



EMC TEST REPORT For CE

Test Report No. : KES-E1-17T0434-R1
Date of Issue : Oct. 23, 2017
Product name : DVR
Model/Type No. : HRD-440P
Variant Model : -
Applicant : Hanwha Techwin Co., Ltd.
Applicant Address : 1204, Changwon-daero, Seongsan-gu, Changwon-si,
Gyeongsangnam-do, Korea
Manufacturer : Hanwha Techwin (Tianjin) Co., Ltd.
Manufacturer Address : No.11 Weiliu Rd, Micro-Electronic Industrial
Park, TEDA, Tianjin, 300385, People's Republic of China.
Date of Receipt : Jun. 20, 2017
Test date : Jul. 04, 2017 – Jul. 07, 2017
Test Results : ☒ **In Compliance** ☐ **Not in Compliance**

Tested by

Seong Min, Choi
EMC Test Engineer

Reviewed by

Dong-Hun, Jang
EMC Technical Manager

This test report is not related to KOLAS.

**KES Co., Ltd.**

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

Test report No.:

KES-E1-17T0434-R1

Page (2) of (64)

REPORT REVISION HISTORY

Date	Test Report No.	Revision History
Jul. 12, 2017	KES-E1-17T0434	Issued
Oct. 23, 2017	KES-E1-17T0434-R1	Standard Revision

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



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	8
1.7	E.U.T Operating Mode(s).....	8
1.8	Configuration.....	9
1.9	Calibration Details of Equipment Used for Measurement.....	10
1.10	Test Facility	10
1.11	Laboratory Accreditations and Listings	10
2.0	Test Regulations.....	11
2.1	Conducted Emissions at Mains Power Ports	13
2.2	Conducted Emissions at Telecommunication Ports	14
2.3	Radiated Electric Field Emissions(Below 1 GHz)	15
2.4	Radiated Electric Field Emissions(Above 1 GHz)	16
2.5	Harmonic Current Emissions.....	17
2.6	Voltage Fluctuations and Flicker	18
3.0	Criteria for compliance.....	19
3.1	Electrostatic Discharge.....	21
3.2	Radiated Electric Field Immunity	25
3.3	Electrical Fast Transients/Bursts	28
3.4	Surge Transients	30
3.5	Conducted Disturbance	33
3.6	Voltage Dips and Short Interruptions	36
APPENDIX A	– TEST DATA.....	38
	Conducted Emissions at Mains Power Ports.....	38
	Conducted Emissions at Telecommunication Ports	40
	Radiated Electric Field Emissions(Below 1 GHz)	43
	Radiated Electric Field Emissions(Above 1 GHz)	44
	Harmonic Current Emissions and Voltage Fluctuations and Flicker	48
	Test Setup Photos and Configuration	51
	Conducted Voltage Emissions	51
	Conducted Telecommunication Emissions	52
	Radiated Electric Field Emissions(Below 1 GHz)	53
	Radiated Electric Field Emissions(Above 1 GHz)	54
	Harmonic Current Emissions and Voltage Fluctuations and Flicker	55
	Electrostatic Discharge	56
	Radiated Electric Field Immunity	56
	Electrical Fast Transients/Bursts	57
	Surge Transients	58
	Conducted Disturbance	59
	Voltage Dips and Short Interruptions	60
	EUT External Photographs	61
	EUT Internal Photographs	62



1.0 General Product Description

Main Specifications of E.U.T are:

HRD-440		
Video	Inputs	4channel BNC : AHD(2MP, 4MP), HDTV(Only 2MP), HDCVI(Only 2MP), NTSC/PAL
	Resolution	2560x1440, 2048x1536, 1920 x 1080, 1280 x 720, 960 x 480, 704 x 480 / 960 x 576, 704 x 576
Live	Frame rate	120fps, 100fps
	Resolution	2560x1440, 2048x1536, 1920 x 1080, 1280 x 720, 960 x 480, 704 x 480, 960 x 576, 704 x 576
	Multi Screen display	1/4/PI/Sequence
Performance		
Operating System	Embedded	Linux
Recording	Compression	H.264, Wisestream
	Record Rate(Analog)	NTSC : Up to 60fps@4MP / PAL : Up to 50fps@4MP
		NTSC : Up to 120fps@1920 x 1080 / PAL : Up to 100fps@1920 x 1080
		NTSC : Up to 120fps @ 1280 x 720, 928x480, 704x480, 704x240, 352x240 PAL: Up to 100fps @ 1280 x 720, 928x576, 704x576, 704x288, 352x288
	Mode	Manual, Schedule (Continuous/Event), Event(Pre/Post), Time lapse (1~30 fps(N), 1~25fps(P))
	Event	Video Loss, Motion(Level 1~10), Alarm Input(4), Tampering(Level Low,Medium, High)
	Overwrite modes	Continuous
	Pre-alarm	Up to 30 sec (5,10,20,30 Sec)
	Post-Alarm	Up to 6 hour (5,10,20,30 sec,1,3,5,10,20 min,1,2,3,4,5,6 hour)
Search & Playback	Search mode	Date/time, Event, Back up, POS(SD Signal only), Motion (※ All Search Included Preview Function)
	Playback function	Fast Forward/Backward (x2,x4,x8,x16,x32,x64, x256) ※ Backward Play with I-frame Only, Slow Forward/Backward (x1/2,x1/4,x1/8) Step Forward/Backward ※ Backward Play with I-frame Only
	Simultaneous playback	4CH(Local Monitor, CMS)
Network(IPv4)	Transmission speed	Record(Main) Stream) 4MP : 15fps/CH, 3MP : 18fps/CH, 1080p/720p/WD1/4CIF/CIF : 30fps/CH(N), 25fps/CH(P) Network(Sub) Stream) WD1/4CIF : 12fps/CH, 2CIF/CIF/QVGA/QCUF : 30fps/CH(N), 25fps/CH(P)
	Transmission Bandwidth	Up to 64Mbps
	Bandwidth control	Selectable
	Stream	Record Stream and Network Stream Selectable (at monitoring Viewer)
	Remote users Maximum	Search(3)/Live Unicast(10)/Live Multicast(20)
	Protocol support	TCP/IP,DHCP,PPPoE,SMTP,NTP,HTTP,DDNS,RTP,RTSP,SNMP SUNAPI
	OS	Supported OS : Windows 7, 8, 10, Mac OS X 10.9, 10.10, 10.11
	Web Browser	- Plug-in free web viewer Supported web browsers : Google Chrome 47, MS Edge 20
		- Plug-in Webviewer Supported web browsers : MS Explorer 11, Mozilla Firefox 43, Apple Safari 9 ※ Mac OS X only
	Viewer Software	SSM, Webviewer, SmartViewer, iPOLiS mobile viewer, WiseNet Mobile (~Apr. 2017)
Smart phone	Platform	Android, iOS
	Protocol support	RTP, RTSP, HTTP, CGI(SUNAPI)
	Control	Live(8ch) : Multi-Profile Support Playback(1ch) Event push



KES Co., Ltd.

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

Test report No.:

KES-E1-17T0434-R1

Page (5) of (64)

	Remote users Maximum	Search (3), Live Unicast (10), Multicast (20)
Storage	Internal	1 SATA HDDs (0~6TB HDD)
	External (e-SATA Interface)	USB(for Backup)
	File Format (Back-up)	BU(DVR Player), SEC(Include Player), AVI
Security	Password Protection	1 Admin, 10 Group, 10 User per 1 Group
	Data Authentication	Watermark
Easy Configuration Interface	Easy Configuration	P2P (TUTK) (Jun. 2017 ~)
Monitors	VGA	1 VGA (1920x1080, 1280x1024, 1280x720)
	HDMI	1 HDMI (4K(3840 x 2160), 2K(2560 x 1440), 1920x1080, 1280x1024, 1280x720)
	Composite(Spot)	BNC(1CH) * Included OSD On Screen, Multi mode Support
	Loop Outputs	-
Audio	Inputs/Output	1CH line in / 1CH line out
	Compression	G.711
	Sampling rate	8KHz
Alarm	Inputs/Outputs	Terminal 4 Inputs (NO/NC) / Terminal 1 relay Outputs (NO/NC)
	Remote notification	Notification via e-mail
Connections	Ethernet	1 RJ45 10/100/1000 Base-T
	Serial interface	RS-485(Half Duplex) for PTZ, Samsung System Keyboard
	USB	1 ports(USB 3.0, Rear), 1 ports(USB 2.0, Front)
	e-SATA	N/A
	Application Support	Mouse, IR Remote
	Protocol support(RS-485)	Samsung-E/Samsung-T/Pelco-D/Pelco-p/Panasonic/ Phillips/ AD/ DIAMOND/ ERNA/ KALATEL/ VCL TP/VICON/ ELMO/GE
	Protocol support(Coaxial)	NTSC/PAL : Pelco-C (Coaxitron) AHD : ACP(AHD Coax Protocol)
General		
Electrical	Input Voltage/Current	DC12V Adaptor(100~250V AC ±10% , 50/60Hz)
	Power consumption	Max. 36W (1x1T HDD)
Environmental	Operating Temperature/Humidity	+0°C to +40°C (+32°F to +104°F) / 20% to 85% RH
Mechanical	Dimension (W x H x D)	W300x H 48x D 208.7
	Weight (with hard disks)	Approx. 1.79Kg
Language	GUI	English, French, German, Spanish, Italian, Russian, Polish, Czech, Turkish, Netherlands Portuguese, Swedish, Danish, Rumania, Serbia, Croatia, Hungary, Greek, Finnish, Norwegian, Korean, Japanese, Chinese(Traditional), Thai, Taiwanese(25 Language)
	Web Browser	English, French, German, Italian, Spanish, Russian, Turkish, Polish, Dutch, Swedish, Czech, Portuguese, Danish, Rumanian, Serbian, Croatian, Hungarian, Greek, Norwegian, Finnish, Korean, Chinese(Simplified), Japanese, Thai (23 Language)

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.



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.

Voltage ☒ 230Vac ☐ 100 Vac ☐ 24 Vac ☐ 12 Vdc ☐ PoE

Frequency ☒ 50 Hz ☐ 60 Hz ☐ 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	HRD-440P	-	Hanwha Techwin (Tianjin) Co.,Ltd	E.U.T
Switching Power Adapter	FSP040-RHAN2	-	FSP GROUP INC.	E.U.T

**KES Co., Ltd.**

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

Test report No.:

KES-E1-17T0434-R1

Page (7) of (64)

1.5 Support Equipments

Description	Model Number	Serial Number	Manufacturer	Remarks
Notebook	LG15N54	410NZGK015231	LG	-
Notebook Adapter	ADP-90WH B	84ZW19F1663	DELTA ELECTRONICS(JIANGSU) LTD.	-
Monitor1	SMT-2232	C95V67VF900025B	Weihai Daewoo Electronics Co., Ltd.	-
Monitor2	24M47VQ	702NTQDA3604	LG	-
Monitor Adapter2	ADS-40FSG-19 19025GPG-1	EAY62768621	Shenzhen Honor Electronic Co., Ltd.	-
Monitor3	W2261VT	005NDCRDV451	LG Electronics NanJing Display Co., Ltd	-
Mouse	-	-	-	-
Speaker	SB-700Plus	-	WEMA INT	-
Alarm1	SIP-1201DD D0	-	SAMSUNG TECHWIN CO., LTD.	-
Alarm2	-	-	-	-
CAMERA	SDH-C74041- CAM	-	Hanwha Techwin	-
CAMERA Adapter	FSP060-DIBAN2	-	FSP GROUP INC.	-
USB Memory	SDCZ73	-	SANDISK	-

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.



1.6 External I/O Cabling

Start		END		Cable Spec.	
Description	I/O Port	Description	I/O Port	Length	Shield
DVR (E.U.T)	BNC	Monitor1	VIDEO IN	3.2	S
	D-SUB	Monitor2	D-SUB	1.6	U
	HDMI	Monitor3	HDMI	1.8	U
	RJ-45	Notebook	RJ-45	4.0	U
	VIDEO IN	CAMERA	VIDEO OUT	3.0	U
	AUDIO OUT	Speaker	AUDIO IN	1.9	U
	2PIN	Alarm1	-	3.1	U
	2PIN	Alarm2	-	3.1	U
	USB	USB Memory	-	-	-
	USB	Mouse	-	1.5	U

* Unshielded=U, Shielded=S

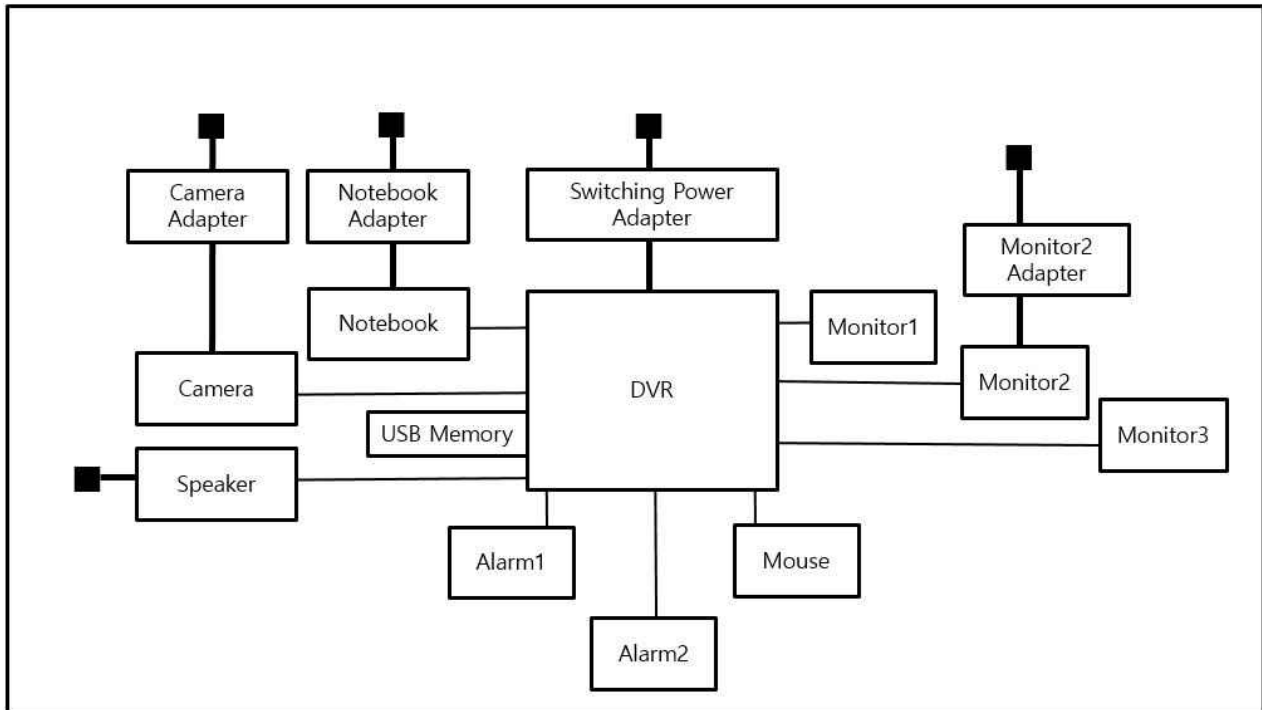
1.7 E.U.T Operating Mode(s)

Test mode	operating
Operating mode	E.U.T Monitoring, Ping Test

E.U.T Test operating S/W		
Name	Version	Manufacture Company
WebViewer	-	Hanwha Techwin Co., Ltd.

1.8 Configuration

■ AC Main
□ DC Main



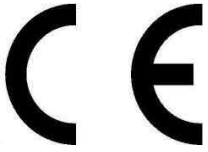
1.9 Calibration Details of Equipment Used for Measurement

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.

1.10 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 and CISPR Publication 22.

1.11 Laboratory Accreditations and Listings

Country	Agency	Scope of Accreditation	Logo
USA	FCC	3 & 10 meter Open Area Test Sites and one conducted site to perform FCC Part 15/18 measurements.	
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-4308, C-4798, T-2311, G-914
KOREA	MSIP	EMI (10 meter Open Area Test Site and two conducted sites) Radio(3 & 10 meter Open Area Test Sites and one conducted site) EMS (ESD, RS, EFT/Burst, Surge, CS, Magnetic, Dips and interruptions)	 KR0100
Canada	IC	3 & 10 meter Open Area Test Sites and one conducted site	 4769B-1
Europe	CE	EMI (10 meter Open Area Test Site and two conducted sites) Radio(3 & 10 meter Open Area Test Sites and one conducted site) EMS (ESD, RS, EFT/Burst, Surge, CS, Magnetic, Dips and interruptions)	
International	KOLAS	EMI (10 meter Open Area Test Site and two conducted sites) Radio(3 & 10 meter Open Area Test Sites and one conducted site) EMS (ESD, RS, EFT/Burst, Surge, CS, Magnetic, Dips and interruptions)	



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 61547:2009

☒ EN 55032:2012

☒ Class A

☐ Class B

☐ EN 55024:2010 +A1:2015

☒ EN 50130-4:2011

☒ EN 61000-3-2:2014

☒ EN 61000-3-3:2013

☐ EN 61326-1:2013



KES Co., Ltd.

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

Test report No.:

KES-E1-17T0434-R1

Page (12) of (64)

☐ **VCCI V-3 / 2015.04**

☐ Class A

☐ Class B

☐ **AS/NZS CISPR22:2009 +A1:2010**

☐ Class A

☐ Class B

☐ **47 CFR Part 15, Subpart B**

☐ CISPR 22:2009 +A1:2010

☐ Class A

☐ Class B

☐ ANSI C63.4-2009

☐ **IC Regulation ICES-003 : 2016**

☐ CAN/CSA CISPR 22-10

☐ Class A

☐ Class B

☐ ANSI C63.4-2014

☐ **RE- Directive 2014/53/EU**

☐ EN 301 489-1 V1.9.2

- ☐ 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.



2.1 Conducted Emissions at Mains Power Ports

Test Date

Jul. 05, 2017

Test Location

Electro wave Shieldroom

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	101781	04, 27, 2018
☒	LISN	ENV216	R & S	101787	01, 11, 2018
☒	LISN	ESH2-Z5	R & S	100450	04, 27, 2018
☒	PULSE LIMITER	ESH3-Z2	R & S	101915	12, 13, 2017

Test Conditions

Temperature: 22,6 °C

Relative Humidity: 47,2 %

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

Remarks

See Appendix A for test data.



2.2 Conducted Emissions at Telecommunication Ports

Test Date

Jul. 05, 2017

Test Location

Electro wave Shieldroom

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	101781	04, 27, 2018
☒	LISN	ENV216	R & S	101787	01, 11, 2018
☒	LISN	ESH2-Z5	R & S	100450	04, 27, 2018
☒	PULSE LIMITER	ESH3-Z2	R & S	101915	12, 13, 2017
☒	8-WIRE ISN CAT3,5	ENY81	R & S	100174	08, 11, 2017
☒	8-WIRE ISN CAT6	ENY81-CAT6	R & S	101665	08, 11, 2017

Test Conditions

Temperature: 22,6 °C

Relative Humidity: 47,2 %

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

Remarks

See Appendix A for test data.



2.3 Radiated Electric Field Emissions(Below 1 GHz)

Test Date

Jul. 04, 2017

Test Location

☐ OPEN AREA TEST SITE #2 ☒ SAC #4(10 m)

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, 18, 2018
☒	AMPLIFIER	SCU 01	R & S	100603	12, 13, 2017
☒	TRILOG-BROADBAND ANTENNA	VULB9163	Schwarzbeck	716	11, 28, 2018

Test Conditions

Temperature: 23,5 °C

Relative Humidity: 51,9 %

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

Remarks

See Appendix A for test data.



2.4 Radiated Electric Field Emissions(Above 1 GHz)

Test Date

Jul. 06, 2017

Test Location

SEMI ANECHOIC CHAMBER #2

Test Equipment

Used	Description	Model Number	Manufacturer	Serial Number	Cal. Due
☒	EMI Test S/W	e3	AUDIX	8.083b	-
☒	EMI TEST RECEIVER	ESU26	R & S	100552	04, 19, 2018
☒	PREAMPLIFIER	8449B	AGILENT	3008A01729	05, 31, 2018
☒	LOG-PERIODIC ANTENNA	STLP 9149	SCHWARZBECK	9149-255	05, 17, 2018

Test Conditions

Temperature: 22,2 °C

Relative Humidity: 43,9 %

Frequency Range of Measurement

1 GHz to 6 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.



2.5 Harmonic Current Emissions

Test Date

Jul. 07, 2017

Test Location

Electro wave Shieldroom

Test Equipment

Used	Description	Model Number	Manufacturer	Serial Number	Cal. Due
☒	EMI Test S/W	dpa.control	EM TEST	5.4.8.0	-
☒	DIGITAL POWER ANALYZER	DPA 500N	EM TEST	V1024106759	08, 08, 2017
☒	POWER SOURCE	ACS 500N6	EM TEST	V1024106760	08, 08, 2017

Test Conditions

Temperature: 21,6 °C

Relative Humidity: 45,8 %

Classification of Equipment for Harmonic Current Emissions

- ☒ Class A
- ☐ Class B
- ☐ Class C(Below 25 W)
- ☐ Class C(Above 25 W)
- ☐ Class D

Test Results

The requirements are:

- ☒ PASS
- ☐ NOT PASS
- ☐ NOT APPLICABLE

Remarks

See Appendix A for test data.



2.6 Voltage Fluctuations and Flicker

Test Date

Jul. 07, 2017

Test Location

Electro wave Shieldroom

Test Equipment

Used	Description	Model Number	Manufacturer	Serial Number	Cal. Due
☒	EMI Test S/W	dpa.control	EM TEST	5.4.8.0	-
☒	DIGITAL POWER ANALYZER	DPA 500N	EM TEST	V1024106759	08, 08, 2017
☒	POWER SOURCE	ACS 500N6	EM TEST	V1024106760	08, 08, 2017

Test Conditions

Temperature: 21,6 °C

Relative Humidity: 45,8 %

Test Results

The requirements are:

- ☒ PASS
☐ NOT PASS
☐ NOT APPLICABLE

Remarks

See Appendix A for test data.

3.0 Criteria for compliance

Criteria for compliance was based on the following guidelines:

EN 50130-4:2011 +A1:2014 Alarm systems-Part 4: Electromagnetic compatibility Product family standard: Immunity requirements for components of fire, intruder and social alarm systems

The variety and the diversity of the apparatus within the scope of this document makes it difficult to define precise criteria for the evaluation of the immunity test results.

If as a result of the application of the tests defined in this standard, the apparatus becomes dangerous or unsafe then the apparatus shall be deemed to have failed the test.

A functional description and a definition of performance by the manufacture and noted in the test report, based on the following criteria:

Electrostatic discharge

There shall be no damage, malfunction or change of status due to the conditioning.

Flickering of an indicator during the application of discharge is permissible, providing that is no residual change in the EUT or any change in outputs, which could be interpreted by associated equipment as a change.

Radiated electromagnetic fields

There shall be no damage, malfunction or change of status due to the conditioning.

Flickering of an indicator during the application of discharge is permissible, providing which could be interpreted by associated equipment as a change, and no such

Flickering of indicators occurs at a field strength of 3 V/m.

For components of CCTV systems, where the picture is allowed at 10 V/m, providing.

(a) there is no permanent damage or change to EUT

(e.g. no corruption of memory or changes to programmable setting etc.)

(b) at 3 V/m, any deterioration of the picture is so minor that the system could still be used; and

(c) there is no observable deterioration of the picture at 1 V/m.

Fast transient burst / slow high energy voltage surge

There shall be no damage, malfunction or change of status due to the conditioning.

Flickering of an indicator during the application of discharge is permissible, providing

That there is no residual is permissible, providing that there is no residual change in the EUT or any change in outputs, which could be interpreted by associated equipment as a change.

Conducted RF immunity

There shall be no damage, malfunction or change of status due to the conditioning.

Flickering of an indicator during the application of discharge is permissible, providing

That there is no residual is permissible, providing that there is no residual change in the EUT or any change in outputs, which could be interpreted by associated equipment as a change,
and no such flickering of indicators oeuvres at $U = 130 \text{ dB}\mu\text{V}$.

For component of CCTV systems, where the status is monitored by observing the TV picture,
then deterioration of the picture is allowed at $U = 140 \text{ dB}\mu\text{V}$, providing:

- (a) there is no permanent damage or change to the EUT
(e.g. no corruption of memory or changes to programmable settings etc.)
- (b) at $U = 130 \text{ dB}\mu\text{V}$, any deterioration of the picture is so minor that the system could still be used; and
- (c) there in no observable deterioration of the picture at $U = 120 \text{ dB}\mu\text{V}$.

Voltage dip/interruption / Voltage variation

There shall be no damage, malfunction or change of status due to the conditioning.

Flickering of an indicator during the conditioning is permissible, providing that there is no residual change in the EUT or any change in outputs, which could be interpreted by associated equipment as a change. The EUT shall meet the acceptance criteria for the functional test, after the conditioning.



3.1 Electrostatic Discharge

Reference Standard

EN 61000-4-2:2009

Test Date

Jul. 07, 2017

Test Location

EMS-ESD: Electro wave Shieldroom

Test Equipment

Used	Description	Model Number	Manufacturer	Serial Number	Cal. Due
☒	EMS Test S/W	-	-	-	-
☒	ESD SIMULATOR	ESS-2000	Noise Ken	ESS01Z0454	10, 14, 2017
☒	HCP	-	KES	-	-
☒	VCP	-	KES	-	-

Test Conditions

Temperature: 22,4 °C
Relative Humidity: 46,0 %
Atmospheric Pressure: 99,3 kPa



KES Co., Ltd.

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

Test report No.:

KES-E1-17T0434-R1

Page (22) of (64)

Test Specifications

Discharge Factor: ≥ 1 s

Discharge Impedance: 330 ohm / 150 pF

Kind of Discharge: Air, Contact (direct and indirect)

Polarity: Positive and Negative

Number of Discharge: 10 at all locations for Air discharge
10 at all locations for Contact discharge

Discharge Voltage:	Contact	Air	HCP	VCP
	☐ 2 kV	☒ 2 kV	☐ 2 kV	☐ 2 kV
	☐ 4 kV	☒ 4 kV	☐ 4 kV	☐ 4 kV
	☒ 6 kV	☐ 6 kV	☒ 6 kV	☒ 6 kV
	☐ 8 kV	☒ 8 kV	☐ 8 kV	☐ 8 kV
	☐ 15 kV	☐ 15 kV	☐ 15 kV	☐ 15 kV

Notes: HCP: Horizontal coupling plane

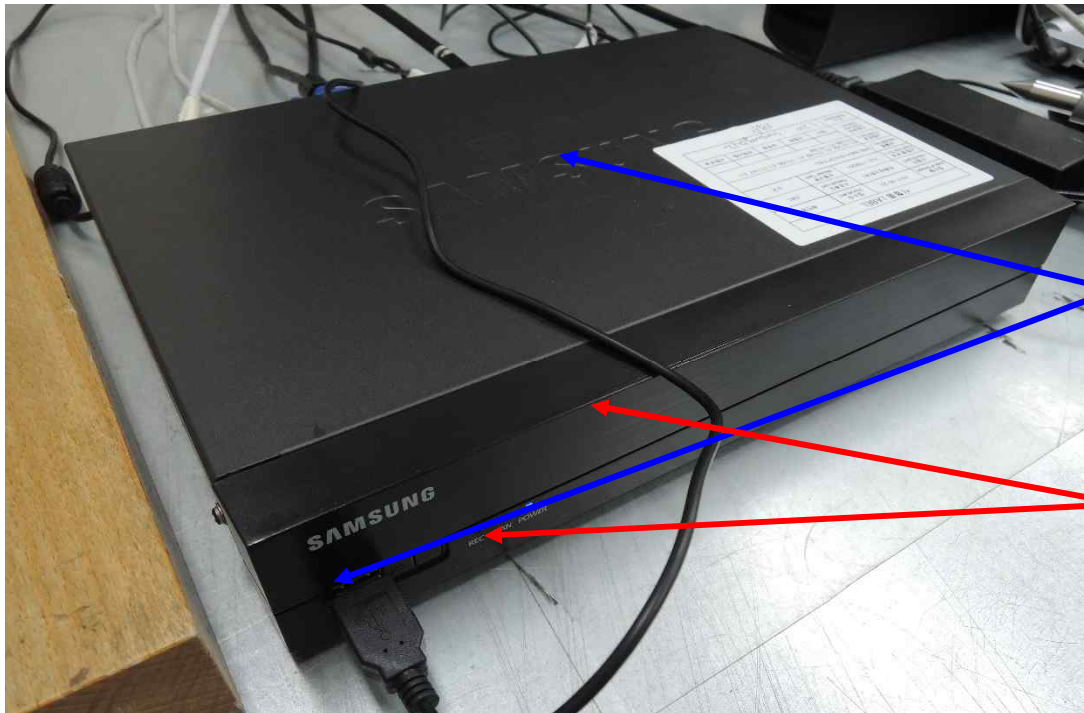
VCP: Vertical coupling plane

Required Performance Criteria: ☒ Complied

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.

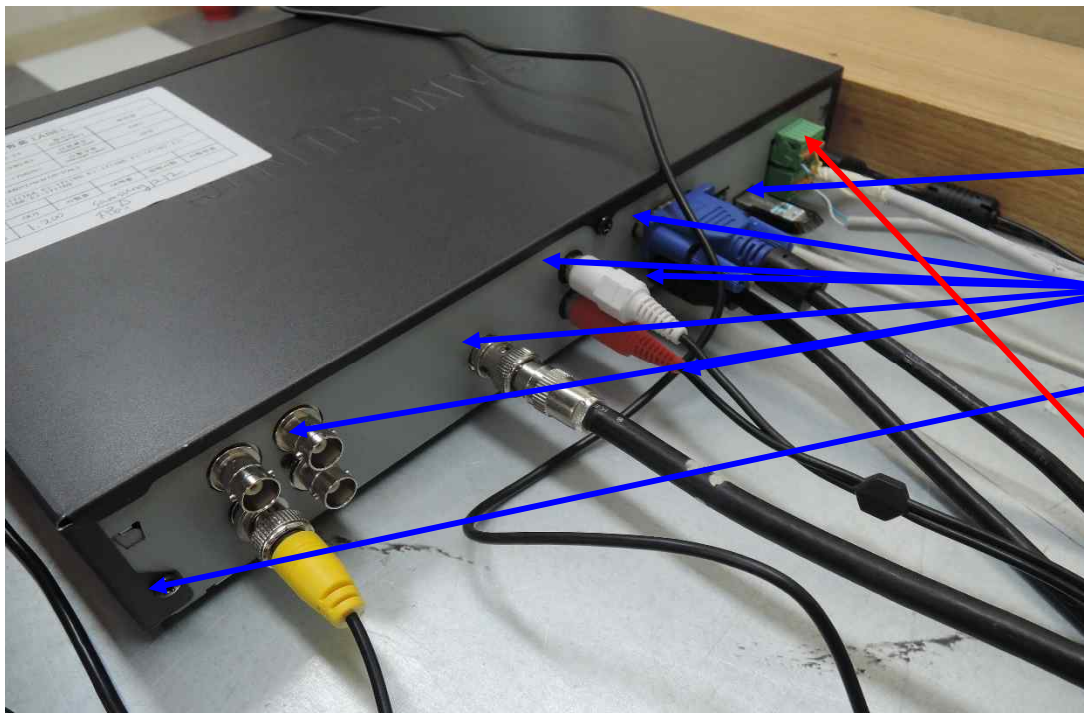
Location of Discharge:

Air
Contact



1

4



1

2

3

5

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.

**KES Co., Ltd.**

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

Test report No.:

KES-E1-17T0434-R1

Page (24) of (64)

Test Data

Indirect Discharge

No.	Test Point	Discharge Method	Observations	Remarks
1	HCP Contact	Contact Discharge	Complied	-
2	VCP Contact	Contact Discharge	Complied	-

Direct Discharge

No.	Test Point	Discharge Method	Observations	Remarks
1	Enclosure, Port(USB)	Contact Discharge	Complied	-
2	Port (BNC, VIDEO IN, AUDIO OUT, D-SUB, HDMI)	Contact Discharge	Complied	-
3	Screw	Contact Discharge	Complied	-
4	Enclosure(Front), LED	Air Discharge	Complied	-
5	Port (Alarm)	Air Discharge	Complied	-

Note: "Blank" = Not performed

Observations:

Complied – No degradation of function

Test Results

- ☒ PASS Required Performance Criteria
☐ NOT PASS Required Performance Criteria

Remarks

PASS Required Performance Criteria.

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.



3.2 Radiated Electric Field Immunity

Reference Standard

EN 61000-4-3:2006 +A2:2010

Test Date

Jul. 06, 2017

Test Location

EMS-RS: ☒ SEMI ANECHOIC CHAMBER #2☐ SEMI ANECHOIC CHAMBER #3

Test Equipment

Used	Description	Model Number	Manufacturer	Serial Number	Cal. Due
☒	EMS Test S/W	KTI_RS2012	KOREA TECHNOLOGY INSTITUTE CO., LTD	2.1.1	-
☒	SIGNAL GENERATOR	ESG-3000A	HP	US37040210	11, 01, 2017
☒	AMPLIFIER	ITA0300-200	Infinitech	-	11, 01, 2017
☒	AMPLIFIER	ITA0750-200	Infinitech	-	11, 01, 2017
☒	AMPLIFIER	ITA1500-100	Infinitech	-	11, 01, 2017
☒	AMPLIFIER	ITA2500-100	Infinitech	-	11, 01, 2017
☒	POWER METER	E4419B	Agilent	MY45101506	06, 26, 2018
☒	AVERAGE POWER SENSOR	E9301A	Agilent	-	06, 26, 2018
☒	AVERAGE POWER SENSOR	E9301A	Agilent	MY41495698	06, 26, 2018
☒	STACKED DOUBLE LOG-PER- ANTENNA	STPL9128 D	SCHWARZBECK	9128D038	-

Test Conditions

Temperature: 22,2 °C
Relative Humidity: 43,9 %
Atmospheric Pressure: 99,3 kPa



Test Specifications

Antenna Polarization: Horizontal & vertical unless indicated otherwise

Antenna Distance: ☒ 3 m

Field Strength: ☐ 1 V/m ☐ 3 V/m
☒ 10 V/m

Frequency Range: ☐ 80 MHz to 1 GHz ☐ 1,4 GHz to 2,7 GHz
☒ 80 MHz to 2,7 GHz

Modulation: ☒ AM, 80 %, 1 kHz sine wave
☒ PM, 1 Hz (0,5 s ON : 0,5 s OFF)

Frequency step: ☒ 1 % step

Dwell Time: ☒ 1 s ☐ 3 s

of Sides Radiated: ☒ 4

Required Performance Criteria: ☒ Complied

**KES Co., Ltd.**

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

Test report No.:

KES-E1-17T0434-R1

Page (27) of (64)

Test Data

Side Exposed	Observations	
	Horizontal	Vertical
Front	Complied	Complied
Right	Complied	Complied
Back	Complied	Complied
Left	Complied	Complied

Note: "Blank" = Not performed

Observations:

Complied – No degradation of function

Test Results

- ☒ PASS Required Performance Criteria
☐ NOT PASS Required Performance Criteria

Remarks

PASS Required Performance Criteria.

3.3 Electrical Fast Transients/Bursts

Reference Standard

EN 61000-4-4:2012

Test Date

Jul. 07, 2017

Test Location

EMS-EFT: Electro wave Shieldroom

Test Equipment

Used	Description	Model Number	Manufacturer	Serial Number	Cal. Due
☒	EMS Test S/W	iec.control	EM TEST	5.4.7	-
☒	ULTRA COMPACT SIMULATOR	UCS 500N7	EM TEST	P1608172950	11, 28, 2017
☒	MOTOR VARIAC	MV2616	EM TEST	P1552169719	11, 28, 2017
☒	CAPACITIVE COUPLING CLAMP	HFK	EM TEST	P1633183115	11, 28, 2017

Test Conditions

Temperature: 22,4 °C
Relative Humidity: 46,0 %
Atmospheric Pressure: 99,3 kPa

Test Specifications

Pulse Amplitude & Polarity: (AC Power Lines)	☐ ± 1.0 kV ☐ ± 4.0 kV	☒ ± 2.0 kV
Pulse Amplitude & Polarity: (Other supply / Signal Lines)	☐ ± 0.5 kV ☐ ± 2.0 kV	☒ ± 1.0 kV
Burst Period:	☒ 300 ms	☐ 2 s
Repetition Rate:	☐ 5 kHz	☒ 100 kHz
Duration of Test Voltage:	☒ ≥ 1 min	
Required Performance Criteria:	☒ Complied	



Test Data

☒ Input a.c. power ports – Coupling/Decoupling Network used

Mode of Application	Observations	
	(+) Burst (kV)	(-) Burst (kV)
L – N – PE	Complied	Complied

☐ Input d.c. power ports – Coupling/Decoupling Network used

Mode of Application	Observations	
	(+) Burst (kV)	(-) Burst (kV)
-	-	-

☒ Signal ports and telecommunication ports – Coupling Clamp used

Mode of Application	Observations	
	(+) Burst (kV)	(-) Burst (kV)
BNC	Complied	Complied
RJ-45	Complied	Complied
VIDEO IN	Complied	Complied
Alarm 1,2	Complied	Complied

Note: “Blank” = Not performed

Observations:

Complied – No degradation of function

Test Results

☒ PASS Required Performance Criteria

☐ NOT PASS Required Performance Criteria

Remarks

PASS Required Performance Criteria.



3.4 Surge Transients

Reference Standard

EN 61000-4-5:2014

Test Date

Jul. 07, 2017

Test Location

EMS-Surge: Electro wave Shieldroom

Test Equipment

Used	Description	Model Number	Manufacturer	Serial Number	Cal. Due
☒	EMS Test S/W	iec.control	EM TEST	5.3.9	-
☒	ULTRA COMPACT SIMULATOR	UCS 500N5T	EM TEST	P1317117973	02, 08, 2018
☒	MOTOR VARIAC	MV2616	EM TEST	V0936105123	02, 08, 2018
☒	CDN	CNV 508N1	EM TEST	P1551168979	04, 26, 2018
☒	EMS Test S/W	iec.control	EM TEST	5.4.7	-
☒	ULTRA COMPACT SIMULATOR	UCS 500N7	EM TEST	P1608172950	11, 28, 2017
☒	MOTOR VARIAC	MV2616	EM TEST	P1552169719	11, 28, 2017

Test Conditions

Temperature: 22,4 °C
Relative Humidity: 46,0 %
Atmospheric Pressure: 99,3 kPa



Test Specifications

AC Power Lines

Source Impedance: 12 ohm for common mode and 2 ohm for differential mode

Surge Amplitude :

Common Mode

☒ (0,5 / 1,0 / 2,0) kV

Differential Mode

☒ (0,5 / 1,0) kV

Number of Surges:

☒ 5 surges per angle

Angle:

☒ 0°, 90°, 180°, 270° (input a.c. power port)

Polarity:

☒ Positive & Negative

Repetition Rate:

☒ 1 surge per min ☐ 1 surge per 30 sec.

Required Performance Criteria: ☒ Complied

Other supply / Signal Lines

Source Impedance: 42 ohm for common mode

Surge Amplitude:

Common Mode

☒ (0,5 / 1,0) kV

Number of Surges:

☒ 5 Surges

Polarity:

☒ Positive & Negative

Repetition Rate:

☒ 1 surge per min ☐ 1 surge per 30 sec.

Required Performance Criteria: ☒ Complied

**KES Co., Ltd.**

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

Test report No.:

KES-E1-17T0434-R1

Page (32) of (64)

Test Data☒ Line to Line – Differential Mode

Mode of Application	Observations	
	(+) Surge (kV)	(-) Surge (kV)
L – N	Complied	Complied
L – PE	Complied	Complied
N – PE	Complied	Complied

☐ Line to Earth – Common Mode

Mode of Application	Observations	
	(+) Surge (kV)	(-) Surge (kV)
-	-	-

Signal Lines☒ Line to Earth – Common Mode

Mode of Application	Observations	
	(+) Surge (kV)	(-) Surge (kV)
RJ-45	Complied	Complied
BNC	Complied	Complied

Note: “Blank” = Not performed

Observations:

Complied – No degradation of function

Test Results

- ☒ PASS Required Performance Criteria
☐ NOT PASS Required Performance Criteria

Remarks

PASS Required Performance Criteria.

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.



3.5 Conducted Disturbance

Reference Standard

EN 61000-4-6:2014

Test Date

Jul. 07, 2017

Test Location

EMS-CS: Electro wave Shieldroom

Test Equipment

Used	Description	Model Number	Manufacturer	Serial Number	Cal. Due
☒	EMS Test S/W	icd.control	EM TEST	5.3.11	-
☒	CONTINUOUS WAVE SIMULATOR	CWS 500N1.4	EM TEST	P1602169880	11, 28, 2017
☒	ATTENUATOR	ATT 6/80	EM TEST	P1614178148	11, 28, 2017
☒	CDN	CDN M016	TESEQ	43694	11, 28, 2017
☒	CDN	CDN T800	TESEQ	42800	11, 28, 2017
☒	EM CLAMP	KEMZ 801A	TESEQ	44099	11, 30, 2017

Test Conditions

Temperature: 23,0 °C
Relative Humidity: 46,9 %
Atmospheric Pressure: 99,1 kPa



KES Co., Ltd.

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

Test report No.:

KES-E1-17T0434-R1

Page (34) of (64)

Test Specifications

Frequency range:

☒ 150 kHz to 100 MHz

☐ 150 kHz to 80 MHz

Voltage Level:

☐ 1 Vrms

☐ 3 Vrms

☒ 10 Vrms

Modulation:

☒ AM, 80 %, 1 kHz sine wave

☒ PM, 1 Hz (0,5 s ON : 0,5 s OFF)

Frequency step:

☒ 1 % step

Dwell Time:

☒ 1 s

☐ 3 s

Required Performance Criteria: ☒ Complied

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.



Test Data

☒ Input a.c. power ports

Coupling Location (Line Stressed)	Coupling Method	Observations
L – N – PE	CDN (☐ M2, ☒ M3)	Complied

☐ Input d.c. power ports

Coupling Location (Line Stressed)	Coupling Method	Observations
-	CDN (☐ M2, ☐ M3)	-

☒ Signal ports and telecommunication ports

Coupling Location (Line Stressed)	Coupling Method	Observations
BNC	EM Injection Clamp	Complied
VIDEO IN	EM Injection Clamp	Complied
Alarm 1,2	EM Injection Clamp	Complied
RJ-45	CDN T800	Complied

Notes: CDN = Coupling Decoupling Network
"blank" = Not performed

Observations:

Complied – No degradation of function

Test Results

☒ PASS Required Performance Criteria

☐ NOT PASS Required Performance Criteria

Remarks

PASS Required Performance Criteria.



3.6 Voltage Dips and Short Interruptions

Reference Standard

EN 61000-4-11:2004

Test Date

Jul. 07, 2017

Test Location

EMS-Voltage dip: Electro wave Shieldroom

Test Equipment

Used	Description	Model Number	Manufacturer	Serial Number	Cal. Due
☒	EMS Test S/W	iec.control	EM TEST	5.4.7	-
☒	ULTRA COMPACT SIMULATOR	UCS 500N7	EM TEST	P1608172950	11, 28, 2017
☒	MOTOR VARIAC	MV2616	EM TEST	P1552169719	11, 28, 2017

Test Conditions

Temperature: 22,4 °C
Relative Humidity: 46,0 %
Atmospheric Pressure: 99,3 kPa



Test Specifications & Observations/Remarks

(Test Voltage : 50 Hz)

<u>Test Level</u>	<u>Duration [in period/ms (50 Hz)]</u>	<u>Results</u>
☒ 20 % dip	☒ 250 / 5000	<u>Complied</u>
☒ 30 % dip	☒ 25 / 500	<u>Complied</u>
☒ 60 % dip	☒ 10 / 200	<u>Complied</u>
☒ 100 % dip	☒ 250 / 5000	<u>Complied</u>

- Voltage variations

☒ Unom + 10 %	☒ 253.0 V (ac)	<u>Complied</u>
<u>Complied</u>		
☒ Unom - 15 %	☒ 195.5 V (ac)	<u>Complied</u>

Observations:

Complied – No degradation of function

Test Results

- ☒ PASS Required Performance Criteria
- ☐ NOT PASS Required Performance Criteria
- ☐ NOT APPLICABLE

Remarks

PASS Required Performance Criteria.

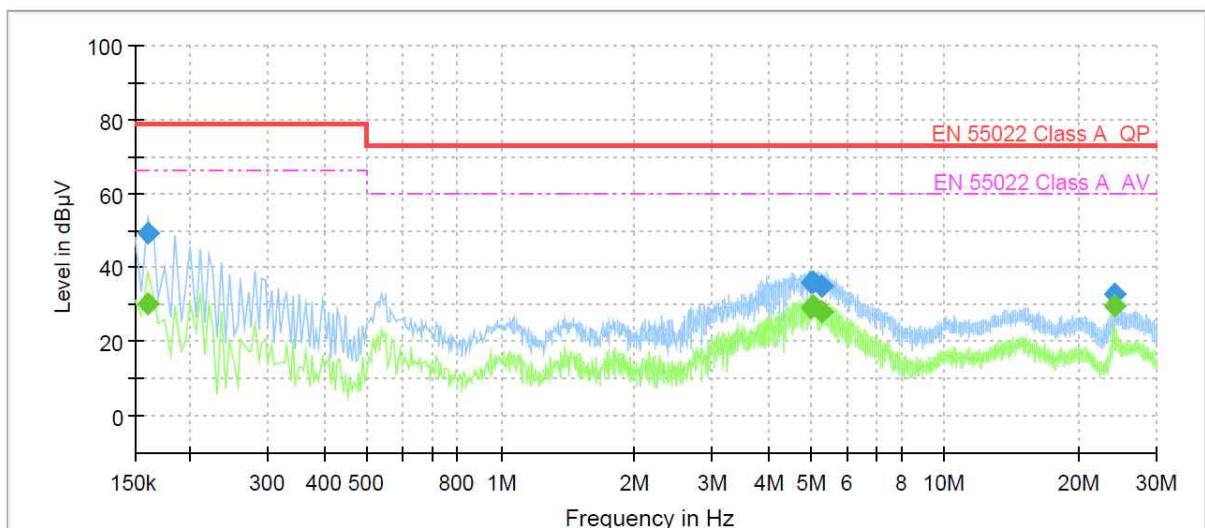
APPENDIX A – TEST DATA

Conducted Emissions at Mains Power Ports

[HOT]

Common Information

Test Description:	Conducted Emission
Model No.:	HRD-440P
Mode	AC230V50HZ
Operator Name:	KES



Final Result

Frequency (MHz)	QuasiPeak (dBμV)	CAverage (dBμV)	Limit (dBμV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.160000	---	30.00	66.00	36.00	1000.0	9.000	L1	20.9
0.160000	48.99	---	79.00	30.01	1000.0	9.000	L1	20.9
4.985000	---	29.39	60.00	30.61	1000.0	9.000	L1	19.7
4.985000	35.93	---	73.00	37.07	1000.0	9.000	L1	19.7
5.040000	---	29.58	60.00	30.42	1000.0	9.000	L1	19.7
5.040000	35.81	---	73.00	37.19	1000.0	9.000	L1	19.7
5.285000	---	27.82	60.00	32.18	1000.0	9.000	L1	19.8
5.285000	35.00	---	73.00	38.00	1000.0	9.000	L1	19.8
24.015000	---	29.71	60.00	30.29	1000.0	9.000	L1	20.4
24.015000	32.70	---	73.00	40.30	1000.0	9.000	L1	20.4

♦ Calculation

QuasiPeak [dBμV] / CAverage [dBμV] = Reading Value [dBμV] + Corr. [dB]

QuasiPeak / CAverage : The Final Value

Reading Value : Not shown in the table.

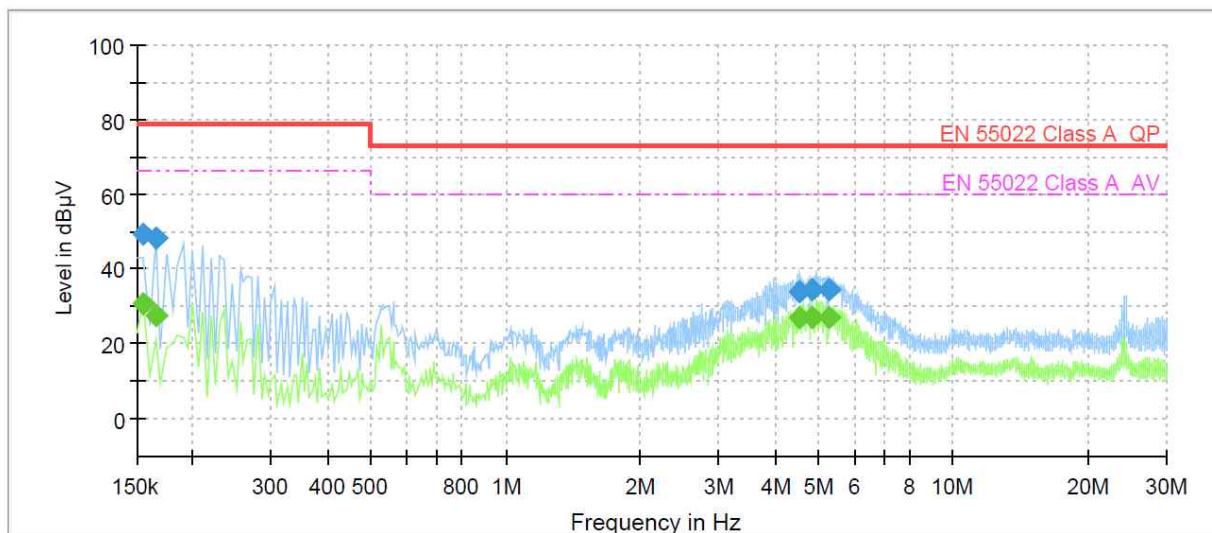
Corr. : Correction values (LISN FACTOR + (Cable Loss + Pulse Limiter FACTOR))



[NEUTRAL]

Common Information

Test Description: Conducted Emission
Model No.: HRD-440P
Mode: AC230V50HZ
Operator Name: KES



Final Result

Frequency (MHz)	QuasiPeak (dBμV)	CAverage (dBμV)	Limit (dBμV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.155000	---	30.46	66.00	35.54	1000.0	9.000	N	20.9
0.155000	49.06	---	79.00	29.94	1000.0	9.000	N	20.9
0.165000	---	27.80	66.00	38.20	1000.0	9.000	N	20.9
0.165000	47.96	---	79.00	31.04	1000.0	9.000	N	20.9
4.555000	---	26.78	60.00	33.22	1000.0	9.000	N	19.7
4.555000	33.88	---	73.00	39.12	1000.0	9.000	N	19.7
4.850000	---	27.20	60.00	32.80	1000.0	9.000	N	19.7
4.850000	34.66	---	73.00	38.34	1000.0	9.000	N	19.7
5.280000	---	26.99	60.00	33.01	1000.0	9.000	N	19.7
5.280000	34.36	---	73.00	38.64	1000.0	9.000	N	19.7

◆ Calculation

QuasiPeak[dBuV] / CAverage [dBuV] = Reading Value[dBuV] + Corr. [dB]

QuasiPeak / CAverage : The Final Value

Reading Value : Not shown in the table.

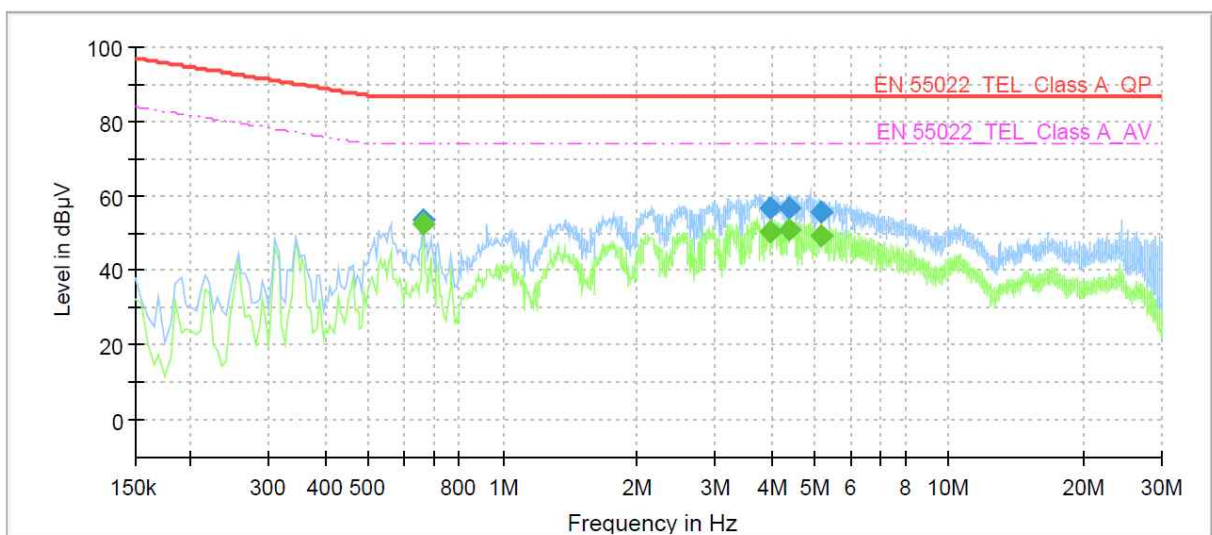
Corr. : Correction values (LISN FACTOR + (Cable Loss + Pulse Limiter FACTOR))

Conducted Emissions at Telecommunication Ports

[10 Mbps]

Common Information

Test Description: Telecommunication Emission
Model No.: HRD-440P
Mode: 10M
Operator Name: KES



Final Result

Frequency (MHz)	QuasiPeak (dBμV)	CAverage (dBμV)	Limit (dBμV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.665000	---	52.59	74.00	21.41	1000.0	9.000	Single Line	20.2
0.665000	53.62	---	87.00	33.38	1000.0	9.000	Single Line	20.2
3.975000	---	50.18	74.00	23.82	1000.0	9.000	Single Line	19.4
3.975000	56.60	---	87.00	30.40	1000.0	9.000	Single Line	19.4
4.385000	---	50.63	74.00	23.37	1000.0	9.000	Single Line	19.4
4.385000	56.54	---	87.00	30.46	1000.0	9.000	Single Line	19.4
5.160000	---	49.46	74.00	24.54	1000.0	9.000	Single Line	19.5
5.160000	55.56	---	87.00	31.44	1000.0	9.000	Single Line	19.5

◆ Calculation

QuasiPeak [dBμV] / CAverage [dBμV] = Reading Value [dBμV] + Corr. [dB]

QuasiPeak / CAverage : The Final Value

Reading Value : Not shown in the table.

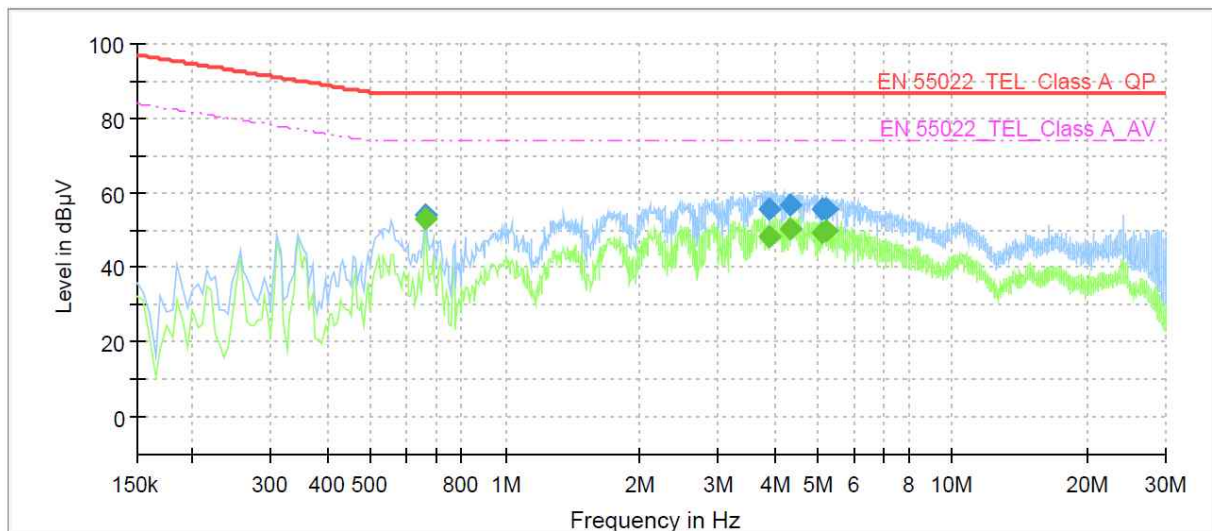
Corr. : Correction values (ISN FACTOR + (Cable Loss + Pulse Limiter FACTOR))



[100 Mbps]

Common Information

Test Description: Telecommunication Emission
Model No.: HRD-440P
Mode: 100M
Operator Name: KES



Final Result

Frequency (MHz)	QuasiPeak (dBμV)	CAverage (dBμV)	Limit (dBμV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.665000	---	52.87	74.00	21.13	1000.0	9.000	Single Line	20.5
0.665000	53.96	---	87.00	33.04	1000.0	9.000	Single Line	20.5
3.890000	---	47.94	74.00	26.06	1000.0	9.000	Single Line	19.7
3.890000	55.69	---	87.00	31.31	1000.0	9.000	Single Line	19.7
4.350000	---	50.10	74.00	23.90	1000.0	9.000	Single Line	19.7
4.350000	56.76	---	87.00	30.24	1000.0	9.000	Single Line	19.7
5.130000	---	49.24	74.00	24.76	1000.0	9.000	Single Line	19.7
5.130000	55.72	---	87.00	31.28	1000.0	9.000	Single Line	19.7
5.225000	---	49.72	74.00	24.28	1000.0	9.000	Single Line	19.7
5.225000	55.68	---	87.00	31.32	1000.0	9.000	Single Line	19.7

◆ Calculation

QuasiPeak[dBμV] / CAverage [dBμV] = Reading Value[dBμV] + Corr. [dB]

QuasiPeak / CAverage : The Final Value

Reading Value : Not shown in the table.

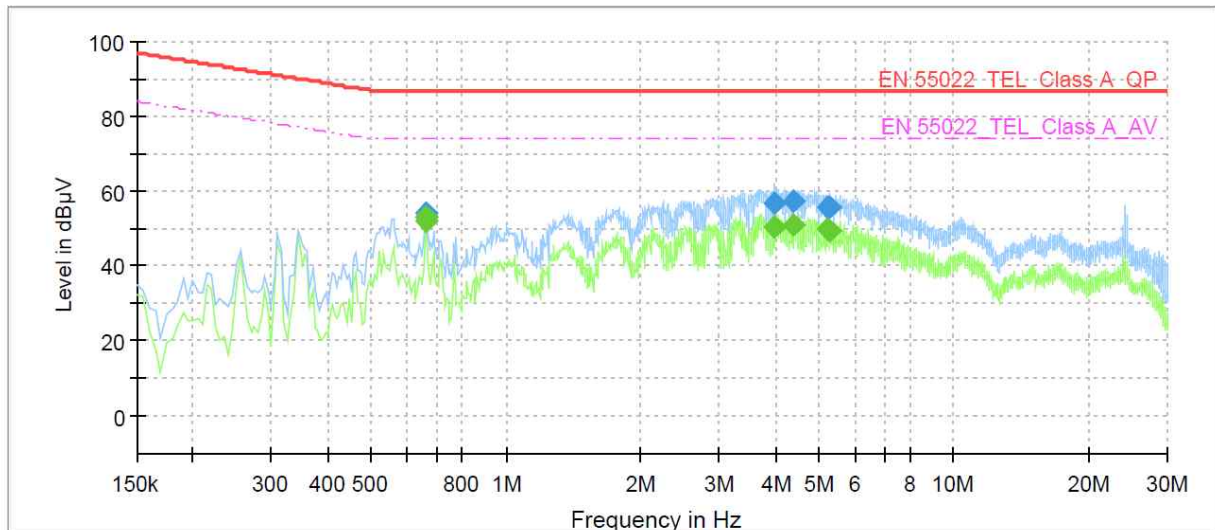
Corr. : Correction values (ISN FACTOR + (Cable Loss + Pulse Limiter FACTOR))



[1 000 Mbps]

Common Information

Test Description: Telecommunication Emission
Model No.: HRD-440P
Mode: 1000M
Operator Name: KES



Final Result

Frequency (MHz)	QuasiPeak (dBμV)	CAverage (dBμV)	Limit (dBμV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.660000	---	52.00	74.00	22.00	1000.0	9.000	Single Line	20.4
0.660000	53.15	---	87.00	33.85	1000.0	9.000	Single Line	20.4
0.665000	---	52.81	74.00	21.19	1000.0	9.000	Single Line	20.4
0.665000	53.88	---	87.00	33.12	1000.0	9.000	Single Line	20.4
3.975000	---	50.12	74.00	23.88	1000.0	9.000	Single Line	19.6
3.975000	56.58	---	87.00	30.42	1000.0	9.000	Single Line	19.6
4.395000	---	51.02	74.00	22.98	1000.0	9.000	Single Line	19.7
4.395000	56.90	---	87.00	30.10	1000.0	9.000	Single Line	19.7
5.225000	---	49.74	74.00	24.26	1000.0	9.000	Single Line	19.7
5.225000	55.69	---	87.00	31.31	1000.0	9.000	Single Line	19.7
5.265000	---	49.47	74.00	24.53	1000.0	9.000	Single Line	19.7
5.265000	55.51	---	87.00	31.49	1000.0	9.000	Single Line	19.7

◆ Calculation

QuasiPeak[dBuV] / CAverage [dBuV] = Reading Value[dBuV] + Corr. [dB]

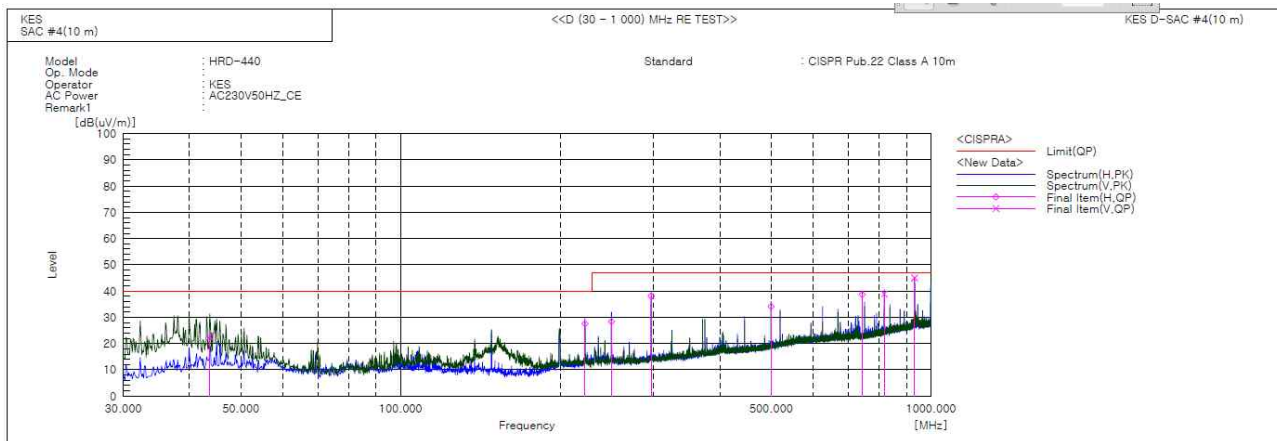
QuasiPeak / CAverage : The Final Value

Reading Value : Not shown in the table.

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



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	932.002	V	56.0	-11.0	45.0	47.0	2.0	213.0	3.0	
2	222.788	H	54.5	-26.9	27.6	40.0	12.4	400.0	333.0	
3	296.993	H	62.9	-24.8	38.1	47.0	8.9	400.0	11.0	
4	499.965	H	52.9	-18.7	34.2	47.0	12.8	200.0	304.0	
5	742.586	H	53.3	-14.6	38.7	47.0	8.3	100.0	35.0	
6	816.791	V	52.1	-13.2	38.9	47.0	8.1	400.0	178.0	
7	43.701	V	51.0	-28.4	22.6	40.0	17.4	150.0	186.0	
8	249.948	H	54.5	-26.1	28.4	47.0	18.6	400.0	333.0	

◆ Calculation – SAC #4(10 m)

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

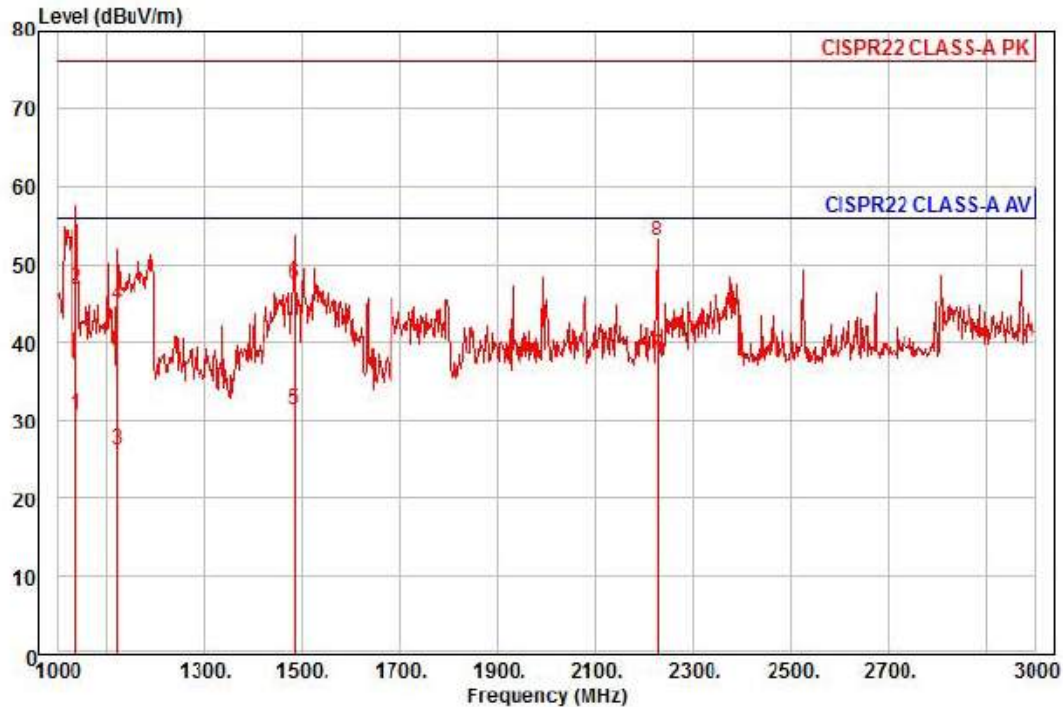
Margin(QP)[dB] = Limit[dB(μV/m)] - Result(QP) [dB(μV/m)]

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

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



Radiated Electric Field Emissions(Above 1 GHz)



Site : chamber
Condition: CISPR22 CLASS-A PK 3m STLP9149(RRA CAL 2017-05-18) horizontal
: RBW:1000.000kHz VBW:1000.000kHz SWT:Auto
Project :
Model : HRD-440P
Mode : AC230V 50HZ
Memo : (1 - 3)GHZ

	Freq	Read Level	Ant Factor	Cable Loss	Preamp Factor	TPos	Limit Line	Over Limit	Pol/Phase	Remark
	MHz	dBuV	dB/m	dB	dB	deg	dBuV/m	dB		
1	1038.00	37.56	22.62	6.60	36.03	295	56.00	-25.25	horizontal	Average
2	1038.00	53.69	22.62	6.60	36.03	295	76.00	-29.12	horizontal	Peak
3	1120.00	32.47	22.86	6.88	35.95	348	56.00	-29.74	horizontal	Average
4	1120.00	51.17	22.86	6.88	35.95	348	76.00	-31.04	horizontal	Peak
5	1484.00	35.16	23.97	7.97	35.63	336	56.00	-24.53	horizontal	Average
6	1484.00	51.14	23.97	7.97	35.63	336	76.00	-28.55	horizontal	Peak
7 pp	2228.00	37.15	26.70	9.87	35.26	35	56.00	-17.54	horizontal	Average
8 pk	2228.00	51.57	26.70	9.87	35.26	35	76.00	-23.12	horizontal	Peak

◆ Calculation

Over Limit [dB] = (Read Level[dB μ V] + Ant Factor[dB/m] + Cable Loss [dB] - Preamp Factor [dB]) - Limit Line[dB μ V]

Over Limit : Margin, Read Level : Reading value, Ant Factor : ANT Factor,

Cable Loss : Cable loss, Preamp Factor : Preamp Factor



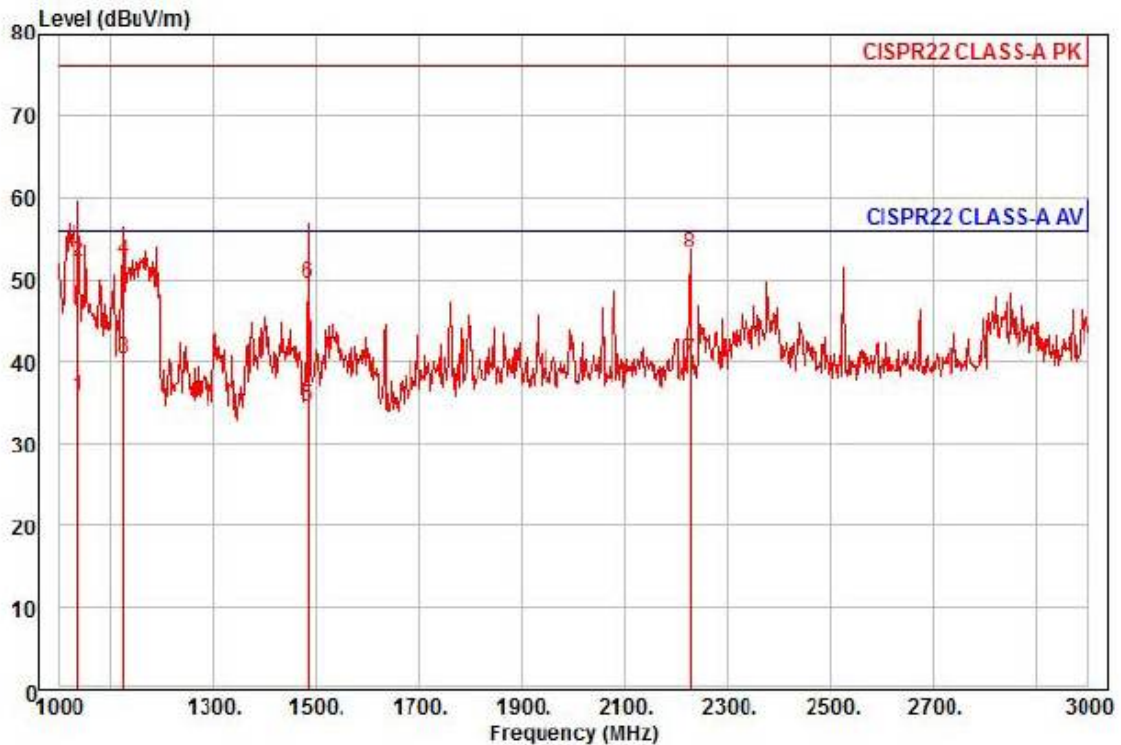
KES Co., Ltd.

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

Test report No.:

KES-E1-17T0434-R1

Page (45) of (64)



Site : chamber
Condition: CISPR22 CLASS-A PK 3m STLP9149(RRA CAL 2017-05-18) vertical
: RBW:1000.000kHz VBW:1000.000kHz SWT:Auto
Project :
Model : HRD-440P
Mode : AC230V 50HZ
Memo : (1 - 3)GHZ

	Freq	Read Level	Ant Factor	Cable Loss	Preamp Factor	TPos	Limit Line	Over Limit	Pol/Phase	Remark
	MHz	dBuV	dB/m	dB	dB	deg	dBuV/m	dB		
1	1038.00	42.56	22.62	6.60	36.03	183	56.00	-20.25	vertical	Average
2	1038.00	58.91	22.62	6.60	36.03	183	76.00	-23.90	vertical	Peak
3 pp	1124.00	46.60	22.88	6.89	35.95	206	56.00	-15.58	vertical	Average
4	1124.00	58.52	22.88	6.89	35.95	206	76.00	-23.66	vertical	Peak
5	1484.00	38.14	23.97	7.97	35.63	347	56.00	-21.55	vertical	Average
6	1484.00	53.07	23.97	7.97	35.63	347	76.00	-26.62	vertical	Peak
7	2228.00	38.85	26.70	9.87	35.26	163	56.00	-15.84	vertical	Average
8 pk	2228.00	51.85	26.70	9.87	35.26	163	76.00	-22.84	vertical	Peak

◆ Calculation

Over Limit [dB] = (Read Level[dBμV] + Ant Factor[dB/m] + Cable Loss [dB] - Preamp Factor [dB]) - Limit Line[dBμV]

Over Limit : Margin, Read Level : Reading value, Ant Factor : ANT Factor,

Cable Loss : Cable loss, Preamp Factor : Preamp 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.



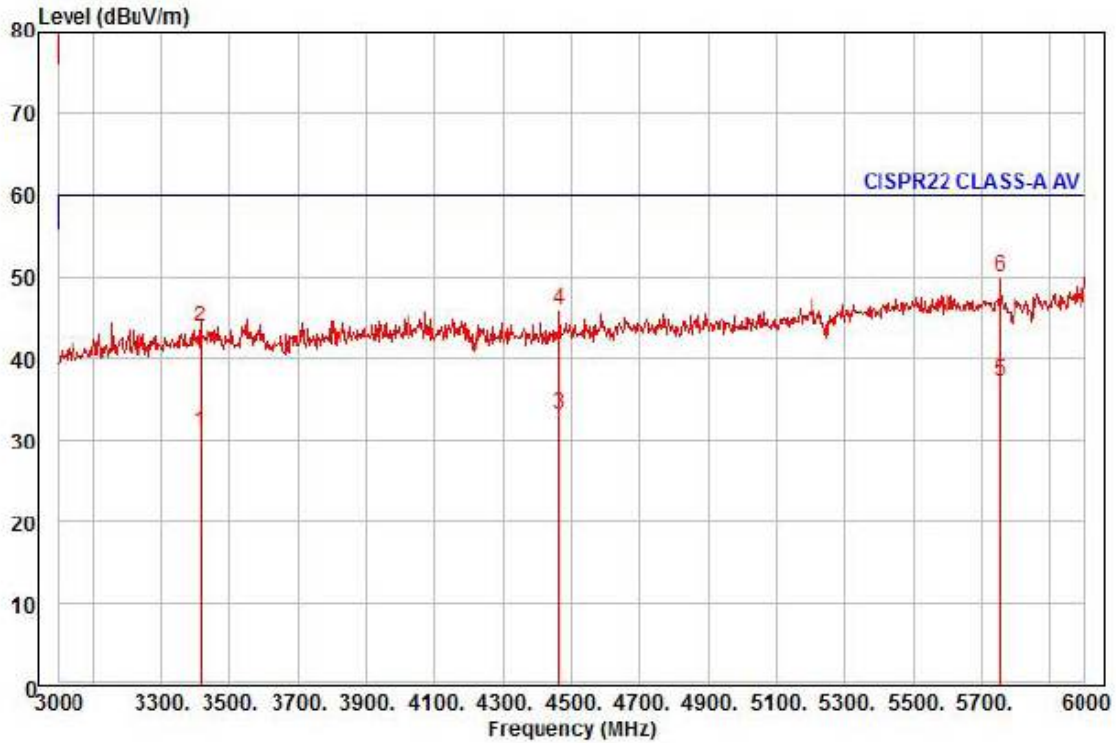
KES Co., Ltd.

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

Test report No.:

KES-E1-17T0434-R1

Page (46) of (64)



Site : chamber
Condition: CISPR22 CLASS-A PK 3m STLP9149(RRA CAL 2017-05-18) horizontal
: RBW:1000.000kHz VBW:1000.000kHz SWT:Auto
Project :
Model : HRD-440P
Mode : AC230V 50HZ
Memo : (3 - 6)GHZ

	Freq	Read Level	Ant Factor	Cable Loss	Preamp Factor	TPos	Limit Line	Over Limit	Pol/Phase	Remark
	MHz	dBuV	dB/m	dB	dB	deg	dBuV/m	dB		
1	3414.00	22.94	30.91	12.47	35.44	329	60.00	-29.12	horizontal	Average
2	3414.00	35.92	30.91	12.47	35.44	329	80.00	-36.14	horizontal	Peak
3	4464.00	21.76	32.37	14.39	35.44	337	60.00	-26.92	horizontal	Average
4	4464.00	34.71	32.37	14.39	35.44	337	80.00	-33.97	horizontal	Peak
5 pp	5754.00	20.52	35.75	16.62	35.68	60	60.00	-22.79	horizontal	Average
6 pk	5754.00	33.14	35.75	16.62	35.68	60	80.00	-30.17	horizontal	Peak

◆ Calculation

Over Limit [dB] = (Read Level[dB μ V] + Ant Factor[dB/m] + Cable Loss [dB] - Preamp Factor [dB]) - Limit Line[dB μ V]

Over Limit : Margin, Read Level : Reading value, Ant Factor : ANT Factor,

Cable Loss : Cable loss, Preamp Factor : Preamp Factor



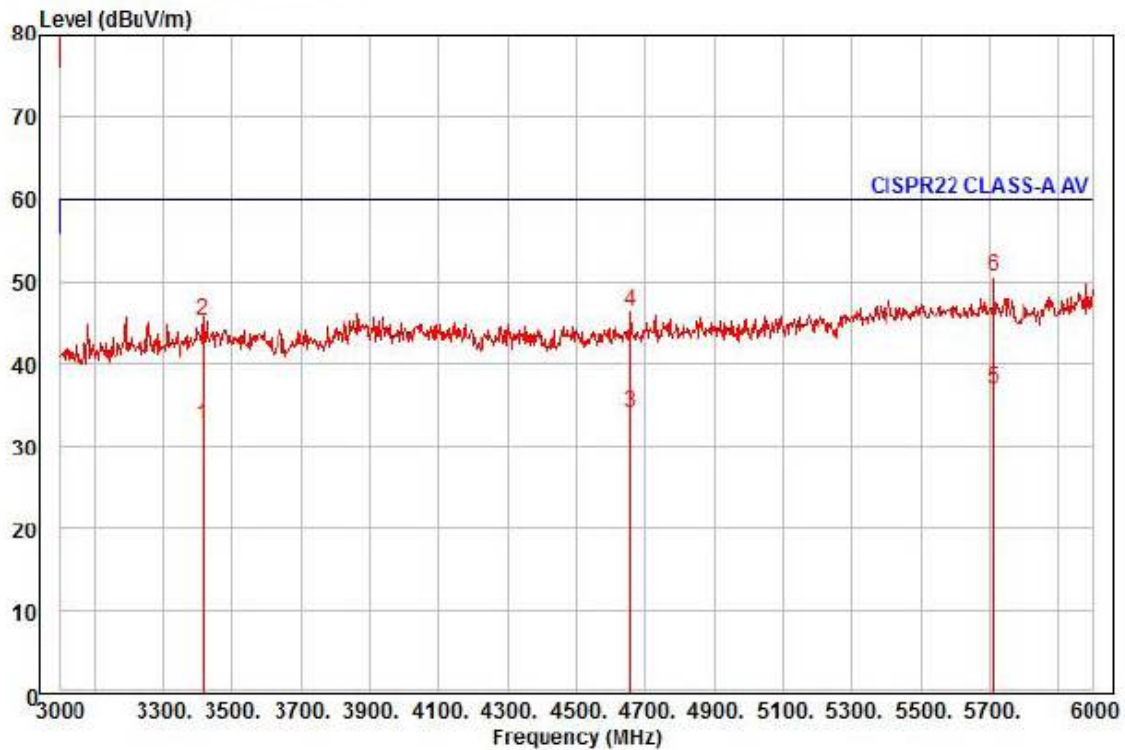
KES Co., Ltd.

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

Test report No.:

KES-E1-17T0434-R1

Page (47) of (64)



Site : chamber
Condition: CISPR22 CLASS-A PK 3m STLP9149(RRA CAL 2017-05-18) vertical
: RBW:1000.000kHz VBW:1000.000kHz SWT:Auto
Project :
Model : HRD-440P
Mode : AC230V 50HZ
Memo : (3 - 6)GHZ

	Freq	Read Level	Ant Factor	Cable Loss	Preamp Factor	TPos	Limit Line	Over Limit	Pol/Phase	Remark
	MHz	dBuV	dB/m	dB	dB	deg	dBuV/m	dB		
1	3414.00	24.44	30.91	12.47	35.44	262	60.00	-27.62	vertical	Average
2	3414.00	37.49	30.91	12.47	35.44	262	80.00	-34.57	vertical	Peak
3	4659.00	21.94	32.69	14.79	35.51	268	60.00	-26.09	vertical	Average
4	4659.00	34.47	32.69	14.79	35.51	268	80.00	-33.56	vertical	Peak
5 pp	5712.00	20.53	35.69	16.54	35.67	167	60.00	-22.91	vertical	Average
6 pk	5712.00	34.07	35.69	16.54	35.67	167	80.00	-29.37	vertical	Peak

◆ Calculation

Over Limit [dB] = (Read Level[dB μ V] + Ant Factor[dB/m] + Cable Loss [dB] - Preamp Factor [dB]) - Limit Line[dB μ V]

Over Limit : Margin, Read Level : Reading value, Ant Factor : ANT Factor,

Cable Loss : Cable loss, Preamp Factor : Preamp 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.

**Harmonic Current Emissions and Voltage Fluctuations and Flicker*****Average harmonic current results***

Hn	I _{eff} [A]	% of Limit	Limit [A]	Result
1	53.319E-3			
2	3.421E-3			PASS
3	48.027E-3	2.088	2.30	PASS
4	4.292E-3			PASS
5	47.960E-3	4.207	1.14	PASS
6	3.114E-3			PASS
7	47.483E-3	6.167	770.00E-3	PASS
8	3.209E-3			PASS
9	45.678E-3	11.420	400.00E-3	PASS
10	3.443E-3			PASS
11	43.983E-3	13.328	330.00E-3	PASS
12	3.314E-3			PASS
13	42.099E-3	20.047	210.00E-3	PASS
14	3.296E-3			PASS
15	39.995E-3	26.663	150.00E-3	PASS
16	3.106E-3			PASS
17	38.119E-3	28.802	132.35E-3	PASS
18	2.989E-3			PASS
19	35.859E-3	30.282	118.42E-3	PASS
20	2.940E-3			PASS
21	33.211E-3	20.665	160.71E-3	PASS
22	2.754E-3			PASS
23	30.782E-3	20.976	146.74E-3	PASS
24	2.744E-3			PASS
25	28.196E-3	20.886	135.00E-3	PASS
26	2.630E-3			PASS
27	25.484E-3	20.388	124.99E-3	PASS
28	2.447E-3			PASS
29	22.713E-3	19.516	116.39E-3	PASS
30	2.280E-3			PASS
31	19.992E-3	18.364	108.87E-3	PASS
32	2.035E-3			PASS
33	17.538E-3	17.149	102.27E-3	PASS
34	1.911E-3			PASS
35	14.840E-3	15.388	96.44E-3	PASS
36	1.629E-3			PASS
37	12.476E-3	13.677	91.21E-3	PASS
38	1.366E-3			PASS
39	10.459E-3	12.087	86.53E-3	PASS
40	1.310E-3			PASS

Harmonic currents less than 0.6% of the input current measured under the test conditions, or less than 5 mA, whichever is greater, are disregarded.



Test Data - Harmonics (continued)

Maximum harmonic current results				
Hn	I _{eff} [A]	% of Limit	Limit [A]	Result
1	53.677E-3			
2	4.101E-3			PASS
3	48.727E-3	1.412	3.45	PASS
4	4.860E-3			PASS
5	48.294E-3	2.824	1.71	PASS
6	3.654E-3			PASS
7	47.835E-3	4.142	1.15	PASS
8	3.741E-3			PASS
9	45.974E-3	7.662	600.00E-3	PASS
10	3.830E-3			PASS
11	44.441E-3	8.978	495.00E-3	PASS
12	3.800E-3			PASS
13	42.507E-3	13.494	315.00E-3	PASS
14	3.730E-3			PASS
15	40.285E-3	17.904	225.00E-3	PASS
16	3.523E-3			PASS
17	38.338E-3	19.312	198.52E-3	PASS
18	3.474E-3			PASS
19	36.043E-3	20.291	177.63E-3	PASS
20	3.360E-3			PASS
21	33.406E-3	20.786	160.71E-3	PASS
22	3.119E-3			PASS
23	30.972E-3	21.106	146.74E-3	PASS
24	3.105E-3			PASS
25	28.337E-3	20.990	135.00E-3	PASS
26	3.002E-3			PASS
27	25.633E-3	20.507	124.99E-3	PASS
28	2.808E-3			PASS
29	22.850E-3	19.633	116.39E-3	PASS
30	2.627E-3			PASS
31	20.128E-3	18.488	108.87E-3	PASS
32	2.301E-3			PASS
33	17.657E-3	17.265	102.27E-3	PASS
34	2.183E-3			PASS
35	14.944E-3	15.497	96.44E-3	PASS
36	1.877E-3			PASS
37	12.602E-3	13.816	91.21E-3	PASS
38	1.549E-3			PASS
39	10.555E-3	12.198	86.53E-3	PASS
40	1.482E-3			PASS

Harmonic currents less than 0.6% of the input current measured under the test conditions, or less than 5 mA, whichever is greater, are disregarded.

**KES Co., Ltd.**

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

Test report No.:

KES-E1-17T0434-R1

Page (50) of (64)

Test Data - Voltage Fluctuations

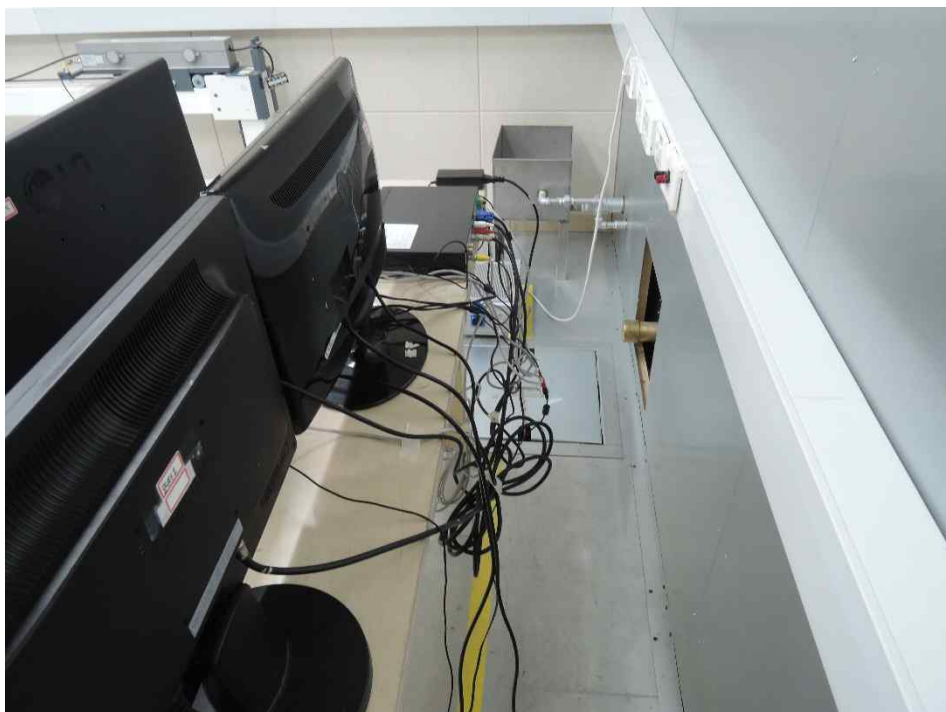
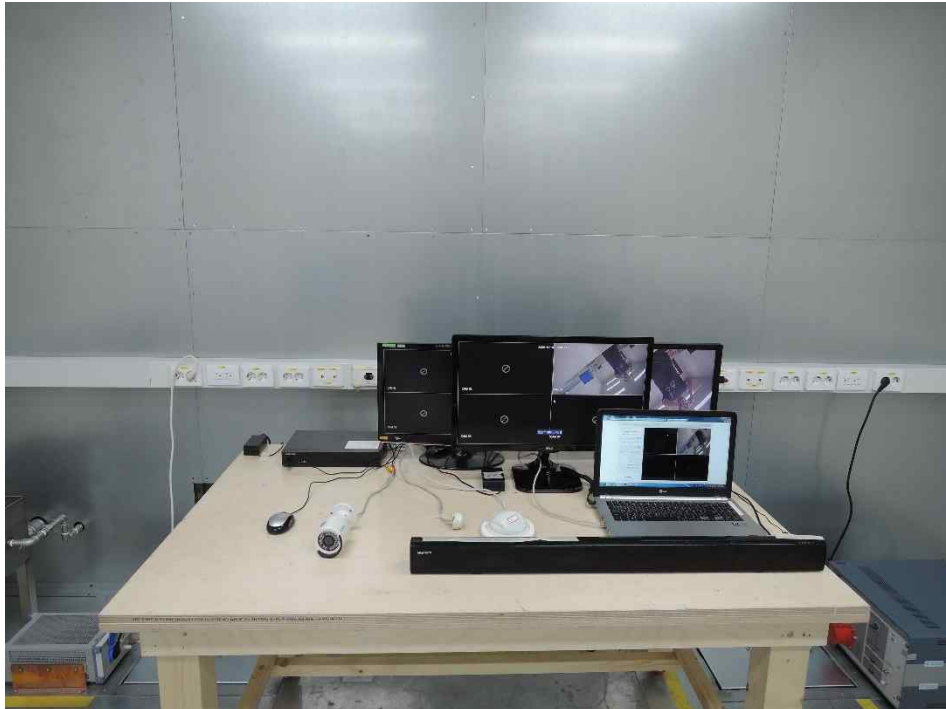
Maximum Flicker results

	EUT values	Limit	Result
Pst	0.034	1.00	PASS
Plt	0.028	0.65	PASS
dc [%]	0.000	3.30	PASS
dmax [%]	0.186	4.00	PASS
Tmax [s]	0.000	0.50	PASS

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.

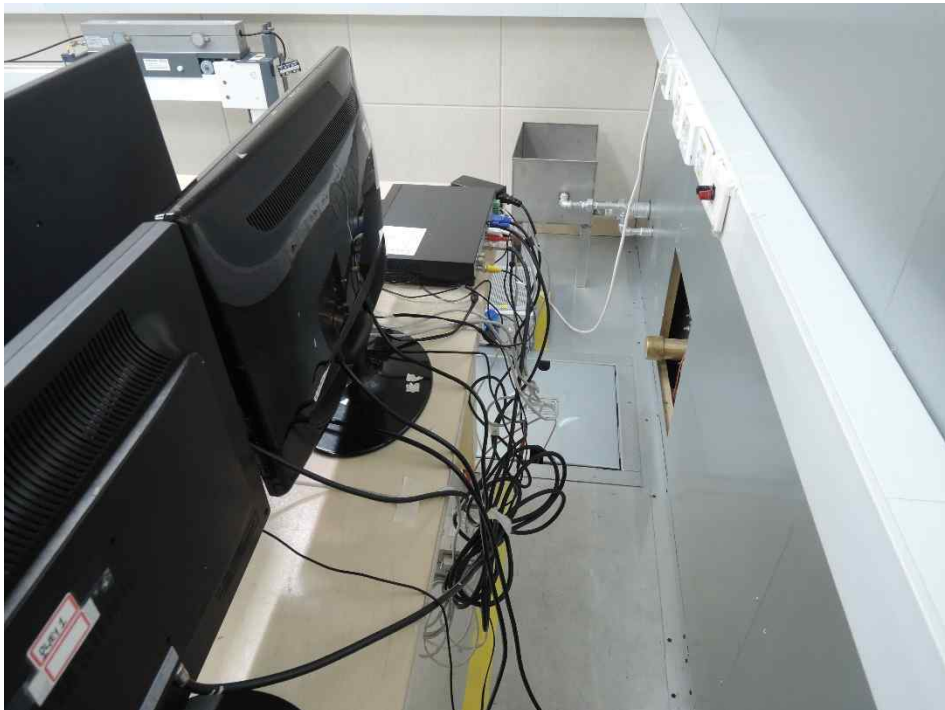
Test Setup Photos and Configuration

Conducted Voltage Emissions



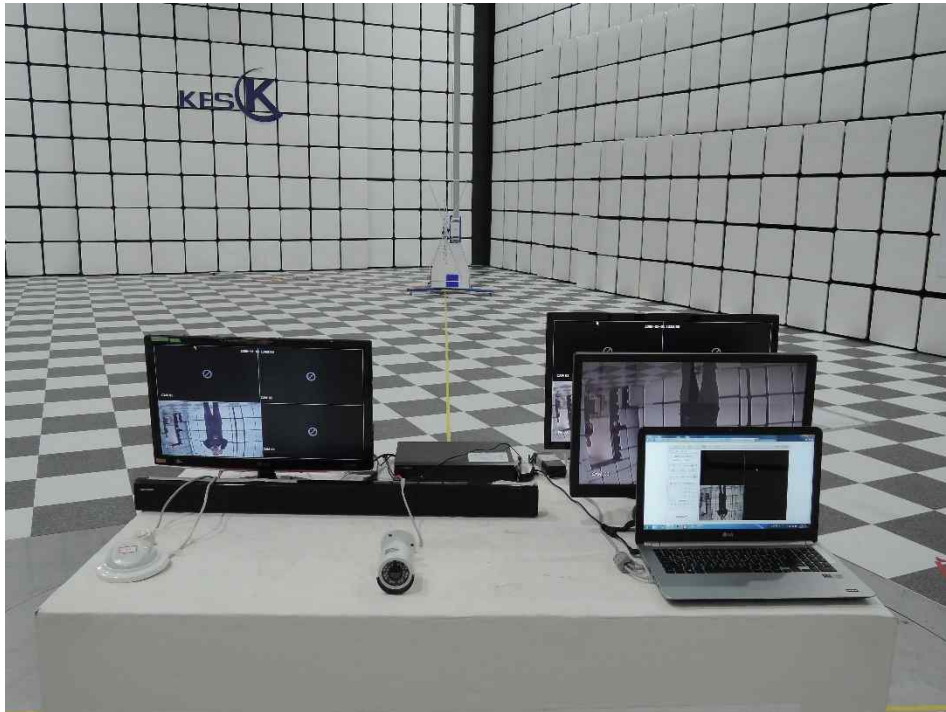
This report shall not be reproduced except in full, without the written approval of KES Co., Ltd.
The results shown in this test report refer only to the sample(s) tested unless otherwise stated.

Conducted Telecommunication Emissions



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.

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.

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.

Harmonic Current Emissions and Voltage Fluctuations and Flicker



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.

Electrostatic Discharge



Radiated Electric Field Immunity



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.

Electrical Fast Transients/Bursts



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.

Surge Transients



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.

Conducted Disturbance



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.

Voltage Dips and Short Interruptions



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.

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.

EUT Internal Photographs

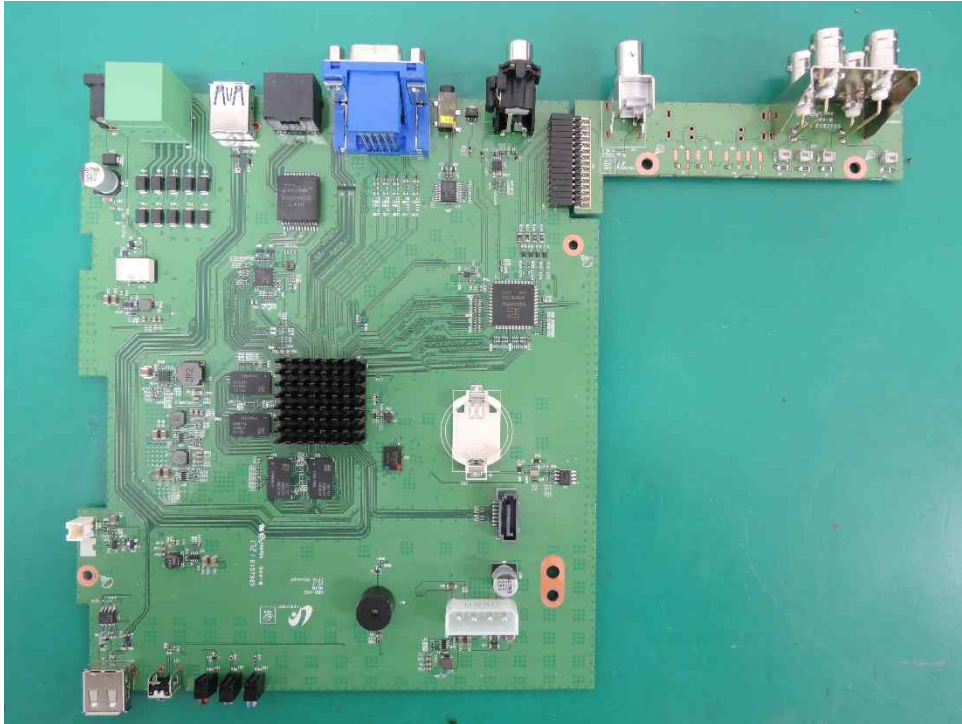
(Internal View)



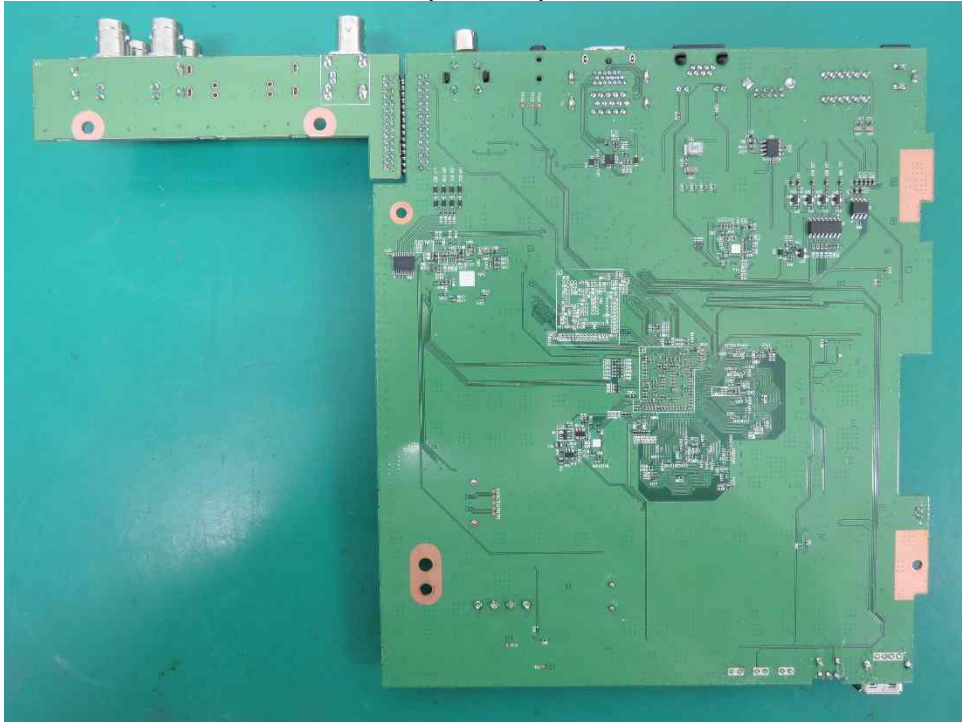
This report shall not be reproduced except in full, without the written approval of KES Co., Ltd.
The results shown in this test report refer only to the sample(s) tested unless otherwise stated.

EUT Internal View – Main Board

(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.

Label and Location



DVR

Model No : HRD-440P

Manufacturer : Hanwha Techwin (Tianjin) Co.,Ltd.

Made in of China

