



EMC TEST REPORT For CE

Test Report No. : KES-E1-17T0721
Date of Issue : Nov. 08, 2017
Product name : DVR
Model/Type No. : SRD-1656DP
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 : Oct. 26, 2017
Test date : Nov. 03, 2017 – Nov. 04, 2017
Test Results : ☒ **In Compliance** ☐ **Not in Compliance**

Tested by

Dong Il, Lee
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-E1-17T0721
Page (2) of (66)

REPORT REVISION HISTORY

Date	Test Report No.	Revision History
Nov. 08, 2017	KES-E1-17T0721	Issued

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	5
1.2	Variant Model Differences	5
1.3	Device Modifications	5
1.4	Equipment Under Test	5
1.5	Support Equipments	6
1.6	External I/O Cabling	7
1.7	E.U.T Operating Mode(s)	7
1.8	Configuration	8
1.9	Remarks when standards applied	8
1.10	Calibration Details of Equipment Used for Measurement	9
1.11	Test Facility	9
1.12	Laboratory Accreditations and Listings	9
2.0	Test Regulations	10
2.1	Conducted Emissions at Mains Power Ports	12
2.2	Conducted Emissions at Telecommunication Ports	13
2.3	Radiated Electric Field Emissions(Below 1 GHz)	14
2.4	Radiated Electric Field Emissions(Above 1 GHz)	15
2.5	Harmonic Current Emissions	16
2.6	Voltage Fluctuations and Flicker	17
3.0	Criteria for compliance	18
3.1	Electrostatic Discharge	20
3.2	Radiated Electric Field Immunity	24
3.3	Electrical Fast Transients/Bursts	27
3.4	Surge Transients	29
3.5	Conducted Disturbance	32
3.6	Voltage Dips and Short Interruptions	35
APPENDIX A – TEST DATA		37
Conducted Emissions at Mains Power Ports		37
Conducted Emissions at Telecommunication Ports		39
Radiated Electric Field Emissions(Below 1 GHz)		42
Radiated Electric Field Emissions(Above 1 GHz)		43
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:

SRD-1656D		
Video	Inputs	16 composite video 0.5~1 Vpp, 75 ohm automatic termination
	Resolution	1280x480 NTSC, 1280x576 PAL / 720x480 NTSC, 720x576 PAL
Live	Frame rate	480fps NTSC, 400fps PAL
	Resolution	1280x480 NTSC, 1280x576 PAL, 704x480 NTSC, 704x576 PAL
	Multi Screen display	1/4/7/9/13/16/16A/PIP/Sequence
Performance		
Operating System	Embedded	Linux
Recording	Compression	H.264
	Record Rate	NTSC: Up to 120fps @ 1280x480 / PAL: Up to 100fps @ 1280x576
		NTSC: Up to 120fps @ 704x480 / PAL: Up to 100fps @ 704x576
		NTSC: Up to 240fps @ 704x240 / PAL: Up to 200fps @ 704x288
		NTSC: Up to 480fps @ 352x240 / PAL: Up to 400fps @ 352x288
	Mode	NTSC: Manual, Schedule (Continuous/Event), Event(Pre/Post), Time lapse (1~30 fps)
	Event	PAL: Manual, Schedule (Continuous/Event), Event(Pre/Post), Time lapse (1~25 fps)
	Overwrite modes	Video Loss, Motion(Level 1~10), Alarm, Tampering(Level 1~3)
	Pre-alarm	Continuous
	Post-Alarm	Up to 30 sec (5,10,20,30 Sec)
Search & Playback	Search mode	Up to 6 hour (5,10,20,30 sec,1,3,5,10,20 min,1,2,3,4,5,6 hour)
	Playback function	Date/time, Event, Back up, Pos, Motion (* All Search Included Preview Function)
Network (IPv4)	Transmission speed	Fast Forward/Backward (x2,x4,x8,x16,x32,x64) * Backward Play with I-frame Only, Slow Forward/Backward (x1/2,x1/4,x1/8) * Backward Play with I-frame Only Step Forward/Backward
	Bandwidth	Option 1) 1280H/4CIF/2CIF/CIF(120/120/240/480fps NTSC, 100/100/200/400fps PAL)
	Bandwidth control	Option 2) 4CIF/2CIF/CIF(120/240/480fps NTSC, 100/200/400fps PAL)
	Stream	Up to 32Mbps
	Remote users Maximum	Selectable
	Protocol support	H.264(4CIF/2CIF/CIF Selectable)
	Monitoring	Search(3)/Live Unicast(10)/Live Multicast(20)
		TCP/IP,DHCP,PPPoE,SMTP,NTP,HTTP,DDNS,RTP,RTSP,SNMP
Smart phone	Platform	Smart viewer,Web viewer, SSM(CMS)
	Protocol support	Android , iOS
	Remote users Maximum	RTP,RTSP,HTTP,CGI,HTTPS
Storage	Internal HDD	Live(4), Search(1)
	External (e-SATA Interface)	Up to 4 SATA HDDs
	DVD Writer (Back-up)	Up to 2 expansion bay (* Model: SVS-5R/5E)
	USB (Back-up)	YES
	File Format (Back-up)	2 USB Ports
		BU(DVR Player), EXE(Include Player), AVI
Security	Password Protection	BU(DVR Player), EXE(Include Player), AVI
	Data Authentication	1 Admin, 10 Group , 10 User per 1 Group
Interface		
Monitors	VGA	Watermark
	HDMI	1 VGA (1280x720, 1280x1024, 1920x1080)
	Main Composite	1 HDMI (1280x720, 1280x1024, 1920x1080)
	Spot(Composite)	N/A
	Loop Outputs	Digital Spot (2CH) * Included OSD On Screen, Multi mode Support(1CH)
Audio	Inputs/Output	16CH
	Compression	16CH line in (Built in 4CH, Option : Audio Extension Cable)/ 1CH line out
	Sampling rate	G.711
Alarm	Inputs/Outputs	8KHz
	Remote notification	Terminal 16 Inputs (NO/NC) / Terminal 4 relay Outputs (NO/NC), Rating : 30V DC/2A, 250V AC/0.25A
Connections	Ethernet	Notification via e-mail
	Serial interface	1 RJ45 10/100/1000 Base-T
	USB	RS-232/RS-485(Full Duplex) for PTZ, Samsung System Keyboard
	e-SATA	USB 2.0, 2 ports
	Application Suport	2 External SATA ports
	Protocol support	Mouse, Remote Controller
		Samsung-E/Samsung-T/Pelco-D/Pelco-p/Panasonic/ Phillips/ AD/ DIAMOND/ ERNA/ KALATEL/ VCL PTZ Control via Coaxial Cable (Samsung CCVC, Pelco-C (Coaxitron))
General		
Electrical	Input Voltage/Current	100 to 240 VAC $\pm$ 10%; 50/60 Hz, Autoranging
	Power consumption	Max. 60 W (with 1x 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)	W440 x H88 x D384.8(17.32" x 3.46" x 15.15")
	Weight (With hard disks)	6.81 kg (15.01 lb)
	Rack mount kit	2 EA
Lauguage	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)	

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	SRD-1656DP	-	Hanwha Techwin (Tianjin) Co.,Ltd.	E.U.T



1.5 Support Equipments

Description	Model Number	Serial Number	Manufacturer	Remarks
MONITOR 1	SMT-2232	C95V67VF900025B	Weihai Daewoo Electronics Co., Ltd.	-
MONITOR 2	24M47VQ	702NTQDA3604	LG	-
MONITOR 2 ADAPTOR	ADS-40FSG-19 19025GPG-1	EAY62768621	Shenzhen Honor Electronic Co., Ltd.	-
MOUSE 1	AA-SM2PCPB	20-1EI06S502	Dongguan Primax Electronic & Telecommunication Products Ltd.	-
MOUSE 2	SMB-400	0DJM008256	SEJIN ELECTRON INC.	-
CCTV CAMERA	HIDC-2600TV	14112598449	Honeywell	-
CCTV CAMERA ADAPTOR	RS-03/12-S335	-	-	-
SPEAKER	Eris™ E5	-	PreSonus®	-
ALARM 1	-	-	-	-
ALARM 2	-	-	-	-
SMART PHONE 1	SHV-E210L	R33D713KA3F	SAMSUNG	-
SMART PHONE 2	SM-G900S	R39F6025XCV	SAMSUNG	-
Notebook	NT63025J	JK9091EF400432X	SAMSUNG	-
Notebook ADAPTOR	A13-040N2A	-	Chicony Power Technology Co., Ltd.	-
HDD	WD10EZEX	WCC1S7452154	WD	1TB
HDD Docking Station	NEXT-652DC	1207230749	YCN	-
HDD Docking Station ADAPTOR	W&T-AD60120B500	-	-	-
IR REMOTE CONTROL	EP10-000329A	-	SAMSUNG	-

1.6 External I/O Cabling

Start		END		Cable Spec.	
Description	I/O Port	Description	I/O Port	Length	Shield
DVR (E.U.T)	D-SUB	MONITOR 1	D-SUB	1.4	S
	HDMI	MONITOR 2	HDMI	1.4	S
	BNC	CCTV CAMERA	BNC	10.0	S
	Audio Out	SPEAKER	Audio Out	2.0	U
	3 Pin	ALARM 1	3 Pin	3.0	U
	3 Pin	ALARM 2	3 Pin	3.0	U
	RJ-45	Notebook	RJ-45	3.0	U
	e-SATA	HDD Doking Station	e-SATA	0.5	U
	USB	MOUSE 1	USB	1.5	U
	Serial	MOUSE 2	Serial	2.0	U
	Audio In	SMARTPHONE 1	Audio In	1.0	U
	Audio In	SMARTPHONE 2	Audio In	1.2	U
HDD Docking Station	HDD Slot	HDD	HDD Slot	-	U

* Unshielded=U, Shielded=S

1.7 E.U.T Operating Mode(s)

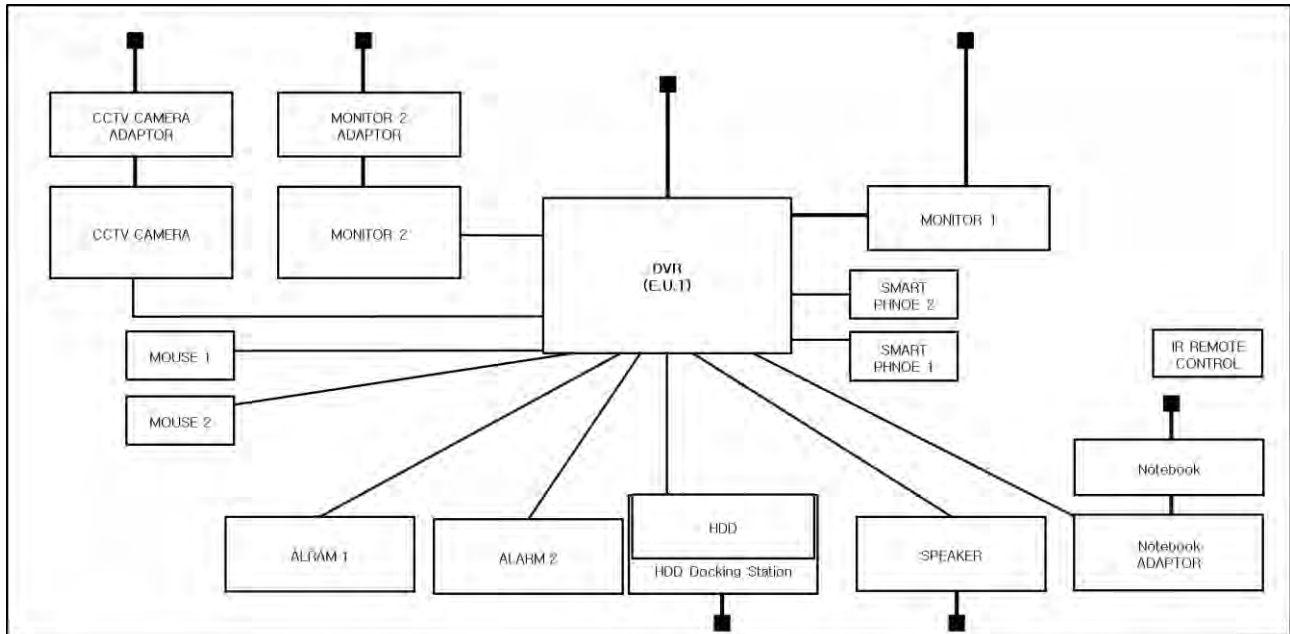
operating
1.Check the output of the camera images on the monitor 2.Ping test between notebook and E.U.T

E.U.T Test operating S/W		
Name	Version	Manufacture Company
-	-	-

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.

1.8 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 and CISPR Publication 22.

1.12 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/AC:2013

☒ Class A

☐ Class B

☐ EN 55024:2010 +A1:2015

☒ EN 50130-4:2011 +A1:2014

☒ EN 61000-3-2:2014

☒ EN 61000-3-3:2013

☐ EN 61326-1:2013



-
- | | | |
|---|----------------------------------|----------------------------------|
| ☐ 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 | | |

2.1 Conducted Emissions at Mains Power Ports

Test Date

Nov. 03, 2017

Test Location

Electro wave Shieldroom #3

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	04, 27, 2018
☒	LISN	ENV216	R & S	101137	02, 03, 2018
☒	LISN	ENV216	R & S	101786	04, 27, 2018
☒	PULSE LIMITER	ESH3-Z2	R & S	101914	12, 13, 2017
☐	LISN	NNBM8124	SCHWARZBECK	8124-1002	
☐	LISN	NNBM8124	SCHWARZBECK	8124-1003	

Test Conditions

Temperature: 19,7 °C
Relative Humidity: 53,5 %

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

Nov. 03, 2017

Test Location

Electro wave Shieldroom #3

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	04, 27, 2018
☒	LISN	ENV216	R & S	101137	02, 03, 2018
☒	LISN	ENV216	R & S	101786	04, 27, 2018
☒	PULSE LIMITER	ESH3-Z2	R & S	101914	12, 13, 2017
☒	8-WIRE ISN CAT3	CAT3 8158	SCHWARZBECK	8158-0019	03, 29, 2018
☒	8-WIRE ISN CAT5	CAT5 8158	SCHWARZBECK	8158-0030	03, 29, 2018
☒	8-WIRE ISN CAT6	NTFM 8158	SCHWARZBECK	8158-0029	08, 10, 2018

Test Conditions

Temperature: 19,7 °C

Relative Humidity: 53,5 %

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.

2.3 Radiated Electric Field Emissions(Below 1 GHz)

Test Date

Nov. 03, 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: 21,7 °C

Relative Humidity: 41,4 %

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.

2.4 Radiated Electric Field Emissions(Above 1 GHz)

Test Date

Nov. 03, 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
☐	ATTENUATOR	8491A	HP	35496	03, 24, 2018
☒	LOG-PERIODIC ANTENNA	STLP 9149	SCHWARZBECK	9149-255	05, 17, 2018

Test Conditions

Temperature: 19,7 °C

Relative Humidity: 53,5 %

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

RemarksSee Appendix A for test data.



2.5 Harmonic Current Emissions

Test Date

Nov. 04, 2017

Test Location

Electro wave Shieldroom #3

Test Equipment

Used	Description	Model Number	Manufacturer	Serial Number	Cal. Due
☒	EMI Test S/W	dpa.control	EM TEST	5.4.11.0	-
☒	DIGITAL POWER ANALYZER	DPA 500N	EM TEST	V1024106759	08, 09, 2018
☒	POWER SOURCE	ACS 500N6	EM TEST	V1024106760	-

Test Conditions

Temperature: 19,5 °C

Relative Humidity: 50,1 %

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

Nov. 04, 2017

Test Location

Electro wave Shieldroom #3

Test Equipment

Used	Description	Model Number	Manufacturer	Serial Number	Cal. Due
☒	EMI Test S/W	dpa.control	EM TEST	5.4.11.0	-
☒	DIGITAL POWER ANALYZER	DPA 500N	EM TEST	V1024106759	08, 08, 2018
☒	POWER SOURCE	ACS 500N6	EM TEST	V1024106760	-

Test Conditions

Temperature: 19,5 °C

Relative Humidity: 50,1 %

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

Nov. 04, 2017

Test Location

EMS-ESD: Electro wave Shieldroom #3

Test Equipment

Used	Description	Model Number	Manufacturer	Serial Number	Cal. Due
☒	ESD SIMULATOR	ESS-2000	Noise Ken	ESS05X4620	02, 24, 2018
☒	HCP	-	Noise Ken	-	-
☒	VCP	-	Noise Ken	-	-

Test Conditions

Temperature: 19,5 °C
Relative Humidity: 50,1 %
Atmospheric Pressure: 99,8 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-E1-17T0721
Page (21) of (66)

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

Location of Discharge:

Air
Contact



**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-E1-17T0721
Page (23) of (66)

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	UPPER Surface	Contact 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

Nov. 04, 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	08, 11, 2018
☒	AMPLIFIER	ITA0300-200	Infinitech	-	08, 11, 2018
☒	AMPLIFIER	ITA0750-200	Infinitech	-	08, 11, 2018
☒	AMPLIFIER	ITA1500-100	Infinitech	-	08, 11, 2018
☒	AMPLIFIER	ITA2500-100	Infinitech	-	08, 11, 2018
☒	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
☒	HYBRID LOG-PERIODIC ANTENNA	HLP-2603	TDK	100400	-
☒	AMPLIFIER	TK-PA8/3W	TESTEK	150008	06, 26, 2018
☒	COUPLER	ZARC-25-63-S+	Mini-Circuits	FM14101424	06, 26, 2018
☒	SIGNAL GENERATOR	SMB100A	R & S	108252	08, 07, 2018
☒	LOG-PERIODIC ANTENNA	STLP 9149	SCHWARZBECK	9149-255	05, 17, 2018

Test Conditions

Temperature: 19,5 °C
Relative Humidity: 50,1 %
Atmospheric Pressure: 99,8 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-E1-17T0721
Page (26) of (66)

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

Nov. 04, 2017

Test Location

EMS-EFT: Electro wave Shieldroom #3

Test Equipment

Used	Description	Model Number	Manufacturer	Serial Number	Cal. Due
☒	EMS Test S/W	iec.control	AMETEK CTS	7.1.2	-
☒	ULTRA COMPACT SIMULATOR	UCS 500 N5	EM TEST	V0936105120	06, 26, 2018
☒	MOTOR VARIAC	MV2616	EM TEST	V0936105123	06, 26, 2018
☒	CAPACITIVE COUPLING CLAMP	HFK	EM TEST	070925	06, 26, 2018

Test Conditions

Temperature: 19,5 °C
Relative Humidity: 50,1 %
Atmospheric Pressure: 99,8 kPa

Test Specifications

Pulse Amplitude & Polarity:
(AC Power Lines) ☐ ± 1.0 kV ☒ ± 2.0 kV
☐ ± 4.0 kV

Pulse Amplitude & Polarity:
(Other supply / Signal Lines) ☐ ± 0.5 kV ☒ ± 1.0 kV
☐ ± 2.0 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)
RJ-45	Complied	Complied
BNC	Complied	Complied
ALARM1	Complied	Complied
ALARM2	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

Nov. 04, 2017

Test Location

EMS-Surge: Electro wave Shieldroom #3

Test Equipment

Used	Description	Model Number	Manufacturer	Serial Number	Cal. Due
☒	EMS Test S/W	iec.control	AMETEK CTS	7.1.2	-
☒	ULTRA COMPACT SIMULATOR	UCS 500 N5	EM TEST	V0936105120	10, 16, 2018
☒	MOTOR VARIAC	MV2616	EM TEST	V0936105123	06, 26, 2018
☐	CDN	CNV 508N1	EM TEST	P1551168979	04, 26, 2018
☒	CDN	CNV 508T5	EM TEST	P1549168422	04, 26, 2018

Test Conditions

Temperature: 19,5 °C
Relative Humidity: 50,1 %
Atmospheric Pressure: 99,8 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

Test Data

☒ Line to Line – Differential Mode

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

☒ Line to Earth – Common Mode

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

Signal Lines

☒ Line to Earth – Common Mode

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

3.5 Conducted Disturbance

Reference Standard

EN 61000-4-6:2014

Test Date

Nov. 04, 2017

Test Location

EMS-CS: Electro wave Shieldroom #3

Test Equipment

Used	Description	Model Number	Manufacturer	Serial Number	Cal. Due
☒	EMS Test S/W	icd.control	EM TEST	5.3.7	-
☒	CONTINUOUS WAVE SIMULATOR	CWS 500N1	EM TEST	V0936105119	08, 07, 2018
☒	ATTENUATOR	ATT6	EM TEST	1208-34	08, 07, 2018
☒	CDN	CDN-M2/M3N	EM TEST	0909-06	08, 07, 2018
☐	CDN	CDN T8RJ45	EM TEST	0909-09	08, 07, 2018
☒	EM INJECTION CLAMP	EM 101	Liithi	35943	02, 03, 2018

Test Conditions

Temperature: 19,5 °C
Relative Humidity: 50,1 %
Atmospheric Pressure: 99,8 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-E1-17T0721
Page (33) of (66)

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
RJ-45	Complied	Complied
BNC	Complied	Complied
ALARM1	Complied	Complied
ALARM2	Complied	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

Nov. 04, 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	AMETEK CTS	7.1.2	-
☒	ULTRA COMPACT SIMULATOR	UCS 500 N5	EM TEST	V0936105120	06, 26, 2018
☒	MOTOR VARIAC	MV2616	EM TEST	V0936105123	06, 26, 2018

Test Conditions

Temperature: 19,5 °C
Relative Humidity: 50,1 %
Atmospheric Pressure: 99,8 kPa



Test Specifications & Observations/Remarks

(Test Voltage : 230 V (ac))

<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>
☒ 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

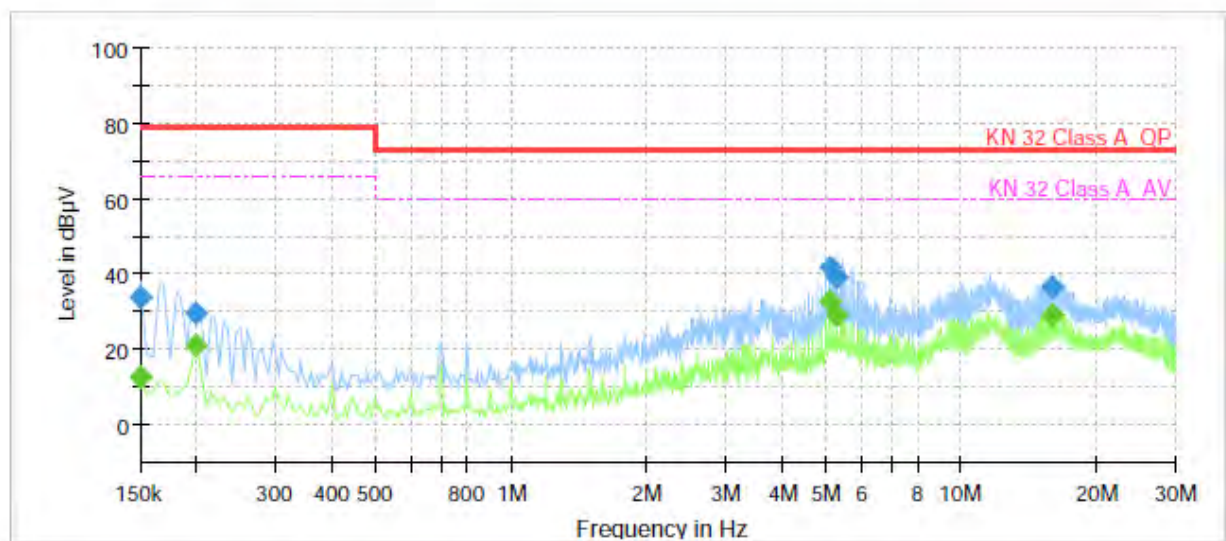
PASS Required Performance Criteria.

APPENDIX A – TEST DATA

Conducted Emissions at Mains Power Ports

[HOT] Common Information

Test Description: Conducted Emission
Model No.: SRD-1656DP
Mode
Operator Name: KES



Final Result

Frequency (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.150000	---	12.72	66.00	53.28	1000.0	9.000	L1	19.4
0.150000	33.87	---	79.00	45.13	1000.0	9.000	L1	19.4
0.200000	---	21.34	66.00	44.66	1000.0	9.000	L1	19.4
0.200000	29.78	---	79.00	49.22	1000.0	9.000	L1	19.4
5.085000	---	32.67	60.00	27.33	1000.0	9.000	L1	19.9
5.085000	41.64	---	73.00	31.36	1000.0	9.000	L1	19.9
5.290000	---	29.20	60.00	30.80	1000.0	9.000	L1	19.9
5.290000	38.95	---	73.00	34.05	1000.0	9.000	L1	19.9
15.855000	---	29.18	60.00	30.82	1000.0	9.000	L1	20.0
15.855000	36.39	---	73.00	36.61	1000.0	9.000	L1	20.0

◆ Calculation

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

QuasiPeak / CAverage : The Final Value

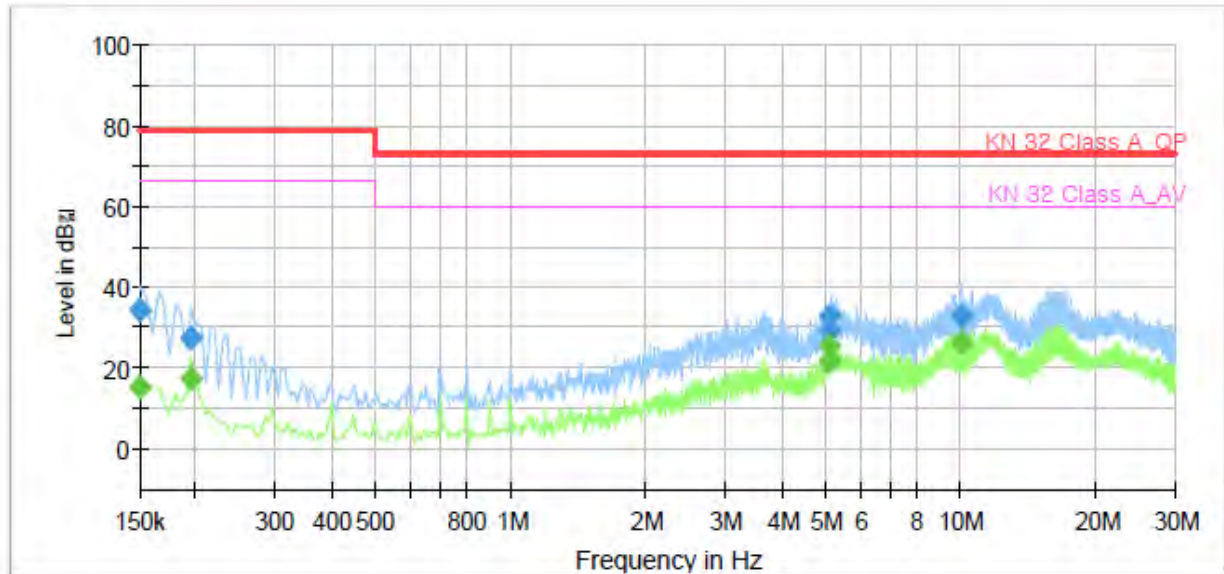
Reading Value : Not shown in the table.

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

[NEUTRAL]

Common Information

Test Description: Conducted Emission
Model No.: SRD-1656DP
Mode:
Operator Name: KES



Final_Result

Frequency (MHz)	QuasiPeak (dBμV)	CAverage (dBμV)	Limit (dBμV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.150000	---	15.20	66.00	50.80	1000.0	9.000	N	19.4
0.150000	34.50	---	79.00	44.50	1000.0	9.000	N	19.4
0.195000	---	17.68	66.00	48.32	1000.0	9.000	N	19.4
0.195000	27.45	---	79.00	51.55	1000.0	9.000	N	19.4
5.085000	---	25.42	60.00	34.58	1000.0	9.000	N	19.9
5.085000	32.92	---	73.00	40.08	1000.0	9.000	N	19.9
5.115000	---	21.63	60.00	38.37	1000.0	9.000	N	19.9
5.115000	29.23	---	73.00	43.77	1000.0	9.000	N	19.9
10.050000	---	26.72	60.00	33.28	1000.0	9.000	N	19.7
10.050000	32.77	---	73.00	40.23	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.

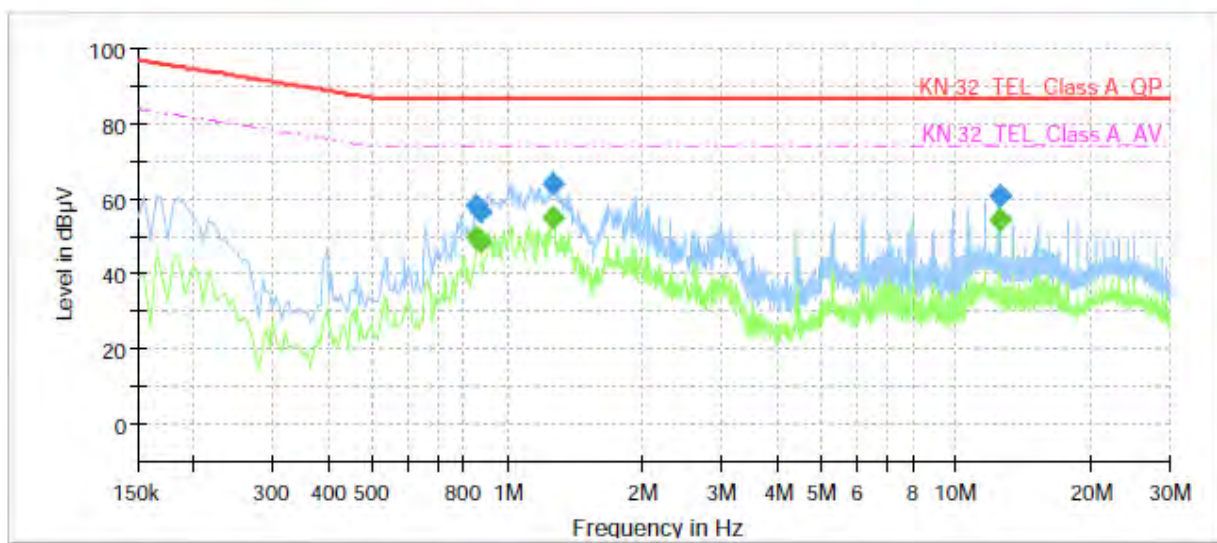
Corr. : Correction values (LISN FACTOR + (Cable Loss + Pulse Limiter FACTOR))

Conducted Emissions at Telecommunication Ports

[10 Mbps]

Common Information

Test Description:	Telecommunication Emission
Model No.:	SRD-1656DP
Mode	10 Mbps
Operator Name:	KES



Final Result

Frequency (MHz)	QuasiPeak (dBμV)	CAverage (dBμV)	Limit (dBμV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.855000	---	49.82	74.00	24.18	1000.0	9.000	Single Line	20.0
0.855000	58.42	---	87.00	28.58	1000.0	9.000	Single Line	20.0
0.870000	---	48.59	74.00	25.41	1000.0	9.000	Single Line	20.0
0.870000	56.88	---	87.00	30.12	1000.0	9.000	Single Line	20.0
1.265000	---	54.86	74.00	19.14	1000.0	9.000	Single Line	20.0
1.265000	63.93	---	87.00	23.07	1000.0	9.000	Single Line	20.0
12.500000	---	54.47	74.00	19.53	1000.0	9.000	Single Line	19.8
12.500000	60.76	---	87.00	26.24	1000.0	9.000	Single Line	19.8

◆ Calculation

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

QuasiPeak / CAverage : The Final Value

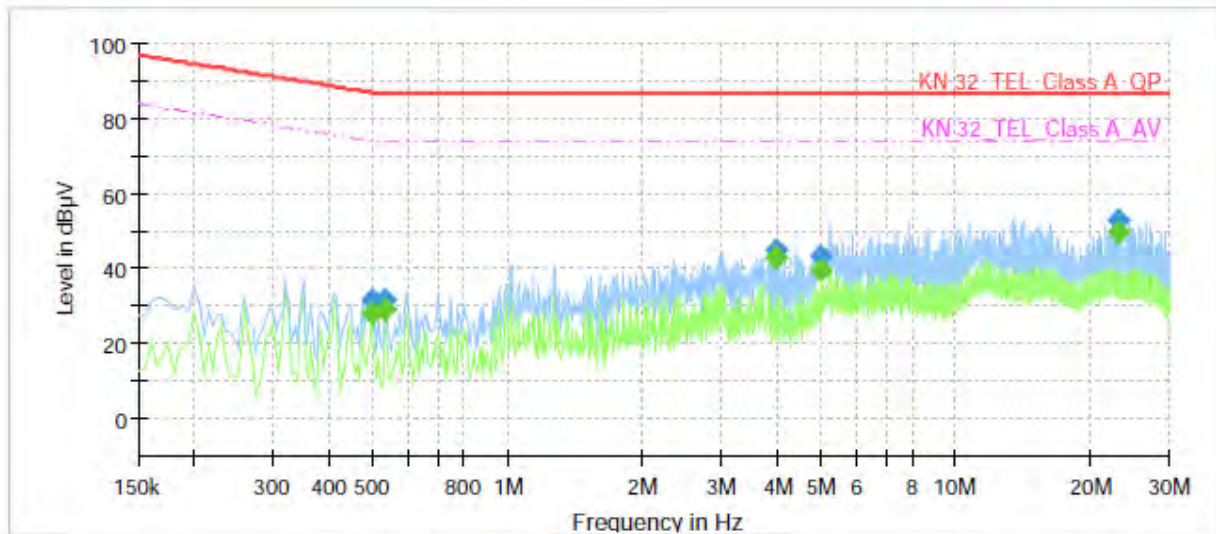
Reading Value : Not shown in the table.

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

[100 Mbps]

Common Information

Test Description:	Telecommunication Emission
Model No.:	SRD-1656DP
Mode	100 Mbps
Operator Name:	KES



Final Result

Frequency (MHz)	QuasiPeak (dBμV)	CAverage (dBμV)	Limit (dBμV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.500000	---	27.90	74.00	46.10	1000.0	9.000	Single Line	19.4
0.500000	32.00	---	87.00	55.00	1000.0	9.000	Single Line	19.4
0.535000	---	29.28	74.00	44.72	1000.0	9.000	Single Line	19.4
0.535000	31.86	---	87.00	55.14	1000.0	9.000	Single Line	19.4
3.955000	---	42.99	74.00	31.01	1000.0	9.000	Single Line	19.5
3.955000	45.11	---	87.00	41.89	1000.0	9.000	Single Line	19.5
5.025000	---	39.83	74.00	34.17	1000.0	9.000	Single Line	19.5
5.025000	43.35	---	87.00	43.65	1000.0	9.000	Single Line	19.5
23.130000	---	49.65	74.00	24.35	1000.0	9.000	Single Line	19.4
23.130000	52.93	---	87.00	34.07	1000.0	9.000	Single Line	19.4

◆ Calculation

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

QuasiPeak / CAverage : The Final Value

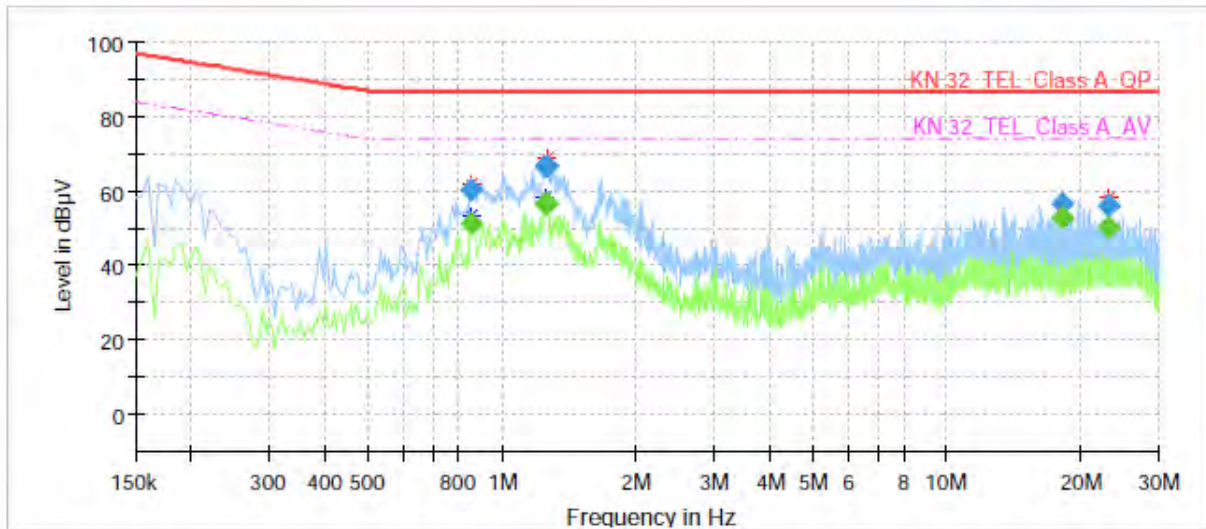
Reading Value : Not shown in the table.

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

[1 000 Mbps]

Common Information

Test Description:	Telecommunication Emission
Model No.:	SRD-1656DP
Mode	1 000 Mbps
Operator Name:	KES



Final Result

Frequency (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.855000	---	51.26	74.00	22.74	1000.0	9.000	Single Line	19.4
0.855000	60.20	---	87.00	26.80	1000.0	9.000	Single Line	19.4
1.255000	---	56.53	74.00	17.47	1000.0	9.000	Single Line	19.5
1.255000	66.64	---	87.00	20.36	1000.0	9.000	Single Line	19.5
1.260000	---	56.79	74.00	17.21	1000.0	9.000	Single Line	19.5
1.260000	66.57	---	87.00	20.43	1000.0	9.000	Single Line	19.5
18.245000	---	52.70	74.00	21.30	1000.0	9.000	Single Line	19.4
18.245000	56.65	---	87.00	30.35	1000.0	9.000	Single Line	19.4
23.130000	---	50.39	74.00	23.61	1000.0	9.000	Single Line	19.3
23.130000	55.94	---	87.00	31.06	1000.0	9.000	Single Line	19.3

◆ 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))

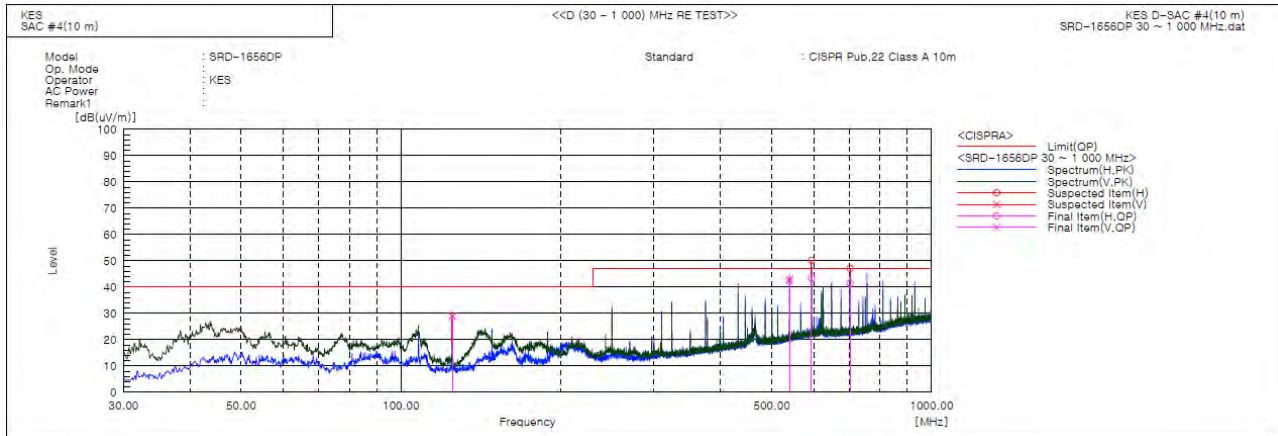


KES Co., Ltd.

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-E1-17T0721
Page (42) of (66)

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	594.013	H	58.0	-14.5	43.5	47.0	3.5	155.0	24.0	
2	540.003	V	58.4	-16.0	42.4	47.0	4.6	100.0	176.0	
3	125.010	V	60.2	-31.4	28.8	40.0	11.2	119.0	210.0	
4	701.994	H	54.9	-13.5	41.4	47.0	5.6	386.0	27.0	

◆ Calculation – SAC #4(10 m)

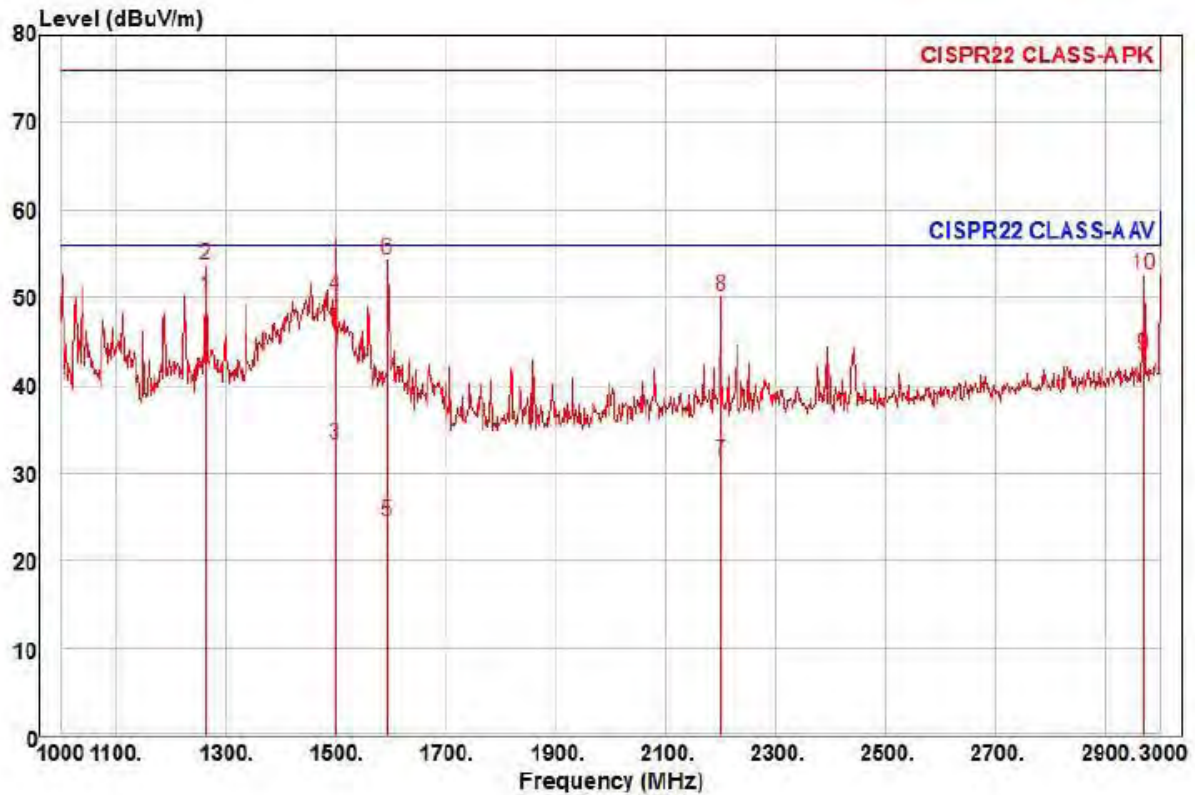
Result(QP) [dB(μV/m)] = (Reading(QP)[dB(μV)] + c.f[dB(1/m)])

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 : YEOJU_C 3 m SAC
Condition: CISPR22 CLASS-A PK 3m STLP9149(RRA CAL 2017-05-18) horizontal
: RBW:1000.000kHz VBW:1000.000kHz SWT:Auto
Project :
Model : SRD-1656DP
Mode :
Memo : 1 ~ 3 GHz

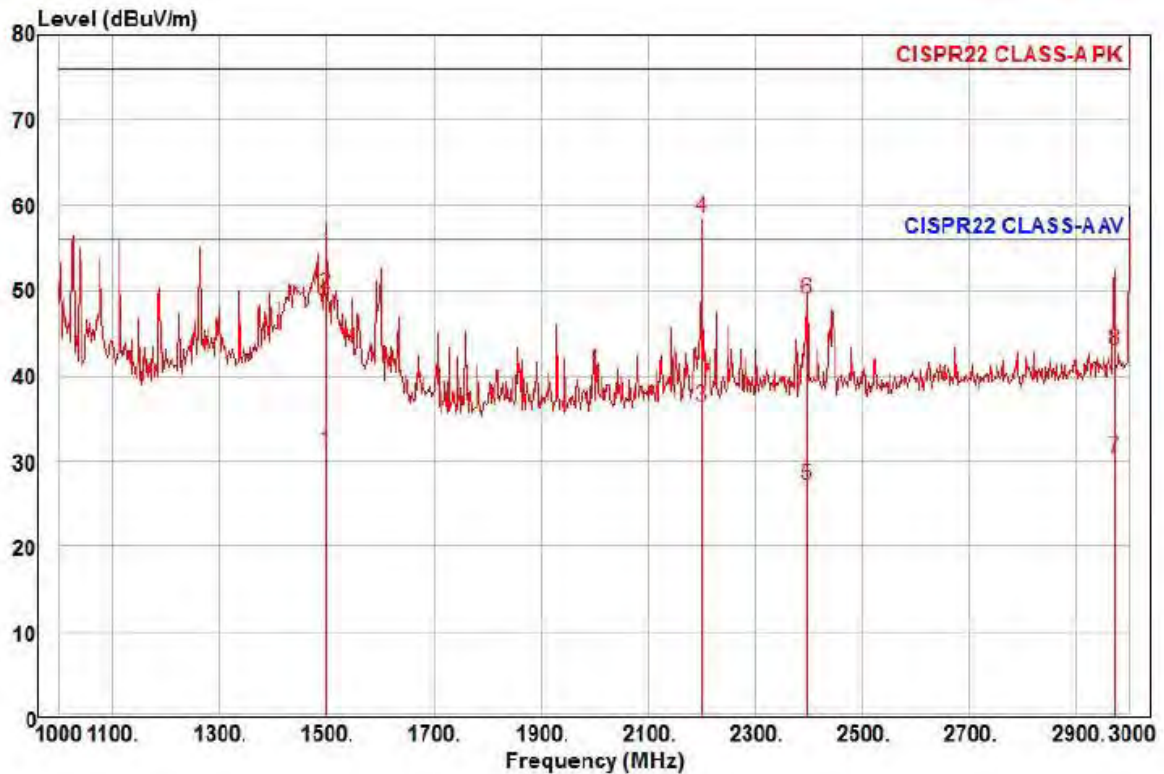
	Read	Ant	Cable	Preamp	TPos	Limit	Over		
Freq	Level	Factor	Loss	Factor		Line	Limit	Pol/Phase	Remark
MHz	dBuV	dB/m	dB	dB	deg	dBuV/m	dB		
1 pp	1262.00	54.94	23.30	7.48	35.76	159	56.00	-6.04	horizontal Average
2	1262.00	58.68	23.30	7.48	35.76	159	76.00	-22.30	horizontal Peak
3	1500.00	36.38	24.02	8.22	35.36	10	56.00	-22.74	horizontal Average
4	1500.00	53.29	24.02	8.22	35.36	10	76.00	-25.83	horizontal Peak
5	1594.00	26.77	24.39	8.49	35.21	272	56.00	-31.56	horizontal Average
6 pk	1594.00	56.71	24.39	8.49	35.21	272	76.00	-21.62	horizontal Peak
7	2200.00	29.08	26.62	10.12	34.39	97	56.00	-24.57	horizontal Average
8	2200.00	47.86	26.62	10.12	34.39	97	76.00	-25.79	horizontal Peak
9	2970.00	35.56	29.61	12.06	33.86	31	56.00	-12.63	horizontal Average
10	2970.00	44.77	29.61	12.06	33.86	31	76.00	-23.42	horizontal Peak



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-E1-17T0721
Page (44) of (66)



Site : YEOJU_C 3 m SAC
Condition: CISPR22 CLASS-A PK 3m STLP9149(RRA CAL 2017-05-18) vertical
: RBW:1000.000kHz VBW:1000.000kHz SWT:Auto
Project :
Model : SRD-1656DP
Mode :
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	1500.00	34.31	24.02	8.22	35.36	28	56.00	-24.81	vertical	Average
2	1500.00	52.80	24.02	8.22	35.36	28	76.00	-26.32	vertical	Peak
3 av	2200.00	34.11	26.62	10.12	34.39	132	56.00	-19.54	vertical	Average
4 pp	2200.00	56.28	26.62	10.12	34.39	131	76.00	-17.37	vertical	Peak
5	2398.00	23.59	27.22	10.59	34.26	105	56.00	-28.86	vertical	Average
6	2398.00	45.52	27.22	10.59	34.26	105	76.00	-26.93	vertical	Peak
7	2972.00	22.48	29.62	12.07	33.86	48	56.00	-25.69	vertical	Average
8	2972.00	35.23	29.62	12.07	33.86	48	76.00	-32.94	vertical	Peak

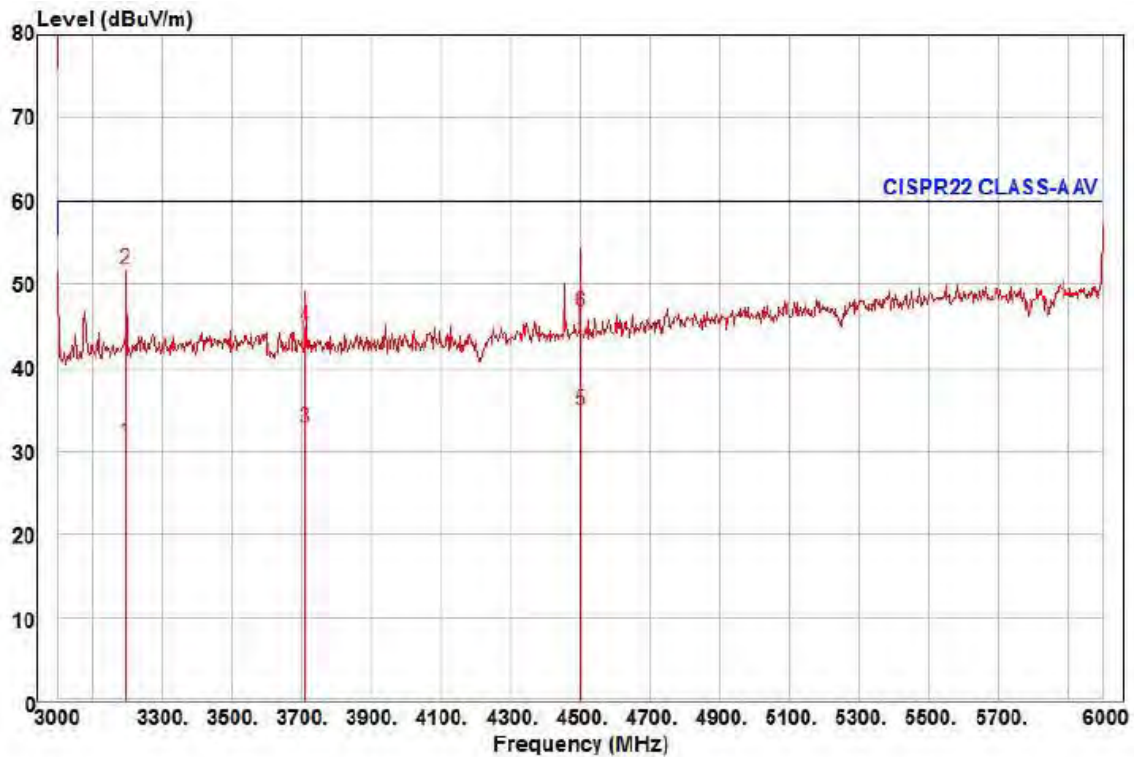
This report shall not be reproduced except in full, without the written approval of KES Co., Ltd.
The results shown in this test report refer only to the sample(s) tested unless otherwise stated.



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-E1-17T0721
Page (45) of (66)



Site : YEOJU_C 3 m SAC
Condition: CISPR22 CLASS-A PK 3m STLP9149(RRA CAL 2017-05-18) horizontal
: RBW:1000.000kHz VBW:1000.000kHz SWT:Auto
Project :
Model : SRD-1656DP
Mode :
Memo : 3 ~ 6 GHz

	Read Freq	Ant Level	Cable Factor	Preamp Loss	TPos	Limit Line	Over Limit	Pol/Phase	Remark
	MHz	dBuV	dB/m	dB	deg	dBuV/m	dB		
1	3195.00	22.12	30.29	12.65	276	60.00	-29.00	horizontal	Average
2 pk	3195.00	42.84	30.29	12.65	276	80.00	-28.28	horizontal	Peak
3	3711.00	22.27	31.72	13.48	1	60.00	-27.17	horizontal	Average
4	3711.00	34.38	31.72	13.48	1	80.00	-35.06	horizontal	Peak
5 pp	4500.00	21.57	32.36	14.96	143	60.00	-25.20	horizontal	Average
6	4500.00	33.56	32.36	14.96	143	80.00	-33.21	horizontal	Peak

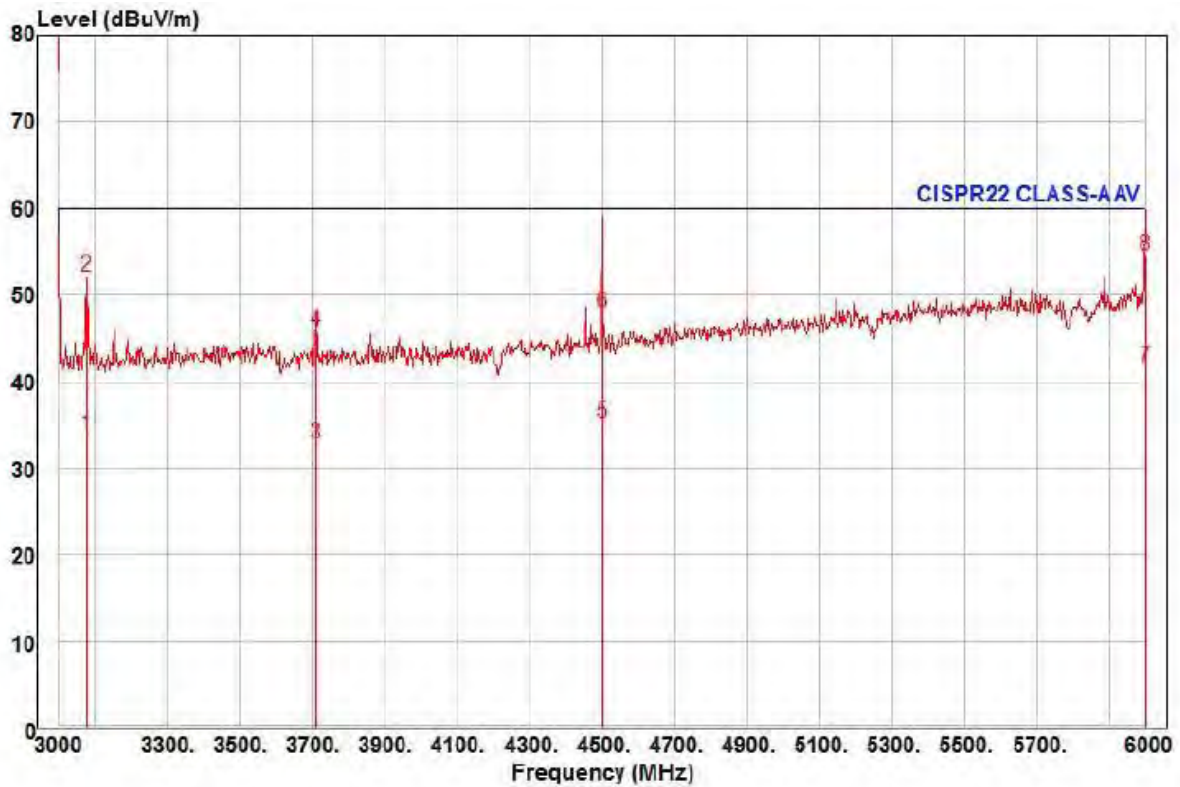
This report shall not be reproduced except in full, without the written approval of KES Co., Ltd.
The results shown in this test report refer only to the sample(s) tested unless otherwise stated.



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-E1-17T0721
Page (46) of (66)



Site : YEOJU_C 3 m SAC
Condition: CISPR22 CLASS-A PK 3m STLP9149(RRA CAL 2017-05-18) vertical
: RBW:1000.000kHz VBW:1000.000kHz SWT:Auto
Project :
Model : SRD-1656DP
Mode :
Memo : 3 ~ 6 GHz

	Freq	Read Level	Ant Factor	Cable Loss	Preamplifier Factor	TPos	Limit Line	Over Limit	Pol/Phase	Remark
	MHz	dBuV	dB/m	dB	dB	deg	dBuV/m	dB		
1	3078.00	25.44	29.96	12.35	33.93	124	60.00	-26.18	vertical	Average
2	3078.00	43.74	29.96	12.35	33.93	124	80.00	-27.88	vertical	Peak
3	3711.00	22.30	31.72	13.48	34.64	5	60.00	-27.14	vertical	Average
4	3711.00	35.27	31.72	13.48	34.64	5	80.00	-34.17	vertical	Peak
5	4500.00	21.99	32.36	14.96	34.09	255	60.00	-24.78	vertical	Average
6	4500.00	34.66	32.36	14.96	34.09	255	80.00	-32.11	vertical	Peak
7 pp	6000.00	21.18	36.12	17.64	33.35	255	60.00	-18.41	vertical	Average
8 pk	6000.00	34.22	36.12	17.64	33.35	255	80.00	-25.37	vertical	Peak

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-E1-17T0721
Page (47) of (66)

◆ 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	217.840E-3			
2	732.176E-6			PASS
3	69.217E-3	3.344	2.07	PASS
4	878.914E-6			PASS
5	11.790E-3	1.149	1.03	PASS
6	682.303E-6			PASS
7	7.868E-3	1.135	693.00E-3	PASS
8	663.490E-6			PASS
9	7.800E-3	2.167	360.00E-3	PASS
10	635.081E-6			PASS
11	7.468E-3	2.514	297.00E-3	PASS
12	656.669E-6			PASS
13	4.944E-3			PASS
14	588.998E-6			PASS
15	4.862E-3			PASS
16	613.100E-6			PASS
17	4.584E-3			PASS
18	606.672E-6			PASS
19	3.401E-3			PASS
20	581.828E-6			PASS
21	2.917E-3			PASS
22	605.398E-6			PASS
23	2.708E-3			PASS
24	611.980E-6			PASS
25	1.970E-3			PASS
26	618.717E-6			PASS
27	1.366E-3			PASS
28	740.630E-6			PASS
29	2.340E-3			PASS
30	675.289E-6			PASS
31	1.559E-3			PASS
32	672.876E-6			PASS
33	2.327E-3			PASS
34	689.280E-6			PASS
35	1.767E-3			PASS
36	542.424E-6			PASS
37	1.431E-3			PASS
38	583.605E-6			PASS
39	1.501E-3			PASS
40	585.214E-6			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	217.939E-3			
2	810.755E-6			PASS
3	69.269E-3	1.506	4.60	PASS
4	1.090E-3			PASS
5	11.863E-3	0.520	2.28	PASS
6	824.378E-6			PASS
7	7.938E-3	0.515	1.54	PASS
8	740.254E-6			PASS
9	7.905E-3	0.988	800.00E-3	PASS
10	725.396E-6			PASS
11	7.583E-3	1.149	660.00E-3	PASS
12	739.193E-6			PASS
13	5.029E-3	1.197	420.00E-3	PASS
14	629.934E-6			PASS
15	4.928E-3			PASS
16	735.606E-6			PASS
17	4.678E-3			PASS
18	662.738E-6			PASS
19	3.498E-3			PASS
20	634.759E-6			PASS
21	2.966E-3			PASS
22	694.800E-6			PASS
23	2.761E-3			PASS
24	682.716E-6			PASS
25	2.045E-3			PASS
26	670.911E-6			PASS
27	1.409E-3			PASS
28	864.249E-6			PASS
29	2.530E-3			PASS
30	742.423E-6			PASS
31	1.846E-3			PASS
32	857.833E-6			PASS
33	2.510E-3			PASS
34	782.881E-6			PASS
35	1.878E-3			PASS
36	590.265E-6			PASS
37	1.605E-3			PASS
38	675.907E-6			PASS
39	1.589E-3			PASS
40	661.572E-6			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.



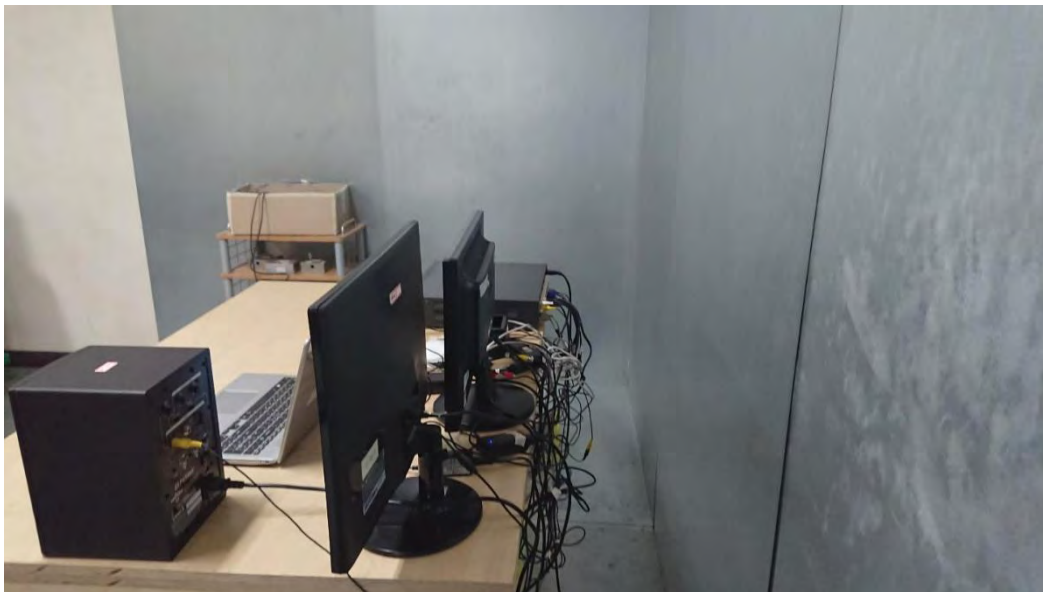
Test Data - Voltage Fluctuations

Maximum Flicker results

	EUT values	Limit	Result
Pst	0.028	1.00	PASS
Plt	0.028	0.65	PASS
dc [%]	0.000	3.30	PASS
dmax [%]	0.099	4.00	PASS
Tmax [s]	0.000	0.50	PASS

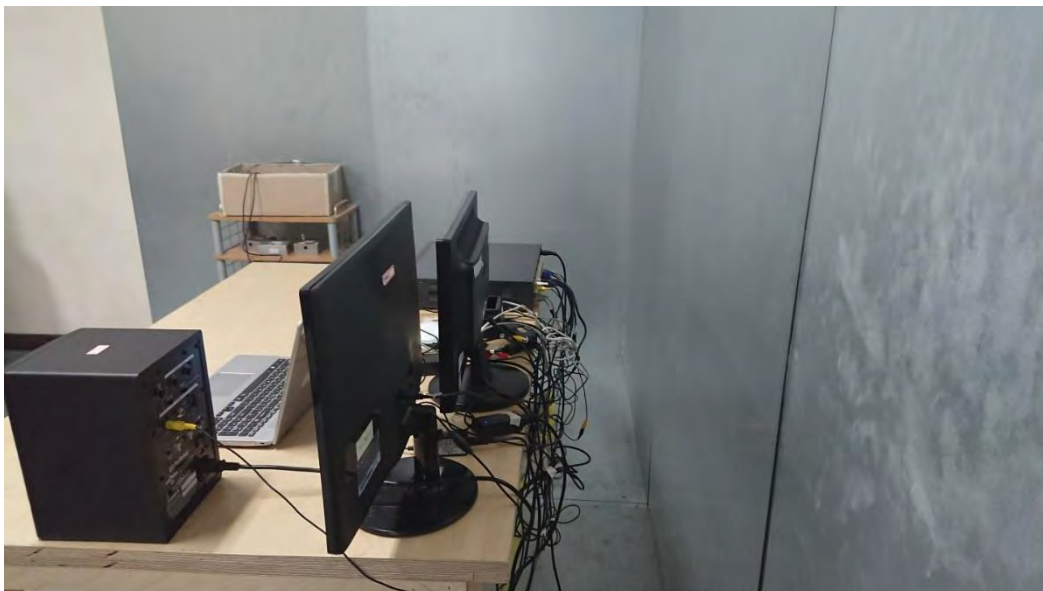
Test Setup Photos and Configuration

Conducted Voltage Emissions



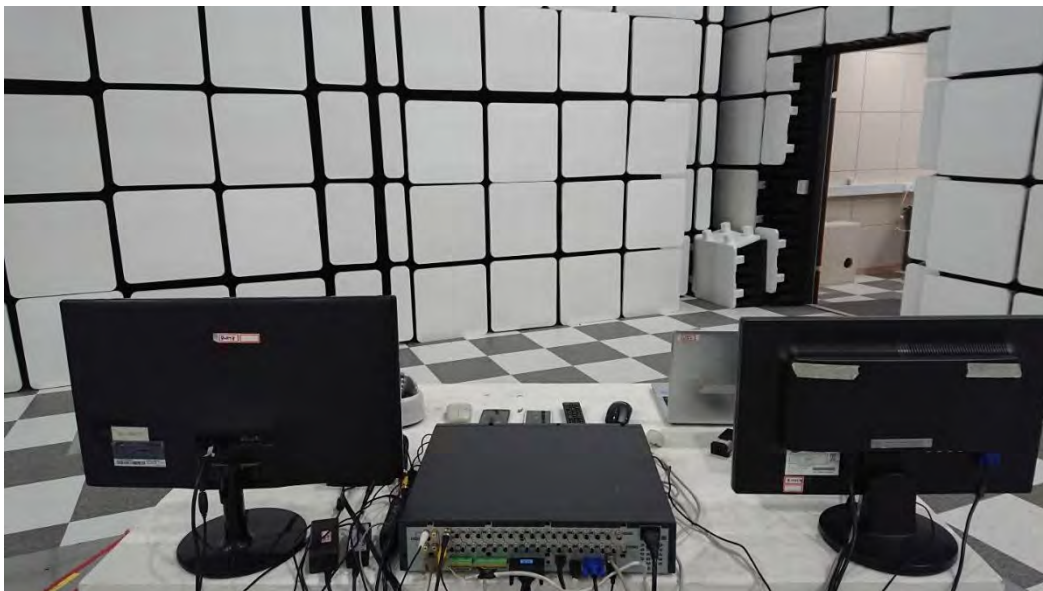
This report shall not be reproduced except in full, without the written approval of KES Co., Ltd.
The results shown in this test report refer only to the sample(s) tested unless otherwise stated.

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)



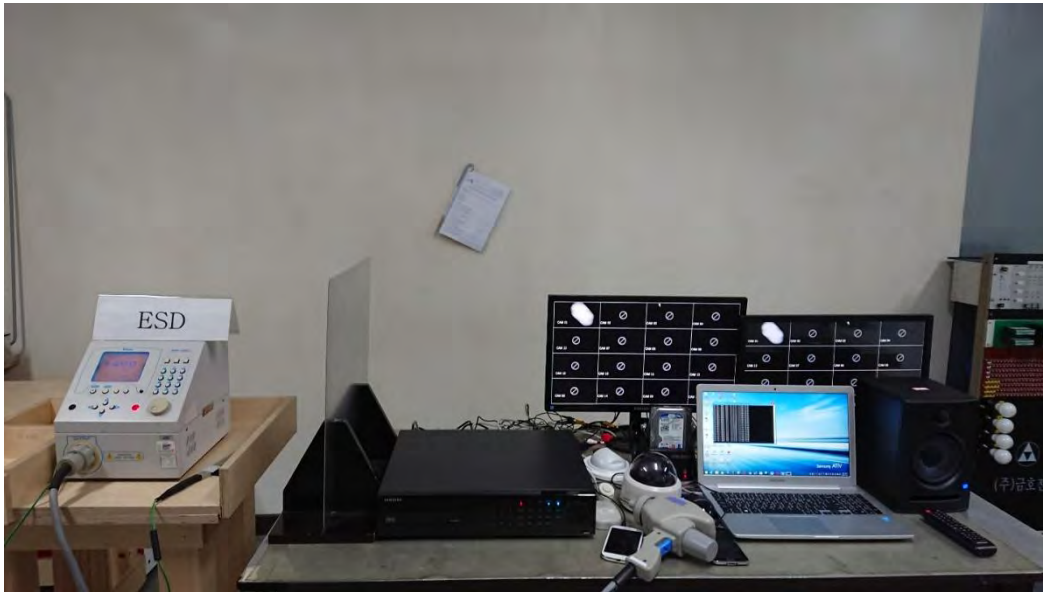
This report shall not be reproduced except in full, without the written approval of KES Co., Ltd.
The results shown in this test report refer only to the sample(s) tested unless otherwise stated.

Harmonic Current Emissions and Voltage Fluctuations and Flicker

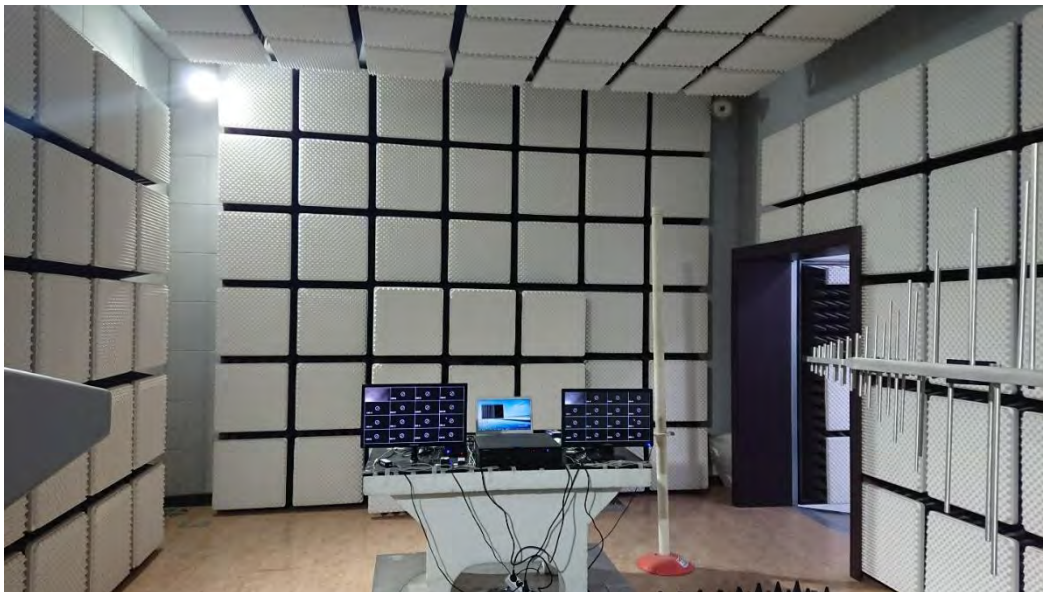


This report shall not be reproduced except in full, without the written approval of KES Co., Ltd.
The results shown in this test report refer only to the sample(s) tested unless otherwise stated.

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)



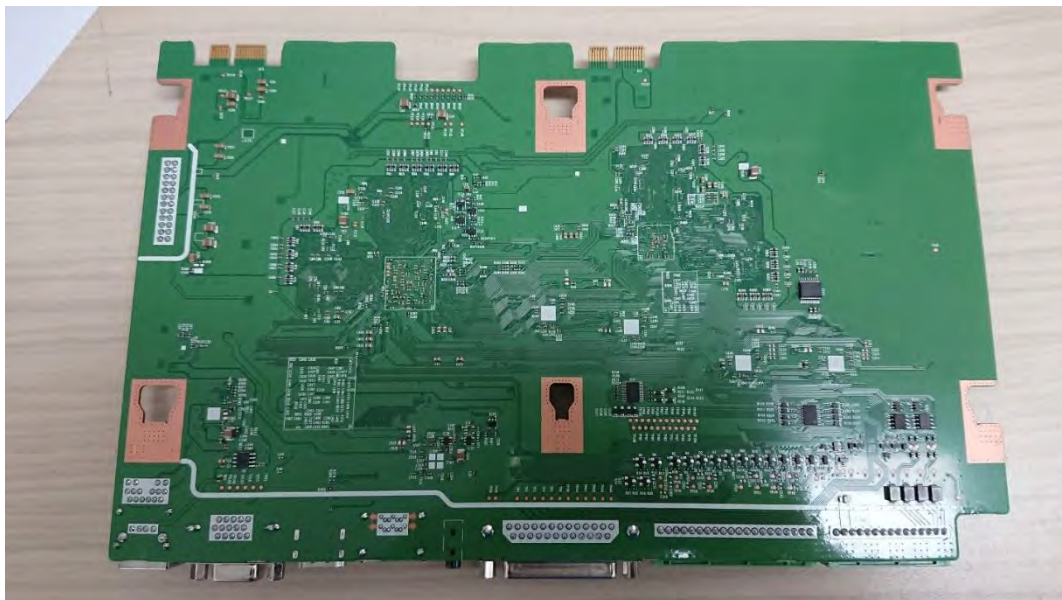
This report shall not be reproduced except in full, without the written approval of KES Co., Ltd.
The results shown in this test report refer only to the sample(s) tested unless otherwise stated.

EUT Internal View – Board 1

(Top)



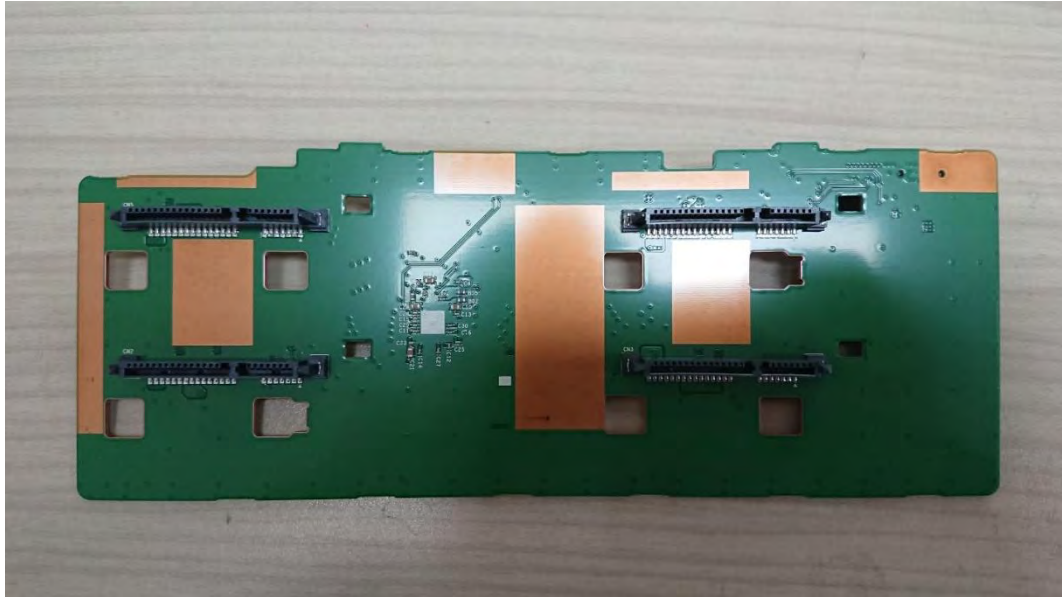
(Bottom)



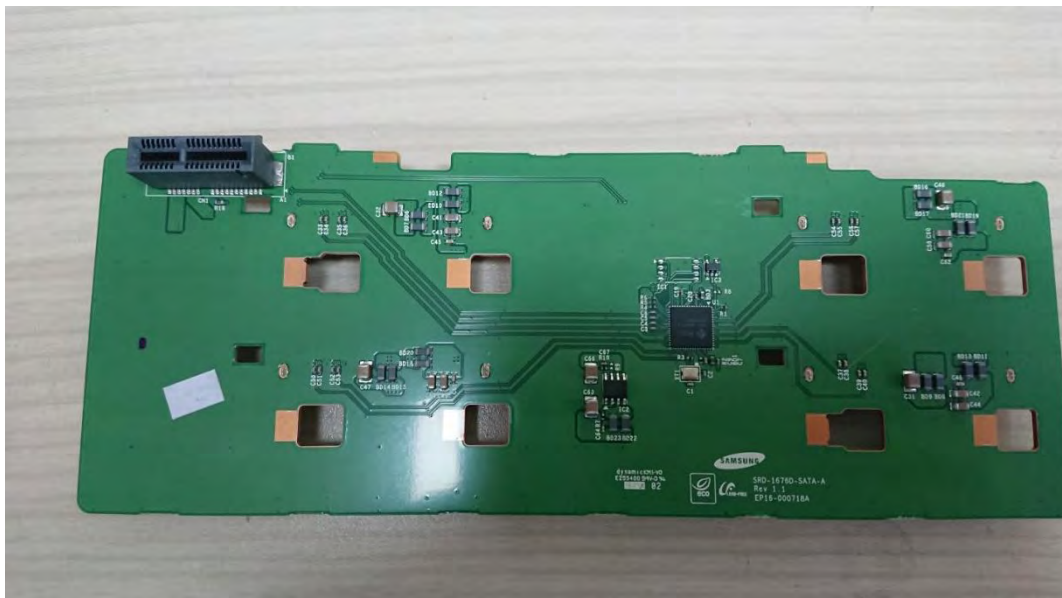
This report shall not be reproduced except in full, without the written approval of KES Co., Ltd.
The results shown in this test report refer only to the sample(s) tested unless otherwise stated.

EUT Internal View – Board 2

(Top)



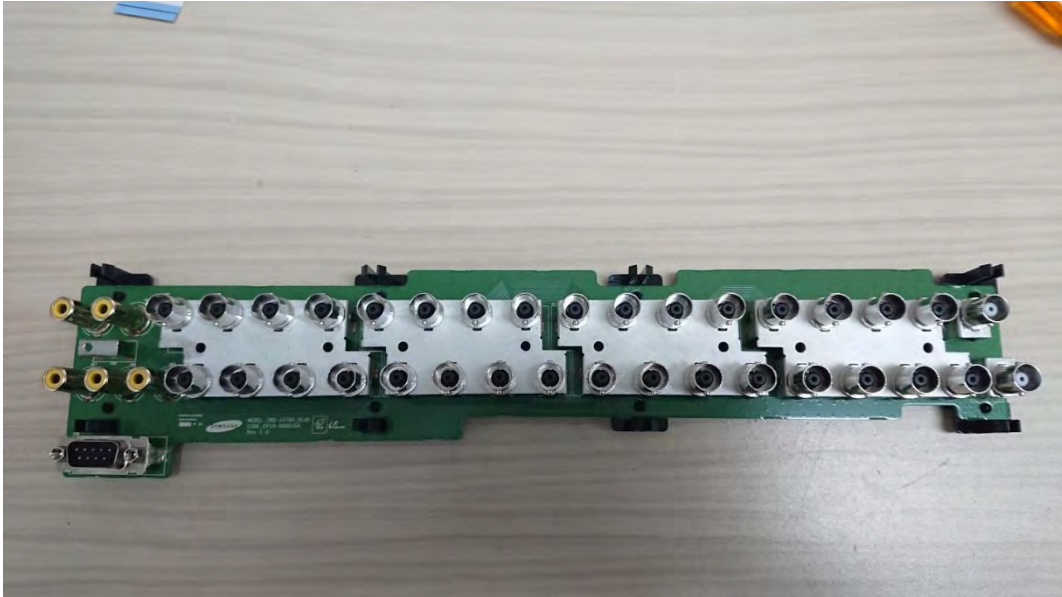
(Bottom)



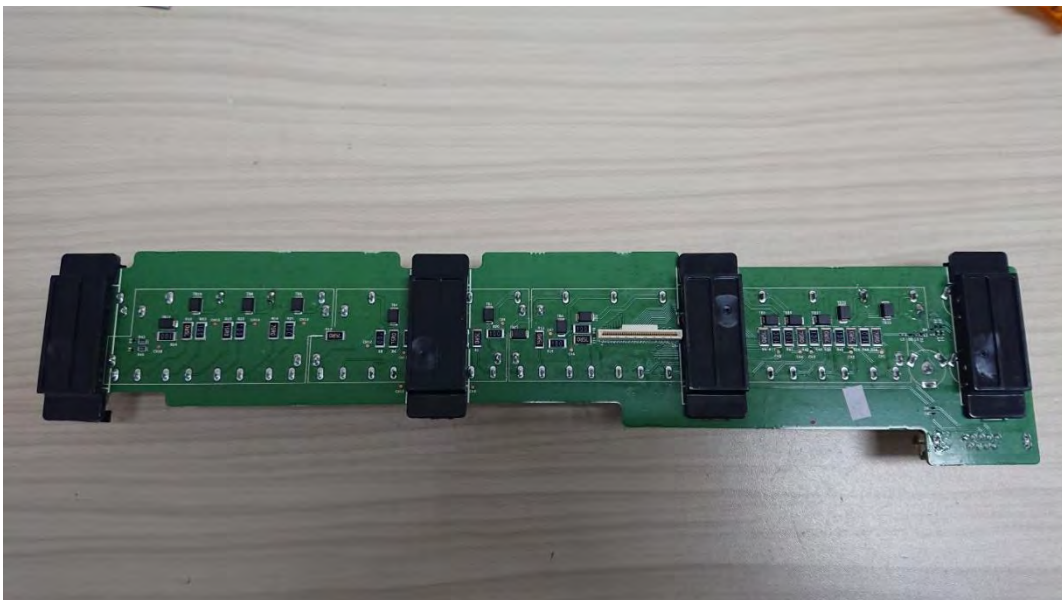
This report shall not be reproduced except in full, without the written approval of KES Co., Ltd.
The results shown in this test report refer only to the sample(s) tested unless otherwise stated.

EUT Internal View – Board 3

(Top)



(Bottom)



Label and Location



DVR

Model No : SRD-1656DP

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

Made in China

