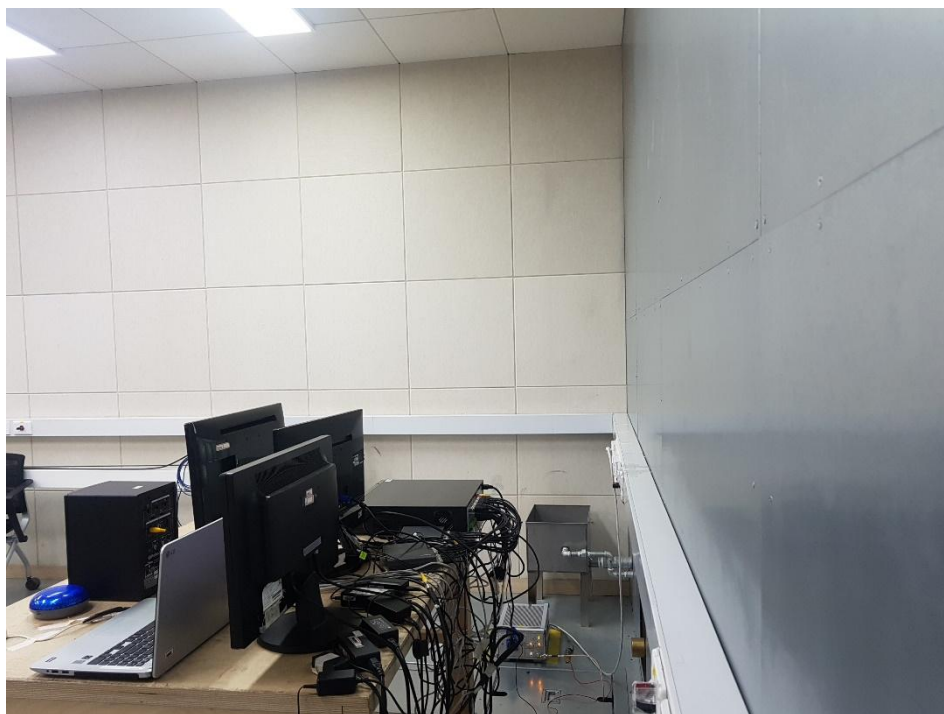
Reading(PK/CAV) : Reading value, Result(PK/CAV) : Reading value + Factor value

Limit(QP) : Limit value, c.f : (ANT Factor + Cable Loss - Preamp Factor), Margin: Margin value

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

Test Setup Photos and Configuration

Conducted Emissions at Mains Power Ports



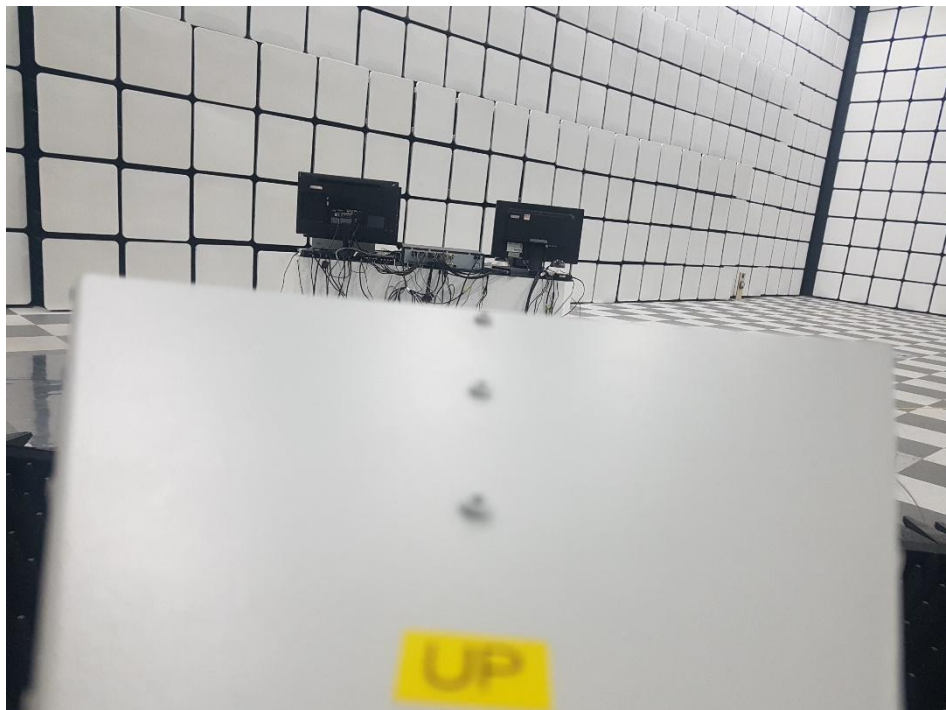
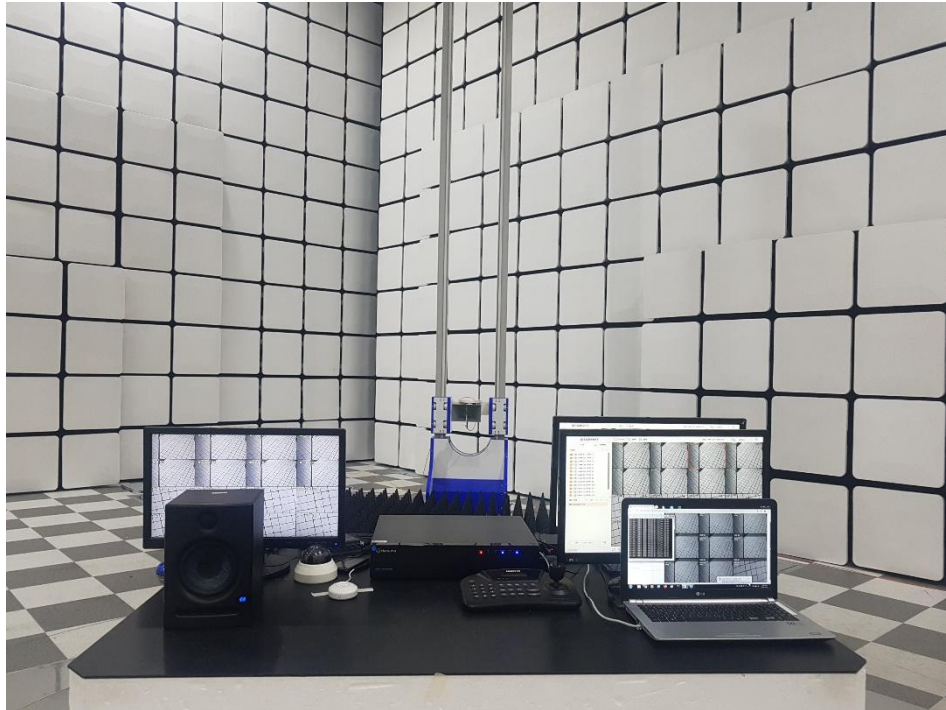
This report shall not be reproduced except in full, without the written approval of KES Co., Ltd.
The results shown in this test report refer only to the sample(s) tested unless otherwise stated.
The authenticity of the test report, contact shchoi@kes.co.kr

Radiated Electric Field Emissions(Below 1 GHz)



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

Radiated Electric Field Emissions(Above 1 GHz)



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

EUT External Photographs

(Top)



(Bottom)



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

EUT Internal Photographs

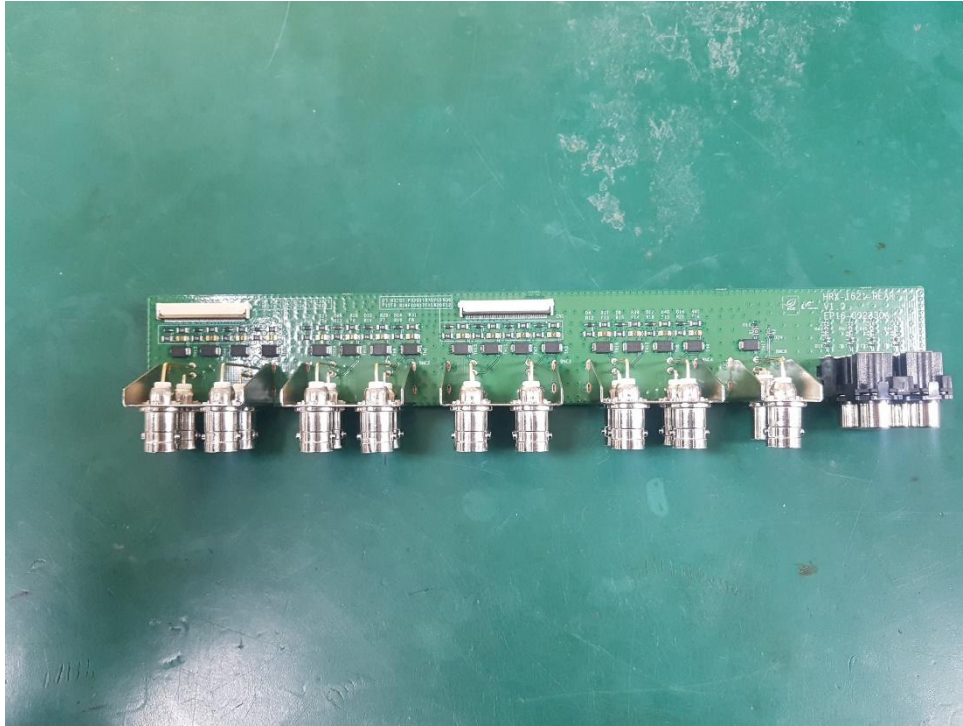
(Internal View)



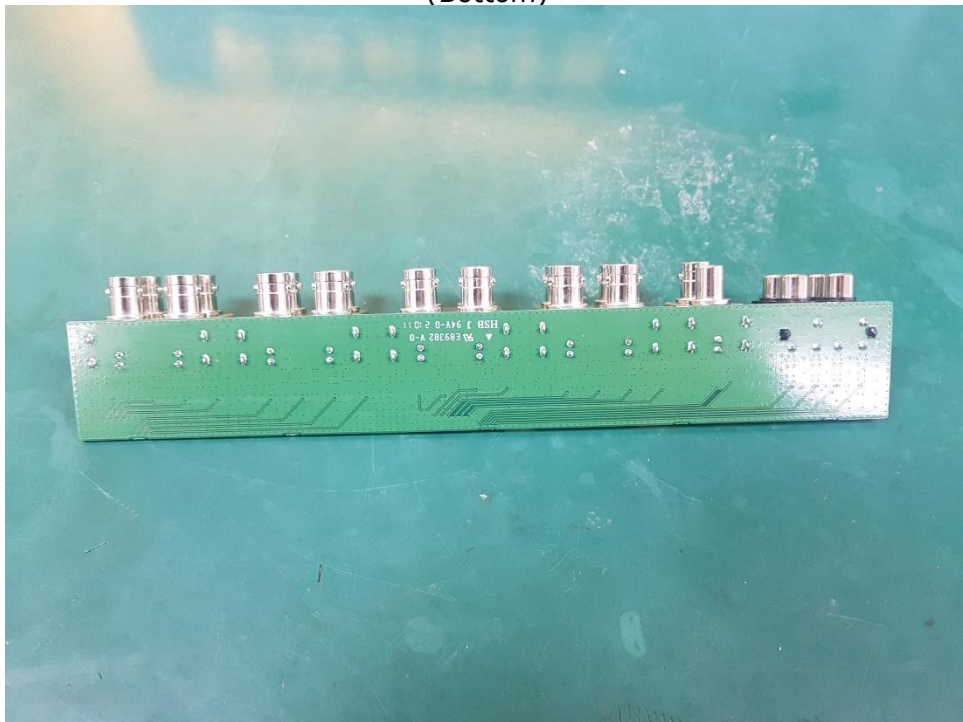
This report shall not be reproduced except in full, without the written approval of KES Co., Ltd.
The results shown in this test report refer only to the sample(s) tested unless otherwise stated.
The authenticity of the test report, contact shchoi@kes.co.kr

EUT Internal View – Board 1

(Top)



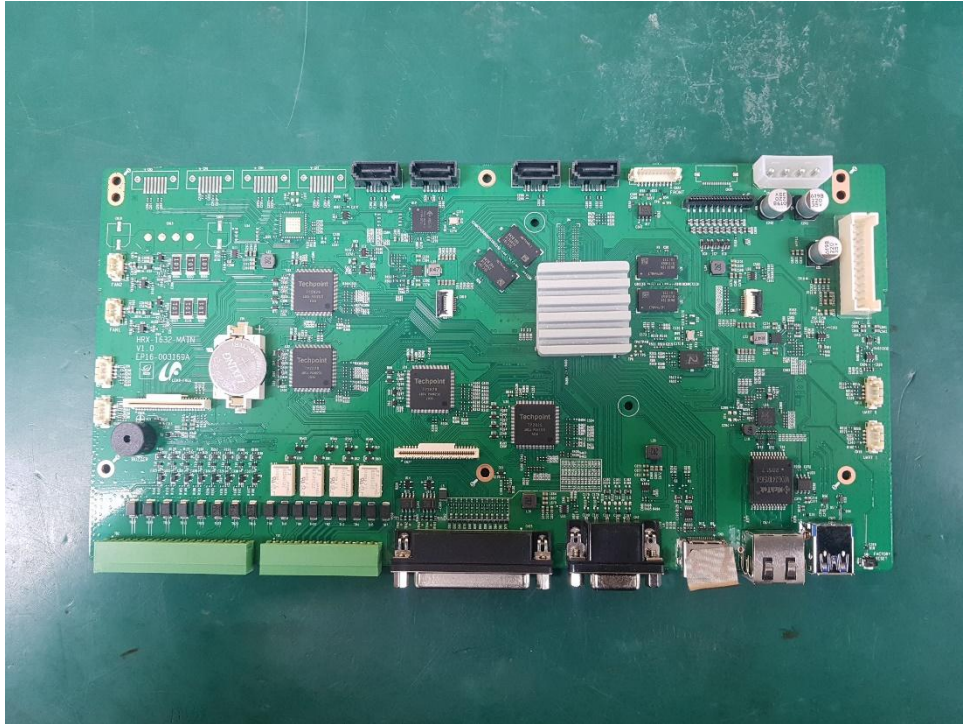
(Bottom)



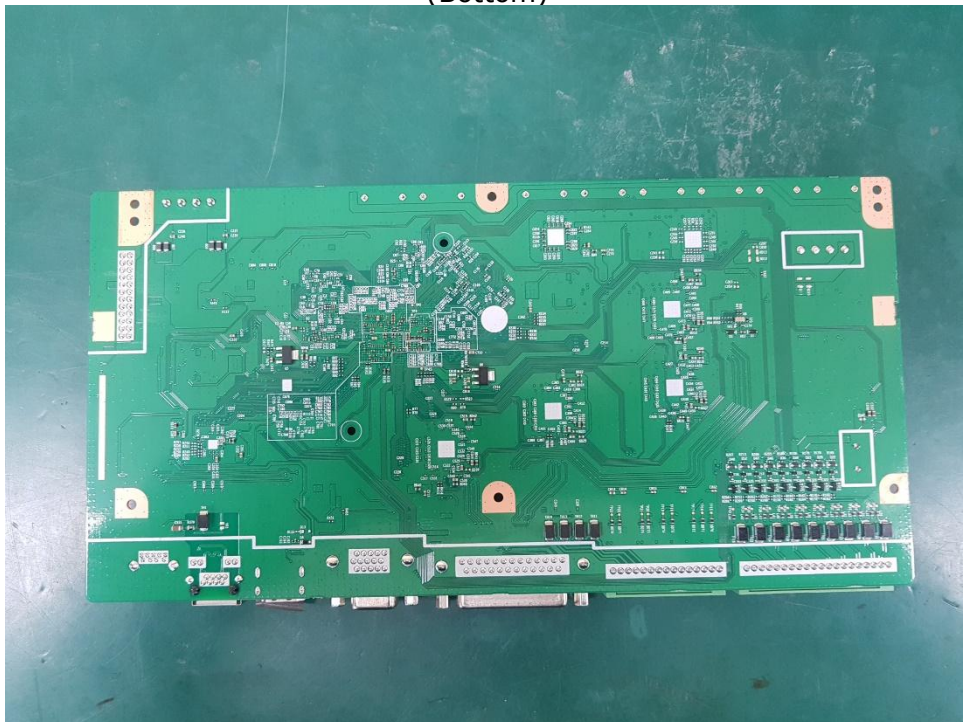
This report shall not be reproduced except in full, without the written approval of KES Co., Ltd.
The results shown in this test report refer only to the sample(s) tested unless otherwise stated.
The authenticity of the test report, contact shchoi@kes.co.kr

EUT Internal View – Board 2

(Top)



(Bottom)



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

EUT Internal View – Board 3

(Top)



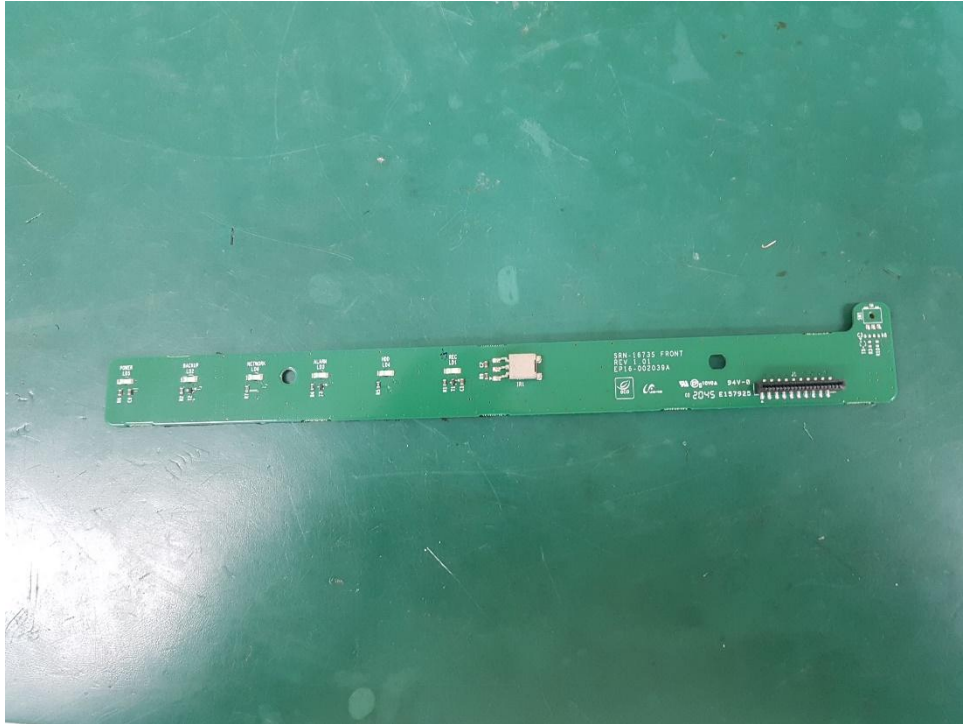
(Bottom)



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

EUT Internal View – Board 4

(Top)



(Bottom)



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

EUT Internal View – HDD

(Top)



(Bottom)



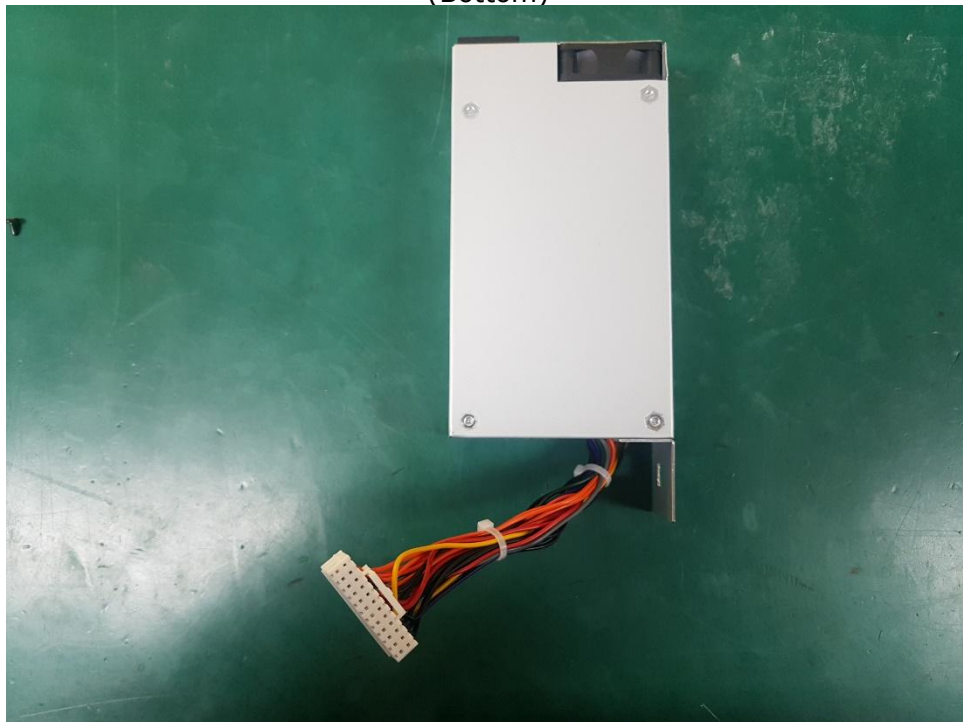
This report shall not be reproduced except in full, without the written approval of KES Co., Ltd.
The results shown in this test report refer only to the sample(s) tested unless otherwise stated.
The authenticity of the test report, contact shchoi@kes.co.kr

EUT Internal View – SMPS

(Top)



(Bottom)



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

Label Photographs



This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.