



EMC TEST REPORT For CE

Test Report No. : KES-E2-17T0063
Date of Issue : Sep. 21, 2017
Product name : NVR
Model/Type No. : TRM-1610M
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 : Sep. 15, 2017
Test date : Sep. 16, 2017 – Sep. 18, 2017
Test Results : ☒ In Compliance ☐ Not in Compliance

Tested by

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This test report is not related to KOLAS.

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KES-E2-17T0063
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REPORT REVISION HISTORY

Date	Test Report No.	Revision History
Sep. 21, 2017	KES-E2-17T0063	Issued

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1.0 General Product Description

Main Specifications of E.U.T are:

Display		
Network Camera	Inputs	Max. 16CH (4 PoE)
	Resolution	CIF ~ 12MP
	Protocols	SUNAPI, ONVIF
Live	Local Display	HDMI / VGA
	Multi-Channel Display	[Local monitor] 1 / 2V / 3V / 4 / 6 / 8 / 9 / 13 / 16 / Auto sequence, [Web] 1 / 4 / 9 / 16 / Auto sequence
	Performance	[Local Monitor] - 12M (30fps). - 8.3M(120fps) - 1080p(480fps)
Performance		
Operating System	Embedded	Linux
Record	Compression	H.265, H.264, MJPEG, WiseStream(H.265, H.264)
	Recording Bandwidth	Max. 128Mbps(80Mbps)
	Resolution	CIF ~ 12MP
	Type	Manual, Schedule (Continuous / Event), Event (Pre / Post), Emergency
	Retention	Retention per channel (1~400 days)
	Event Trigger	Alarm Input (16), Video Loss, Camera Event(Sensor, MD, Video Analytics, Defocus)
	Event Action	e-Mail, Alarm Out, Buzzer, Monitor Out, vms
Search & Play	Playback Bandwidth	32Mbps (16CH simultaneously)
	User	Max. 4 Users (Local 1, Remote 3)
	Mode	Date & Time(Calendar)/Event Log list / Smart Search(Virtual Line w/ direction, Enter/Exit)
	Simultaneous playback	Max. 16CH(Local Monitor, CMS)



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 ☐ 230 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
NVR	TRM-1610M	-	Hanwha Techwin (Tianjin) Co.,Ltd	E.U.T



1.5 Support Equipments

Description	Model Number	Serial Number	Manufacturer	Remarks
Monitor1	LS23A300	ZS2XHVNB902349Z	SAMSUNG	-
Monitor1 Adapter	PN3014	-	POWERNET Technologies Corp.	-
Monitor2	LS23C340	ZXPCHTMF A02346H	SAMSUNG	-
Monitor2 Adapter	A2514_DPN	CN07BN4400591BSK 28F5NK904	11ssan Elecom(shen yang) Co., Ltd	-
Laptop1	LG15N54	410NZXE015458	LG	-
Laptop1 Adapter	ADP-90WH B	84ZW19F1747	DELTA ELECTRONICS(JIANGSU) LTD.	-
Laptop2	X56K	HN11N5151FJ0045W	HanSunG Corporation	-
Laptop2 Adapter	A12-120P1A	F180271552011758	CHICONY POWER TECHNOLOGY CO.,LTD.	-
Speaker	BR10000A CUVE	-	BEIJING EDIFIER HI-TECH GROUP.	-
Mouse	M-U0026	1505HS0687B8	Logiech	-
Home Router	N604R	-	ipTIME	-
Home Router Adapter	DCP005C9050K	-	Zioncom Electronics (Shenzhen) Ltd.	-
Camera Controller	-	-	WISENET	-
Controller	SPC-1010	C50E67WG10100F	SamSung Techwin Co.,Ltd.	-
Controller Adapter	RS-AB1000	-	Dongguan Jinhua Sheng Power Technology Co.,Ltd.	-
Camera	XND-8030R	-	Hanwha Techwin (Tianjin) Co.,Ltd	-
GPS receiving set	-	-	-	-
USB 3.0 Memory	-	-	Lexar	-

1.6 External I/O Cabling

Start		END		Cable Spec.	
Description	I/O Port	Description	I/O Port	Length	Shield
NVR (EUT)	D-SUB	Monitor1	D-SUB	1.3	S
	HDMI	Monitor2	HDMI	1.4	S
	RJ-45	Laptop1	RJ-45	4.0	U
	4Pin	Mouse	USB	1.2	U
	RS-232	Camera Controller	RS-232	1.0	U
	Parallel port	Controller	Parallel port	3.0	U
	RJ-45	Camera	RJ-45	3.0	U
	AUDIO	Speaker	AUDIO	1.3	U
	GPS Port	GPS receiving set	GPS Port	2.0	U
	USB 3.0	USB 3.0 Memory	USB 3.0	-	-
	-	Home Router	-	-	-
Laptop2	-	Home Router	-	-	-

* Unshielded = U, Shielded = S

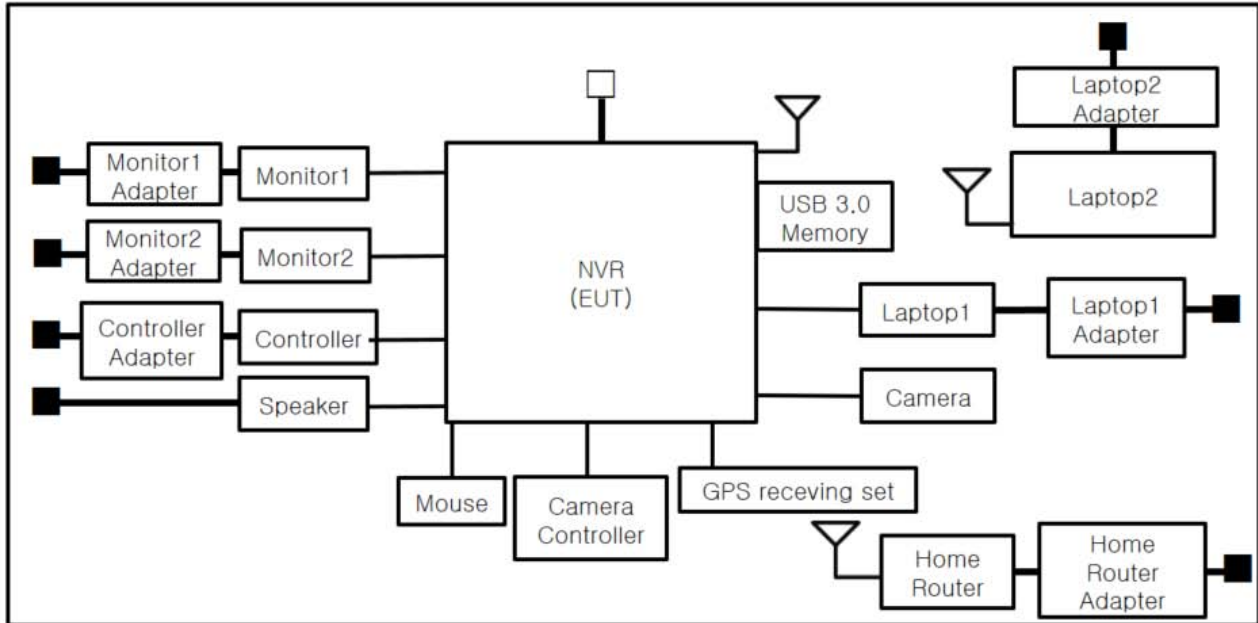
1.7 E.U.T Operating Mode(s)

Test mode	operating
Operating	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 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 32.

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)	

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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 55022:2010

☐ Class A

☐ Class B

☐ EN 55024:2010

☐ EN 50130-4:2011 +A1:2014

☐ 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 V2.1.1

- ☒ Equipment for fixed use
- ☐ Equipment for vehicular use
- ☐ Equipment for portable use

☐ EN 301 489-3 V1,6,1

☐ EN 301 489-9 V1,4,1

☒ EN 301 489-17 V2,2,1

☐ EN 60945:2002

☐ EN 61000-3-2:2014

☐ EN 61000-3-3:2013



2.1 Conducted Emissions at Mains Power Ports

Test Date

Sep. 16, 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	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

Test Conditions

Temperature: 23,0 °C
Relative Humidity: 52,1 %

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

N/A

2.2 Conducted Emissions at Telecommunication Ports

Test Date

Sep. 16, 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	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: 23,0 °C
Relative Humidity: 52,1 %

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

Sep. 16, 2017

Test Location

☐ Open Area Test Site #1 ☒ 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: 23,6 °C

Relative Humidity: 52,3 %

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

Sep. 16, 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: 23,0 °C

Relative Humidity: 52,1 %

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

N/A

Test Location

Electro wave Shieldroom

Test Equipment

Used	Description	Model Number	Manufacturer	Serial Number	Cal. Due
☐	EMI Test S/W	dpa.control	EM TEST	5.4.11.0	-
☐	DIGITAL POWER ANALYZER	DPA 500N	EM TEST	V1024106759	2018.08.09
☐	POWER SOURCE	ACS 500N6	EM TEST	V1024106760	-

Test Conditions

Temperature: °C
Relative Humidity: %

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

N/A : Input power condition during the measurements was 24 V(dc).



2.6 Voltage Fluctuations and Flicker

Test Date

N/A

Test Location

Electro wave Shieldroom

Test Equipment

Used	Description	Model Number	Manufacturer	Serial Number	Cal. Due
☐	EMI Test S/W	dpa.control	EM TEST	5.4.11.0	-
☐	DIGITAL POWER ANALYZER	DPA 500N	EM TEST	V1024106759	2018.08.09
☐	POWER SOURCE	ACS 500N6	EM TEST	V1024106760	-

Test Conditions

Temperature: °C
Relative Humidity: %

Test Results

The requirements are:

- ☐ PASS
☐ NOT PASS
☒ NOT APPLICABLE

Remarks

N/A : Input power condition during the measurements was 24 V(dc).

3.0 Criteria for compliance

The performance criteria are:

- performance criteria A for immunity tests with phenomena of a continuous nature;
- performance criteria B for immunity tests with phenomena of a transient nature;
- performance criteria for immunity tests with power interruptions exceeding a certain time.

The equipment shall meet the performance criteria as specified in the following clauses.

Performance table

Criteria	During test	After test
A	Shall operate as intended. May show degradation of performance (see note 1). Shall be no loss of function. Shall be no unintentional transmissions.	Shall operate as intended. Shall be no degradation of performance (see note 2). Shall be no loss of function. Shall be no loss of stored data or user programmable functions.
B	May show loss of function (one or more). May show degradation of performance (see note 1). No unintentional transmissions.	Functions shall be self-recoverable. Shall operate as intended after recovering. Shall be no degradation of performance (see note 2). Shall be no loss of stored data or user programmable functions.
C	May be loss of function (one or more).	Functions shall be recoverable by the operator. Shall operate as intended after recovering. Shall be no degradation of performance (see note 2).
NOTE 1:	Degradation of performance during the test is understood as a degradation to a level not below a minimum performance level specified by the manufacturer for the use of the apparatus as intended. In some cases the specified minimum performance level may be replaced by a permissible degradation of performance. If the minimum performance level or the permissible performance degradation is not specified by the manufacturer then either of these may be derived from the product description and documentation (including leaflets and advertising) and what the user may reasonably expect from the apparatus if used as intended.	
NOTE 2:	No degradation of performance after the test is understood as no degradation below a minimum performance level specified by the manufacturer for the use of the apparatus as intended. In some cases the specified minimum performance level may be replaced by a permissible degradation of performance. After the test no change of actual operating data or user retrievable data is allowed. If the minimum performance level or the permissible performance degradation is not specified by the manufacturer then either of these may be derived from the product description and documentation (including leaflets and advertising) and what the user may reasonably expect from the apparatus if used as intended.	



Performance criteria for Continuous phenomena applied to Transmitters (CT)

The performance criteria A shall apply.

The EUT shall not unintentional transmission during the test.

The EUT shall to wireless communication camera and check the REMOVU MotorStabilizer

Performance criteria for Transient phenomena applied to Transmitters (TT)

The EUT shall not unintentional transmission after the test.

The EUT shall to wireless communication camera and check the REMOVU MotorStabilizer

The performance criteria B shall apply, except for voltage dips of 100 ms and voltage interruptions of 5 000 ms duration, for which performance criteria C shall apply. However, internal battery benchmark since it is applied B

Performance criteria for Continuous phenomena applied to Receivers (CR)

The performance criteria A shall apply.

The EUT shall not unintentional transmission during the test.

The EUT shall to wireless communication camera and check the REMOVU MotorStabilizer

Performance criteria for Transient phenomena applied to Receivers (TR)

The EUT shall not unintentional transmission after the test.

The EUT shall to wireless communication camera and check the REMOVU MotorStabilizer

The performance criteria B shall apply, except for voltage dips of 100 ms and voltage interruptions of 5 000 ms duration for which performance criteria C shall apply. However, internal battery benchmark since it is applied B



3.1 Electrostatic Discharge

Reference Standard

EN 61000-4-2:2009

Test Date

Sep. 18, 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	ESS05X4620	2018.02.24
☒	HCP	-	Noise Ken	-	-
☒	VCP	-	KES	-	-

Test Conditions

Temperature: 23,4 °C
Relative Humidity: 52,5 %
Atmospheric Pressure: 101,6 kPa



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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

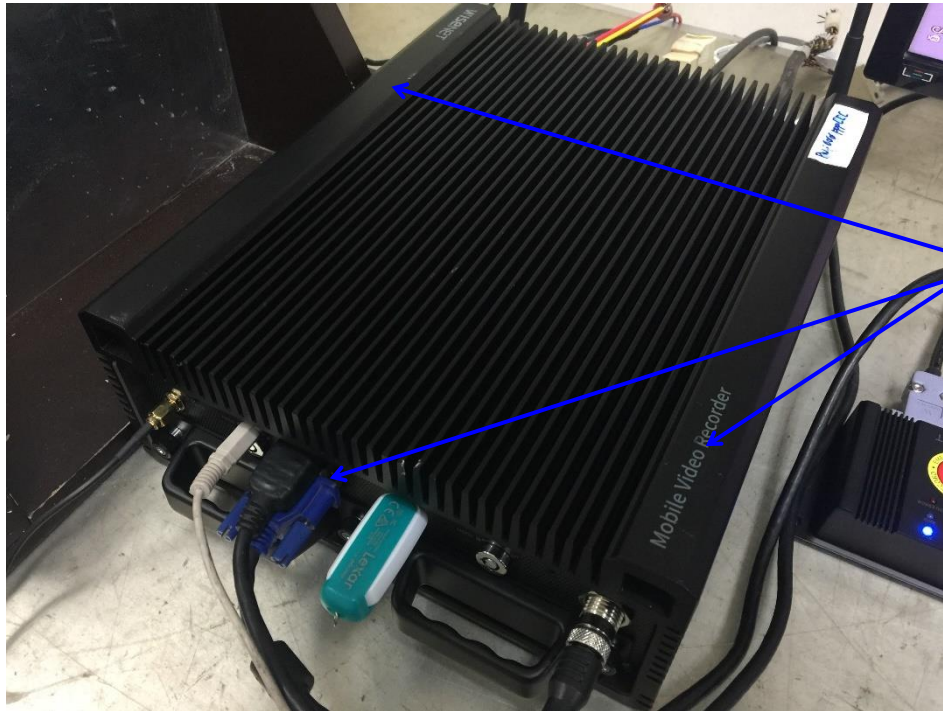
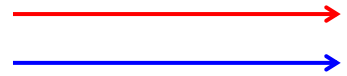
Discharge Voltage:	Contact	Air	HCP	VCP
	☐ 2 kV	☐ 2 kV	☐ 2 kV	☐ 2 kV
	☒ 4 kV	☐ 4 kV	☒ 4 kV	☒ 4 kV
	☐ 6 kV	☐ 6 kV	☐ 6 kV	☐ 6 kV
	☐ 8 kV	☒ 8 kV	☐ 8 kV	☐ 8 kV
	☐ 15 kV	☐ 15 kV	☐ 15 kV	☐ 15 kV

Notes: HCP: Horizontal coupling plane
VCP: Vertical coupling plane

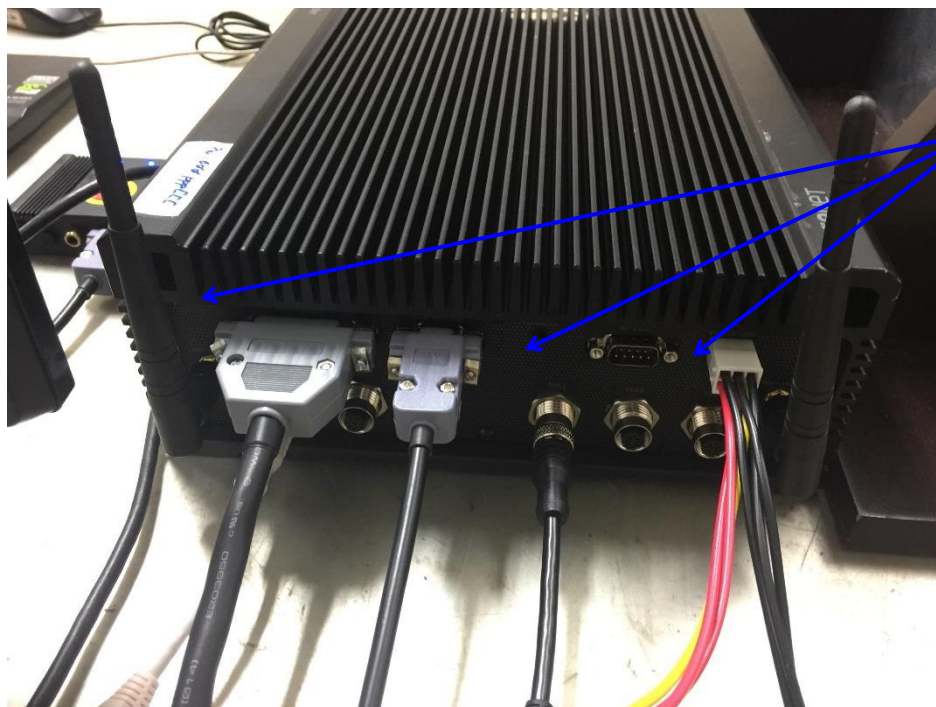
Required Performance Criteria: ☒ Complied

Location of Discharge:

Air
Contact



1



2

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Test Data**Indirect Discharge**

No.	Test Point	Discharge Method	Performance		Remarks
			Criteria	Results	
1	HCP Contact	Contact Discharge	B	A	-
2	VCP Contact	Contact Discharge	B	A	-

Direct Discharge

No.	Test Point	Discharge Method	Performance		Remarks
			Criteria	Results	
1	Enclosure	Contact Discharge	B	A	-
2	Port rear	Contact Discharge	B	A	-

Note: "Blank" = Not performed

Observations:

A – No degradation of function

B – Distortion/Error of function (self-recoverable)

C – Loss of function

Test Results

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

Remarks

PASS Required Performance Criteria.



3.2 Radiated Electric Field Immunity

Reference Standard

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

Test Date

Sep. 16, 2017

Test Location

EMS-RS: ☐ Semi Anechoic Chamber #1 ☒ Semi Anechoic Chamber #2

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	-	2017.11.01
☒	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	-

Test Conditions

Temperature: 23,0 °C
Relative Humidity: 52,1 %
Atmospheric Pressure: 99,7 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: ☒ A

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Test Data

Side Exposed	Performance Criteria	Results	
		Horizontal	Vertical
Front	A	A	A
Right	A	A	A
Back	A	A	A
Left	A	A	A

Note: "Blank" = Not performed

Observations:

- A – No degradation of function
- B – Distortion/Error of function (self-recoverable)
- C – Loss of function

Test Results

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

Remarks

PASS Required Performance Criteria

3.3 Electrical Fast Transients / Bursts

Reference Standard

EN 61000-4-4:2012

Test Date

Sep. 18, 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	5.3.9	-
☒	ULTRA COMPACT SIMULATOR	UCS 500N5T	EM TEST	P1317117973	02, 08, 2018
☒	MOTOR VARIAC	MV2616	EM TEST	V0936105123	02, 08, 2018
☒	CAPACITIVE COUPLING CLAMP	HFK	EM TEST	070925	06, 26, 2018

Test Conditions

Temperature: 23,4 °C
Relative Humidity: 52,5 %
Atmospheric Pressure: 101,6 kPa

Test Specifications

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

Pulse Amplitude & Polarity:
(DC Power 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: ☒ B

**Test Data**☐ Input a.c. power ports – Coupling/Decoupling Network used

Mode of Application	Performance Criteria	Results	
		(+) Burst (kV)	(-) Burst (kV)
-	B	-	-

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

Mode of Application	Performance Criteria	Results	
		(+) Burst (kV)	(-) Burst (kV)
L - N	B	A	A

☒ Signal ports and telecommunication ports – Coupling Clamp used

Mode of Application	Performance Criteria	Results	
		(+) Burst (kV)	(-) Burst (kV)
RJ-45(Laptop)	B	A	A
RJ-45(Camera)	B	A	A
Parallel Port	B	A	A

Observations:

A – No degradation of function

B – Distortion/Error of function (self-recoverable)

C – Loss of function

Test Results

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

Remarks

PASS Required Performance Criteria



3.4 Surge Transients

Reference Standard

EN 61000-4-5:2014

Test Date

Sep. 18, 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	5.3.9	-
☒	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

Test Conditions

Temperature: 23,4 °C
Relative Humidity: 52,5 %
Atmospheric Pressure: 101,6 kPa



Test Specifications

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: ☐ B

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: ☒ B

**Test Data****Power Lines**☐ Line to Line – Differential Mode

Mode of Application	Performance Criteria	Results	
		(+) Surge (kV)	(-) Surge (kV)
-	B	-	-

☐ Line to Earth – Common Mode

Mode of Application	Performance Criteria	Results	
		(+) Surge (kV)	(-) Surge (kV)
-	B	-	-

Signal Lines☒ Line to Earth – Common Mode

Mode of Application	Performance Criteria	Results	
		(+) Surge (kV)	(-) Surge (kV)
RJ-45(Laptop)	B	C	C
RJ-45(Camera)	B	C	C
Parallel Port	B	C	C

Note: "Blank" = Not performed

Observations:

A – No degradation of function

B – Distortion/Error of function (self-recoverable)

C – Loss of function

Test Results

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

Remarks

PASS Required Performance Criteria



3.5 Conducted Disturbance

Reference Standard

EN 61000-4-6:2014

Test Date

Sep. 18, 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	5.3.7	-
☒	CONTINUOUS WAVE SIMULATOR	CWS 500N1	EM TEST	V0936105119	2018.08.07
☒	ATTENUATOR	ATT6	EM TEST	1208-34	2018.08.07
☒	CDN	CDN-M2/M3N	EM TEST	0909-06	2018.08.07
☒	CDN	CDN T8RJ45	EM TEST	0909-09	2018.08.07
☒	EM INJECTION CLAMP	EM 101	Liithi	35943	2018.02.03

Test Conditions

Temperature: 23,4 °C
Relative Humidity: 52,5 %
Atmospheric Pressure: 101,6 kPa



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Test Specifications

Frequency range:

☒ 150 kHz to 80 MHz

☐ 150 kHz to 230 MHz

☐ 10 kHz to 30 MHz

☐ 10 kHz to 100 MHz

Voltage Level:

☐ 1 Vrms

☐ 10 Vrms

☒ 3 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: ☒ A

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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	Performance Criteria	Results
-	CDN (☐ M2, ☐ M3)	A	-

☒ Input d.c. power ports

Coupling Location (Line Stressed)	Coupling Method	Performance Criteria	Results
L-N	CDN (☒ M2, ☐ M3)	A	-

☒ Signal ports and telecommunication ports

Coupling Location (Line Stressed)	Coupling Method	Performance Criteria	Results
RJ-45(Laptop)	CDN	A	A
RJ-45(Camera)	CDN	A	A
Parallel Port	EM Injection Clamp	A	A

Notes: CDN = Coupling Decoupling Network
EMC = Electro Magnetic Clamp
"blank" = Not performed

Observations:

A – No degradation of function
B – Distortion/Error of function (self-recoverable)
C – Loss of function

Test Results

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

Remarks

PASS Required Performance Criteria



3.6 Voltage Dips and Short Interruptions

Reference Standard

EN 61000-4-11:2004

Test Date

N/A

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	5.3.9	-
☐	ULTRA COMPACT SIMULATOR	UCS 500N5T	EM TEST	P1317117973	02, 08, 2018
☐	MOTOR VARIAC	MV2616	EM TEST	V0936105123	02, 08, 2018

Test Conditions

Temperature: °C
Relative Humidity: %
Atmospheric Pressure: kPa

Test Specifications

Number of Tests : 3 times
Test Intervals : 10 sec
Performance Criteria :
B for Voltage Dips (100 %, 0.5 T)
B for Voltage Dips (100 %, 1 T)
C for Voltage Dips (30%, 25 T)
C for Voltage Interruptions (100 %, 250 T)

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Test Data

Voltage Dips

NO	Depth	Duration	Performance		Remarks
			Criteria	Results	
1	100 %	0.5 T	B	-	-
2	100 %	1 T	B	-	-
3	30 %	25 T	C	-	-

Short Interruptions

NO	Depth	Duration	Performance		Remarks
			Criteria	Results	
1	100 %	250 T	C	-	-

Observations:

- A – No response observed from E.U.T
B – Unit shuts down then automatically restarts when full voltage is restored.
C – Unit shuts down then manually restarts when full voltage is restored or Loss of function.

Test Results

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

Remarks

- N/A



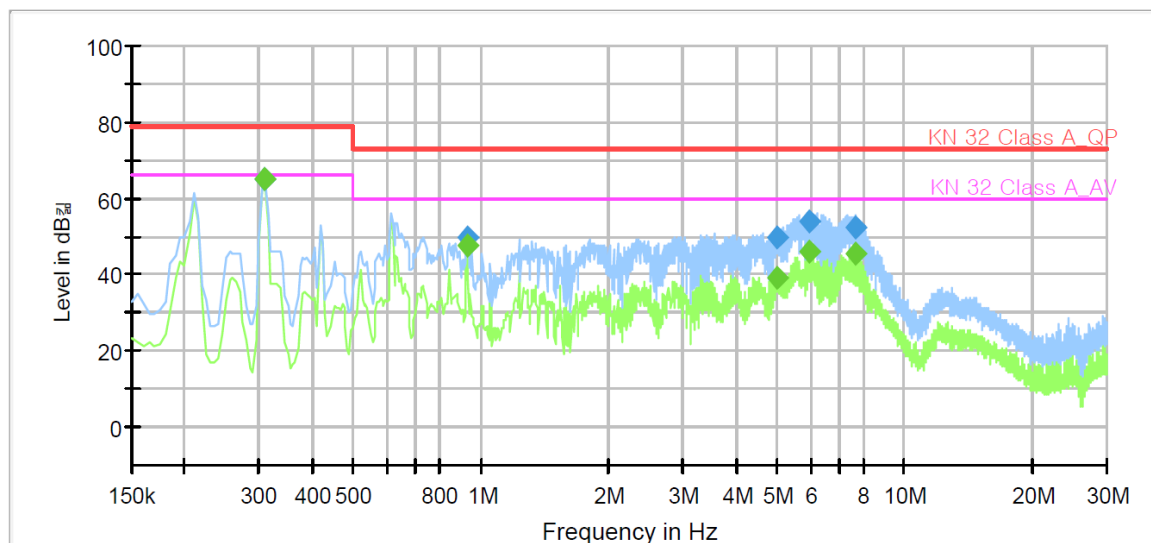
APPENDIX A – TEST DATA

Conducted Emissions at Mains Power Ports

[HOT]

Common Information

Test Description: Telecommunication Emission
Model No.: TRM-1610M
Mode: +
Operator Name: KES



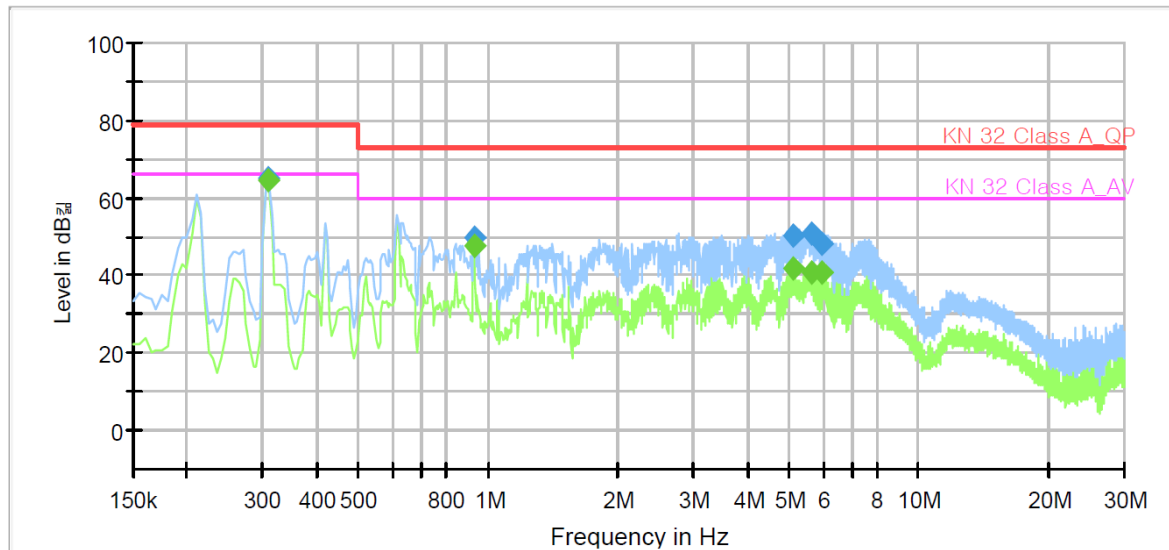
Final Result

Frequency (MHz)	QuasiPeak (dB μ V)	CAverage (dB μ V)	Limit (dB μ V)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.310000	---	64.80	66.00	1.20	1000.0	9.000	Single Line	10.1
0.310000	65.00	---	79.00	13.98	1000.0	9.000	Single Line	10.1
0.925000	---	46.57	60.00	13.43	1000.0	9.000	Single Line	10.2
0.925000	49.31	---	73.00	23.29	1000.0	9.000	Single Line	10.2
5.015000	---	38.03	60.00	19.97	1000.0	9.000	Single Line	10.4
5.015000	49.81	---	73.00	23.19	1000.0	9.000	Single Line	10.4
5.975000	---	46.16	60.00	13.84	1000.0	9.000	Single Line	14.4
5.975000	54.25	---	73.00	18.75	1000.0	9.000	Single Line	14.4
7.620000	---	45.56	60.00	14.44	1000.0	9.000	Single Line	16.1
7.620000	52.51	---	73.00	20.49	1000.0	9.000	Single Line	16.1

[NEUTURAL]

Common Information

Test Description: Telecommunication Emission
Model No.: TRM-1610M
Mode: -
Operator Name: KES



Final Result

Frequency (MHz)	QuasiPeak (dBμV)	CAverage (dBμV)	Limit (dBμV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.310000	---	64.82	66.00	1.18	1000.0	9.000	Single Line	10.0
0.310000	64.99	---	79.00	14.01	1000.0	9.000	Single Line	10.0
0.925000	---	47.48	60.00	12.52	1000.0	9.000	Single Line	10.2
0.925000	49.52	---	73.00	23.48	1000.0	9.000	Single Line	10.2
5.120000	---	41.59	60.00	18.41	1000.0	9.000	Single Line	10.3
5.120000	50.46	---	73.00	22.54	1000.0	9.000	Single Line	10.3
5.660000	---	40.68	60.00	19.32	1000.0	9.000	Single Line	10.2
5.660000	50.63	---	73.00	22.37	1000.0	9.000	Single Line	10.2
5.975000	---	40.70	60.00	19.30	1000.0	9.000	Single Line	10.2
5.975000	48.06	---	73.00	24.94	1000.0	9.000	Single Line	10.2

◆ Calculation

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

QuasiPeak / CAverage : The Final Value

Reading Value : Not shown in the table.

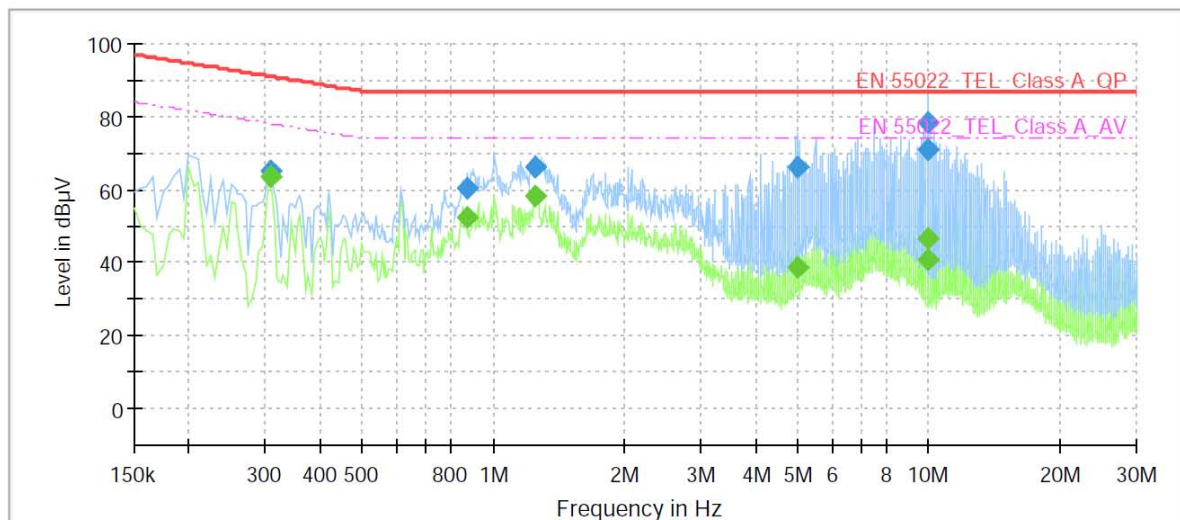
Corr. : Correction values (LISN FACTOR+ (Cable Loss + Pulse Limiter FACTOR))

Conducted Emissions at Telecommunication Ports

[10 Mbps]

Common Information

Test Description: Telecommunication Emission
Model No.:
Mode: 10
Operator Name: KES



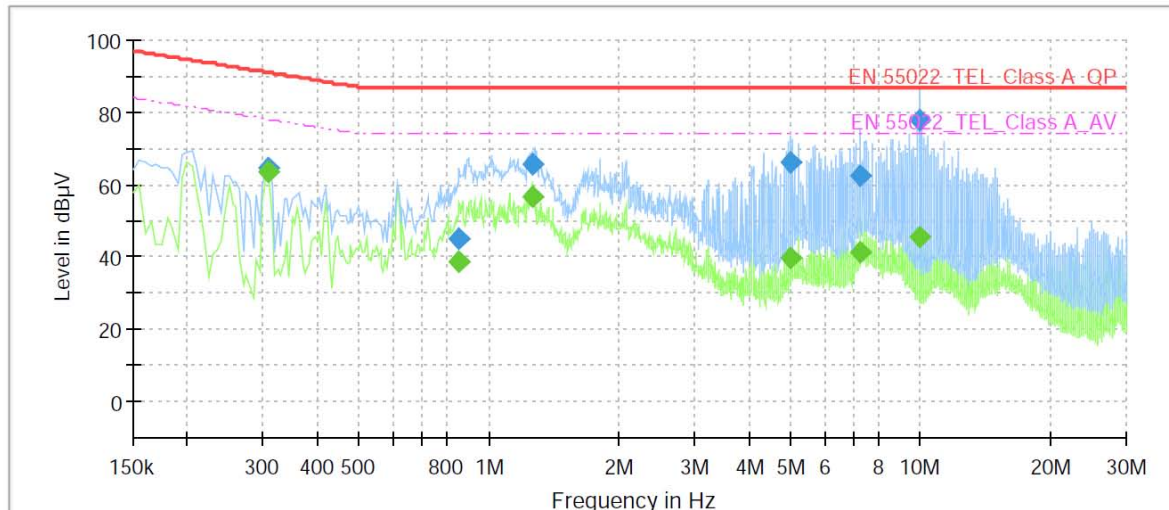
Final Result

Frequency (MHz)	QuasiPeak (dBμV)	CAverage (dBμV)	Limit (dBμV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.310000	---	63.37	77.97	14.60	1000.0	9.000	Single Line	19.9
0.310000	64.98	---	90.97	25.99	1000.0	9.000	Single Line	19.9
0.875000	---	52.27	74.00	21.73	1000.0	9.000	Single Line	20.0
0.875000	60.43	---	87.00	26.57	1000.0	9.000	Single Line	20.0
1.255000	---	58.39	74.00	15.61	1000.0	9.000	Single Line	20.0
1.255000	66.37	---	87.00	20.63	1000.0	9.000	Single Line	20.0
5.015000	---	38.59	74.00	35.41	1000.0	9.000	Single Line	20.0
5.015000	66.32	---	87.00	20.68	1000.0	9.000	Single Line	20.0
9.965000	---	40.91	74.00	33.09	1000.0	9.000	Single Line	19.8
9.965000	70.72	---	87.00	16.28	1000.0	9.000	Single Line	19.8
10.000000	---	46.76	74.00	27.24	1000.0	9.000	Single Line	19.8
10.000000	78.47	---	87.00	8.53	1000.0	9.000	Single Line	19.8

[1000 Mbps]

Common Information

Test Description: Telecommunication Emission
Model No.:
Mode: 1000
Operator Name: KES



Final Result

Frequency (MHz)	QuasiPeak (dBμV)	CAverage (dBμV)	Limit (dBμV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.310000	---	63.43	77.97	14.54	1000.0	9.000	Single Line	19.3
0.310000	64.38	---	90.97	26.59	1000.0	9.000	Single Line	19.3
0.855000	---	38.51	74.00	35.49	1000.0	9.000	Single Line	19.4
0.855000	45.03	---	87.00	41.97	1000.0	9.000	Single Line	19.4
1.260000	---	56.75	74.00	17.25	1000.0	9.000	Single Line	19.5
1.260000	65.45	---	87.00	21.55	1000.0	9.000	Single Line	19.5
5.000000	---	39.58	74.00	34.42	1000.0	9.000	Single Line	19.4
5.000000	65.96	---	87.00	21.04	1000.0	9.000	Single Line	19.4
7.265000	---	41.55	74.00	32.45	1000.0	9.000	Single Line	19.3
7.265000	62.43	---	87.00	24.57	1000.0	9.000	Single Line	19.3
10.005000	---	45.70	74.00	28.30	1000.0	9.000	Single Line	19.2
10.005000	77.64	---	87.00	9.36	1000.0	9.000	Single Line	19.2

◆ 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))



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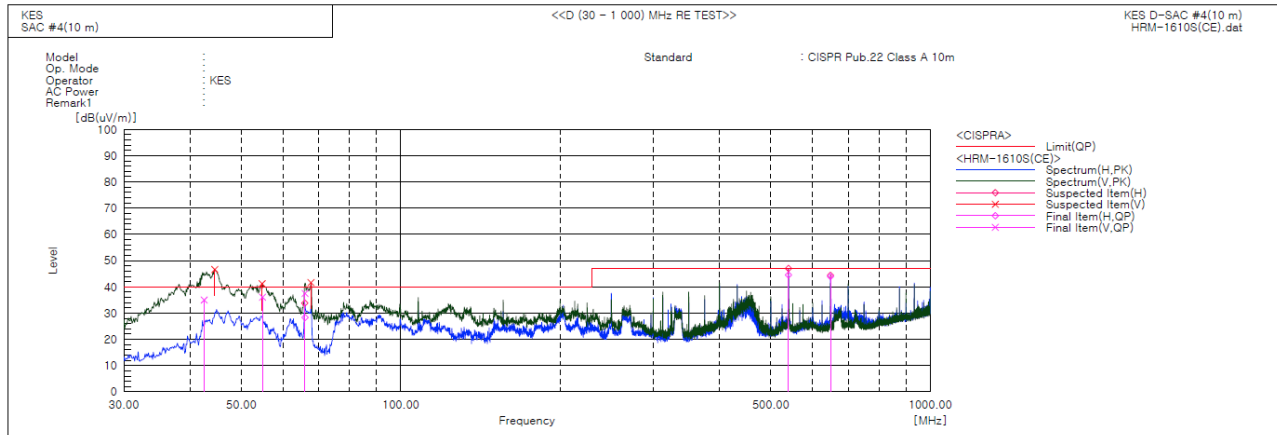
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Radiated Electric Field Emissions(Below 1 GHz)



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	42.542	V	63.4	-28.4	35.0	40.0	5.0	394.0	49.0	
2	54.826	V	64.1	-28.0	36.1	40.0	3.9	100.0	300.0	
3	65.981	H	59.0	-30.6	28.4	40.0	11.6	272.0	280.0	
4	65.980	V	68.1	-30.6	37.5	40.0	2.5	101.0	170.0	
5	540.003	H	60.5	-16.0	44.5	47.0	2.5	138.0	141.0	
6	647.994	H	57.9	-13.9	44.0	47.0	3.0	173.0	4.0	

◆ Calculation – SAC #4(10 m)

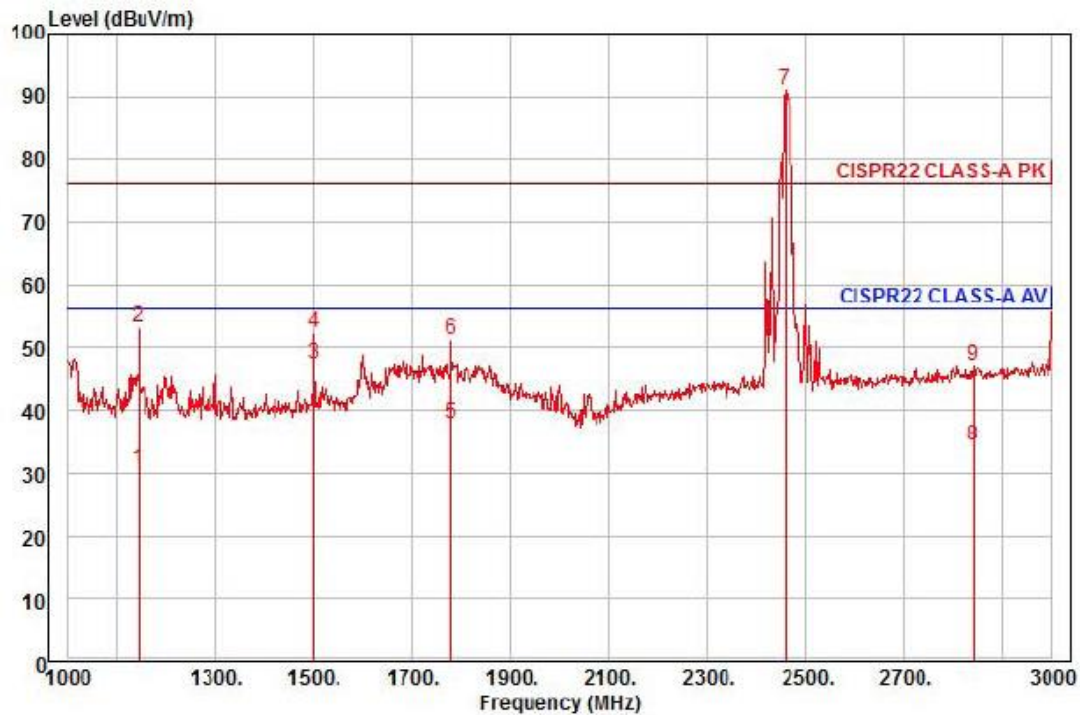
Result(QP) [dB(μV/m)] = (Reading(QP)[dB(μV)] + c.f[dB(1/m)])

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 :

Mode : CE

Memo : (1 ~ 3) GHz

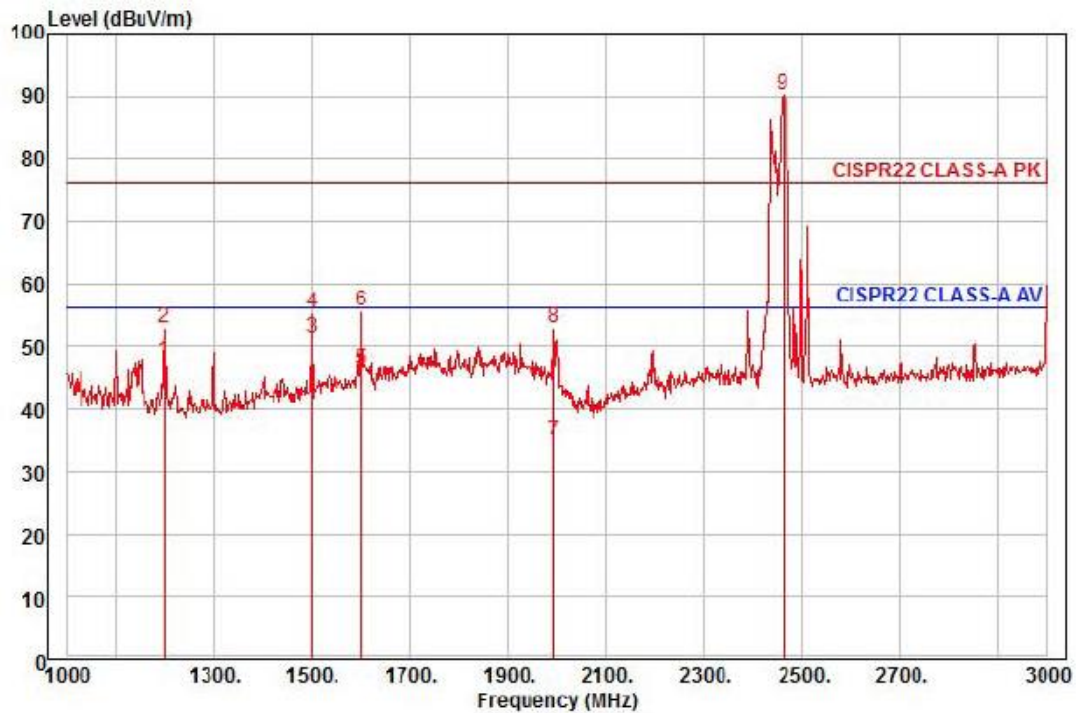
	Freq	Read Level	Ant Factor	Cable Loss	Preamp Factor	TPos	Limit Line	Over Limit	Pol/Phase	Remark
	MHz	dBuV	dB/m	dB	dB	deg	dBuV/m	dB		
1	1144.00	30.38	22.94	7.10	35.93	320	56.00	-25.42	horizontal	Average
2	1144.00	52.84	22.94	7.10	35.93	320	76.00	-22.96	horizontal	Peak
3 av	1500.00	44.77	24.02	8.22	35.61	294	56.00	-8.50	horizontal	Average
4	1500.00	49.61	24.02	8.22	35.61	294	76.00	-23.66	horizontal	Peak
5	1778.00	33.11	25.13	9.03	35.37	222	56.00	-18.00	horizontal	Average
6	1778.00	46.25	25.13	9.03	35.37	222	76.00	-24.86	horizontal	Peak
7 pp	2458.00	82.08	27.40	10.73	35.35	324	76.00	14.97	horizontal	Peak
8	2840.00	22.90	29.03	11.71	35.50	192	56.00	-21.75	horizontal	Average
9	2840.00	35.69	29.03	11.71	35.50	192	76.00	-28.96	horizontal	Peak



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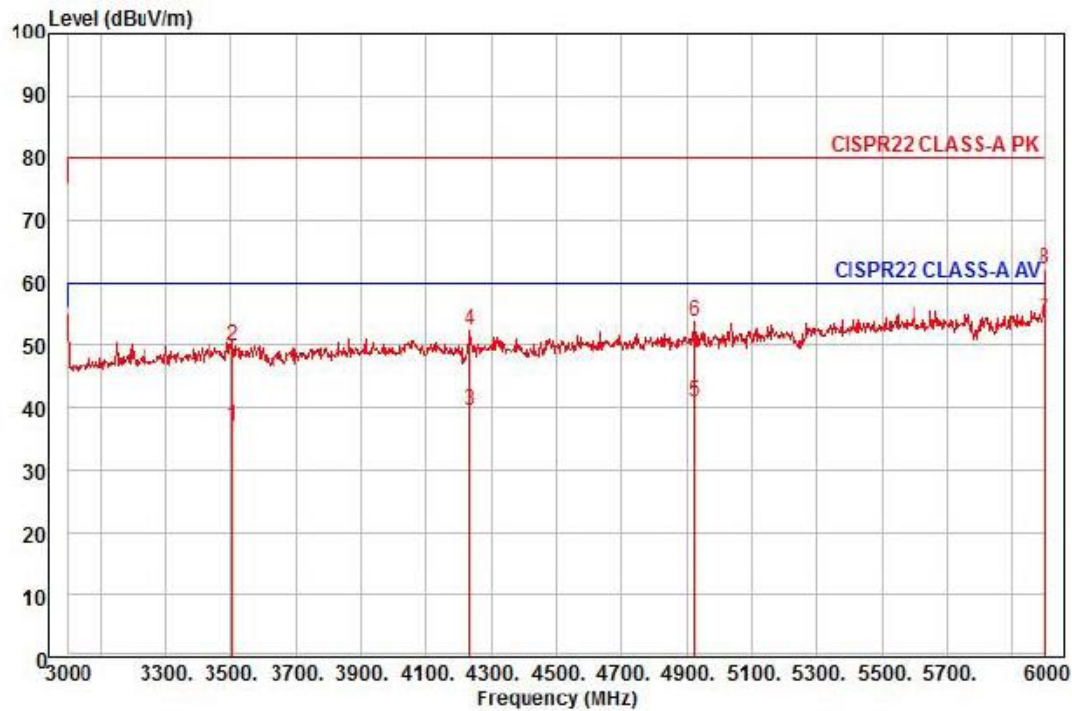
Test report No.:
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Site : chamber
Condition: CISPR22 CLASS-A PK 3m STLP9149(RRA CAL 2017-05-18) vertical
: RBW:1000.000kHz VBW:1000.000kHz SWT:Auto
Project :
Model :
Mode : CE
Memo : (1 ~ 3) GHz

	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	1200.00	47.19	23.11	7.28	35.88	228	56.00	-8.21	vertical	Average
2	1200.00	52.18	23.11	7.28	35.88	228	76.00	-23.22	vertical	Peak
3 av	1500.00	48.44	24.02	8.22	35.61	219	56.00	-4.83	vertical	Average
4	1500.00	52.53	24.02	8.22	35.61	219	76.00	-20.74	vertical	Peak
5	1600.00	42.76	24.42	8.51	35.53	239	56.00	-9.74	vertical	Average
6	1600.00	51.97	24.42	8.51	35.53	239	76.00	-20.53	vertical	Peak
7	1994.00	28.27	25.99	9.63	35.18	21	56.00	-21.19	vertical	Average
8	1994.00	46.43	25.99	9.63	35.18	21	76.00	-23.03	vertical	Peak
9 pp	2462.00	81.26	27.41	10.74	35.35	53	76.00	14.17	vertical	Peak

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Site : chamber

Condition: CISPR22 CLASS-A PK 3m STLP9149(RRA CAL 2017-05-18) horizontal

: RBW:1000.000kHz VBW:1000.000kHz SWT:Auto

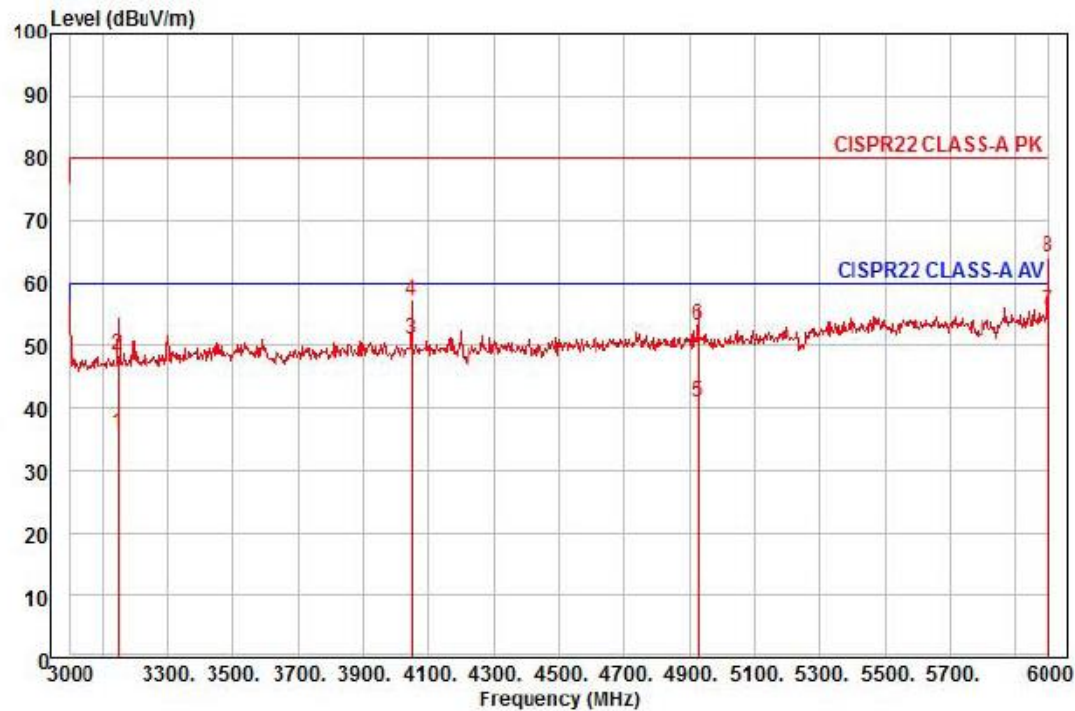
Project :

Model :

Mode : CE

Memo : (3 ~ 6) GHz

	Freq	Read Level	Ant Factor	Cable Loss	Preampl Factor	TPos	Limit Line	Over Limit	Pol/Phase	Remark
	MHz	dBuV	dB/m	dB	dB	deg	dBuV/m	dB		
1	3504.00	22.16	31.16	13.15	35.42	216	60.00	-22.84	horizontal	Average
2	3504.00	34.78	31.16	13.15	35.42	216	80.00	-30.22	horizontal	Peak
3	4236.00	21.91	32.43	14.48	35.36	1	60.00	-20.40	horizontal	Average
4	4236.00	34.69	32.43	14.48	35.36	1	80.00	-27.62	horizontal	Peak
5	4923.00	21.28	33.25	15.67	35.60	152	60.00	-19.21	horizontal	Average
6	4923.00	34.22	33.25	15.67	35.60	152	80.00	-26.27	horizontal	Peak
7 pp	6000.00	29.66	36.12	17.64	35.69	193	60.00	-6.12	horizontal	Average
8 pk	6000.00	37.92	36.12	17.64	35.69	193	80.00	-17.86	horizontal	Peak



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 :
Mode : CE
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	3147.00	22.70	30.15	12.53	35.52	292	60.00	-24.03	vertical	Average
2	3147.00	35.31	30.15	12.53	35.52	292	80.00	-31.42	vertical	Peak
3	4050.00	33.50	32.49	14.15	35.30	250	60.00	-9.03	vertical	Average
4	4050.00	39.67	32.49	14.15	35.30	250	80.00	-22.86	vertical	Peak
5	4926.00	21.26	33.25	15.67	35.60	25	60.00	-19.23	vertical	Average
6	4926.00	33.72	33.25	15.67	35.60	25	80.00	-26.77	vertical	Peak
7 pp	6000.00	31.39	36.12	17.64	35.69	229	60.00	-4.39	vertical	Average
8 pk	6000.00	39.81	36.12	17.64	35.69	229	80.00	-15.97	vertical	Peak

◆ Calculation

Over Limit [dB] = (Read Level[$\text{dB}\mu\text{V}$] + Ant Factor[dB/m] + Cable Loss [dB] - Preamp Factor [dB] + ATT[dB]) - Limit Line[$\text{dB}\mu\text{V}$]

Over Limit : Margin, Read Level : Reading value, Ant Factor : ANT Factor,
Cable Loss : Cable loss, Preamp Factor : Preamp Factor, ATT : Attenuator Factor



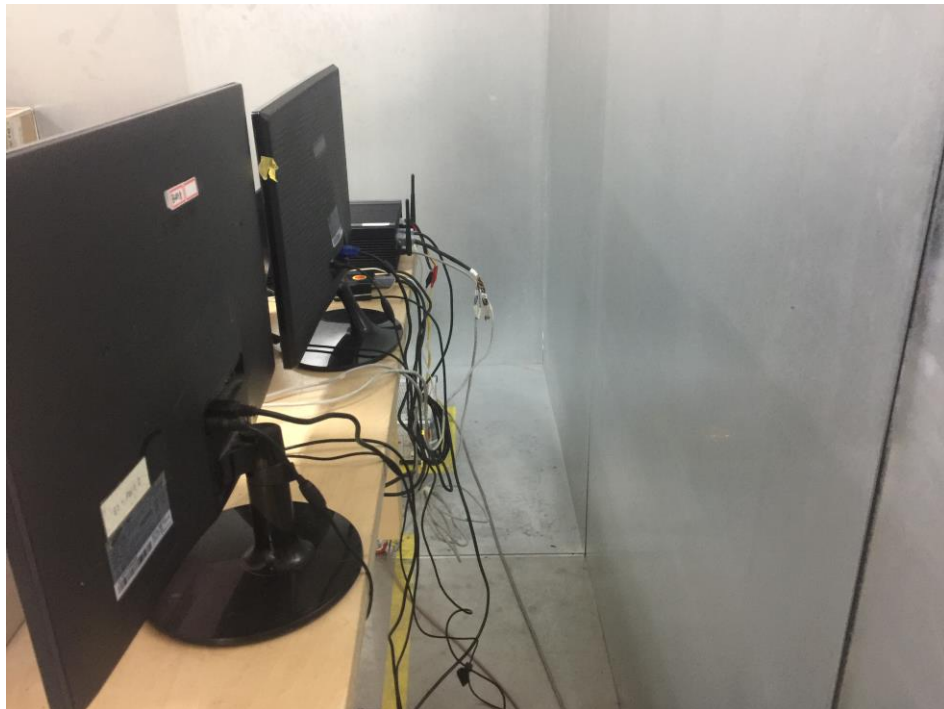
Test Data - Voltage Fluctuations

Maximum Flicker results

	EUT values	Limit	Result
Pst	N/A		
Plt			
dc [%]			
dmax [%]			
Tmax [s]			

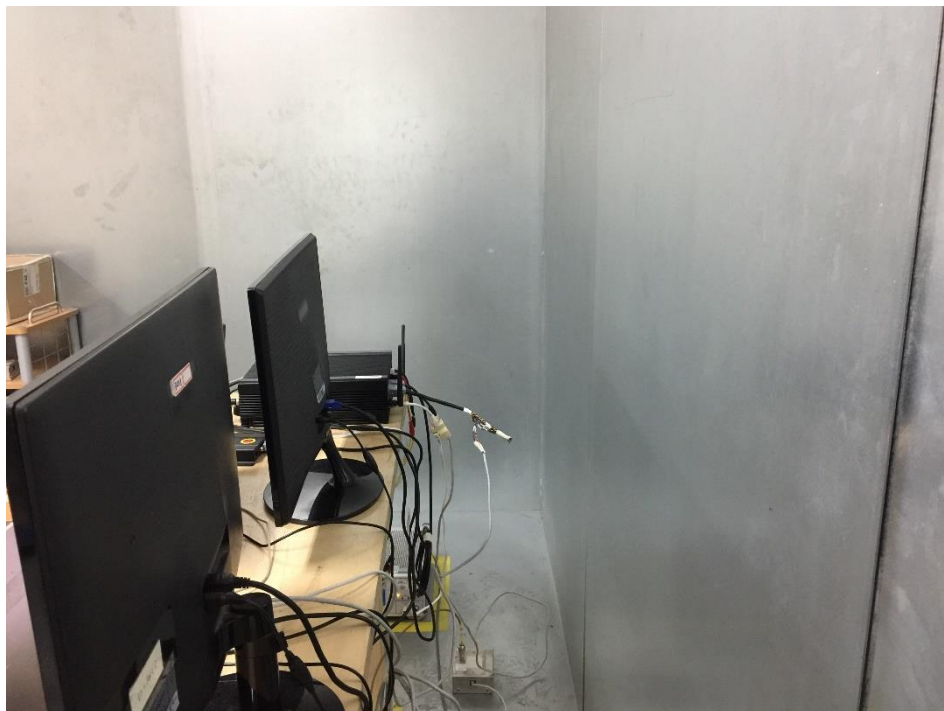
Test Setup Photos and Configuration

Conducted Voltage Emissions



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Conducted Emissions at Telecommunication Ports



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Radiated Electric Field Emissions(Below 1 GHz)



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Radiated Electric Field Emissions(Above 1 GHz)



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www.kes.co.kr

Test report No.:
KES-E2-17T0063
Page (53) of (63)

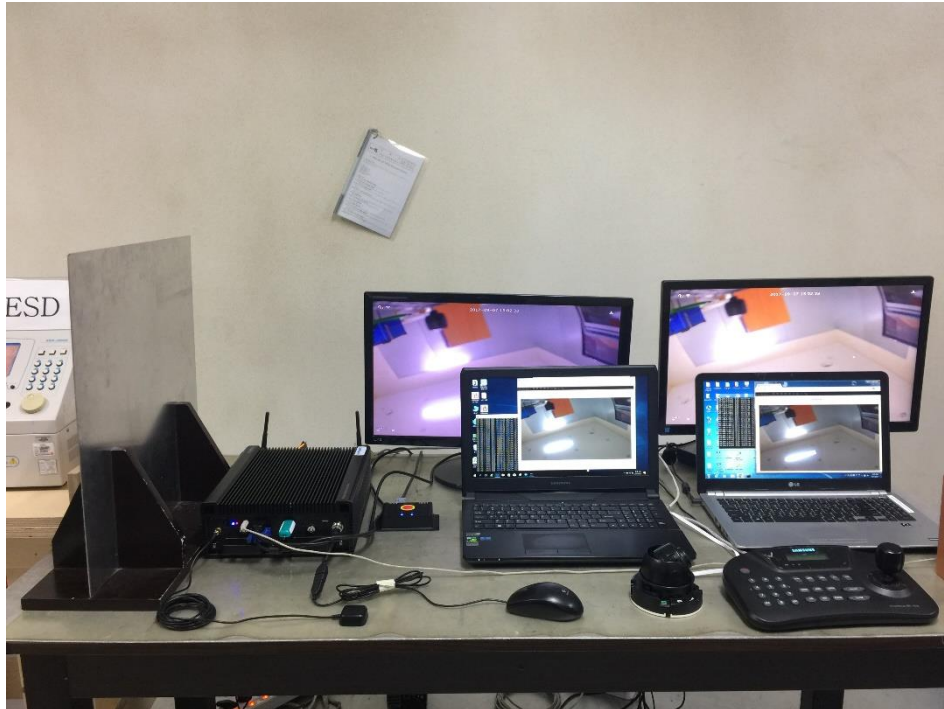
Harmonic Current Emissions and Voltage Fluctuations and Flicker

N/A

N/A

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Electrostatic Discharge



Radiated Electric Field Immunity



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Electrical Fast Transients / Bursts



Surge Transients



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Conducted Disturbance



Voltage Dips and Short Interruptions

N/A

E.U.T External Photographs

(Top)



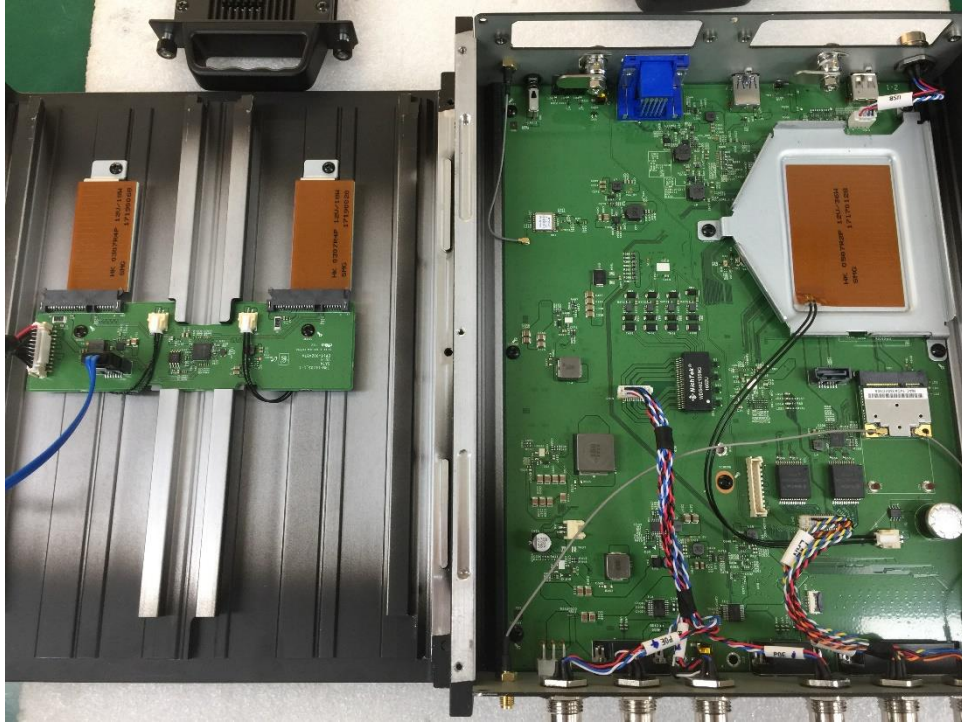
(Bottom)



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E.U.T Internal Photographs

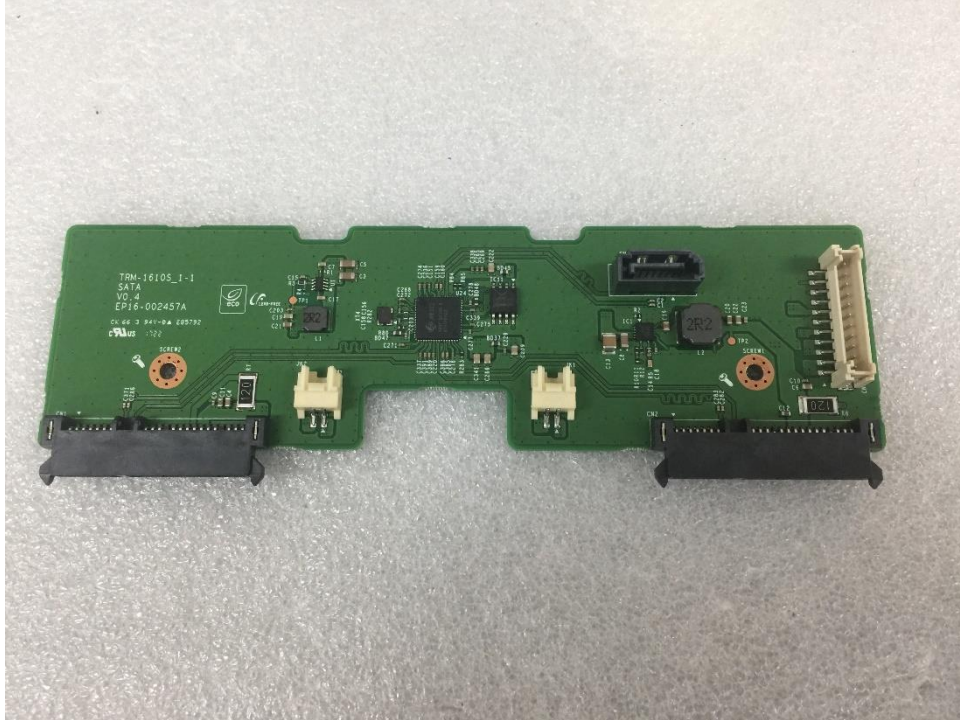
(Internal View)



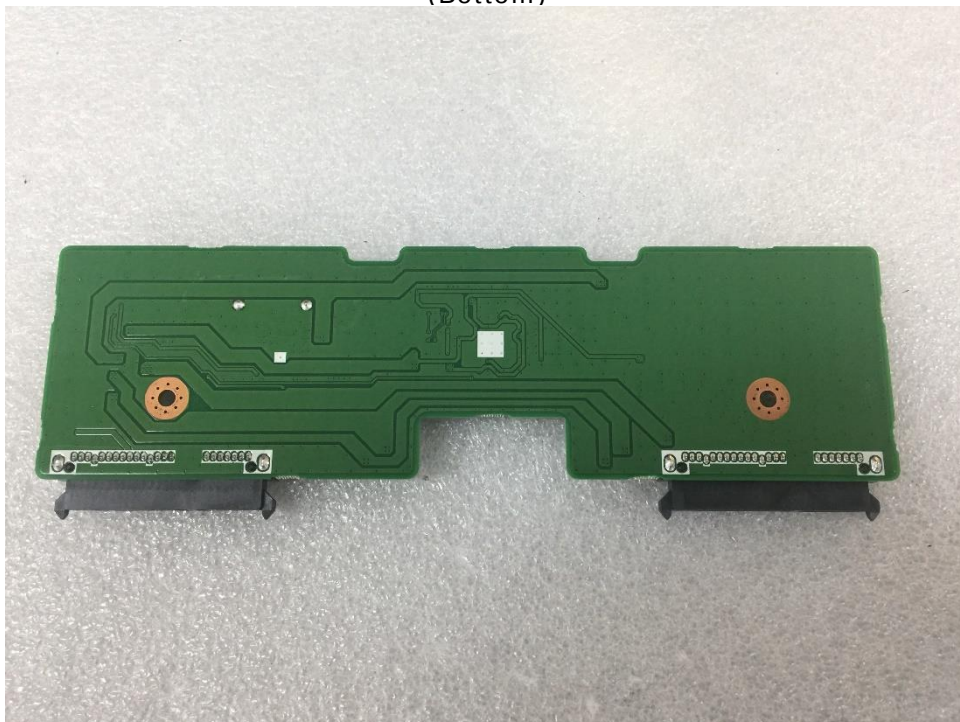
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EUT Internal View – Board 1

(Top)



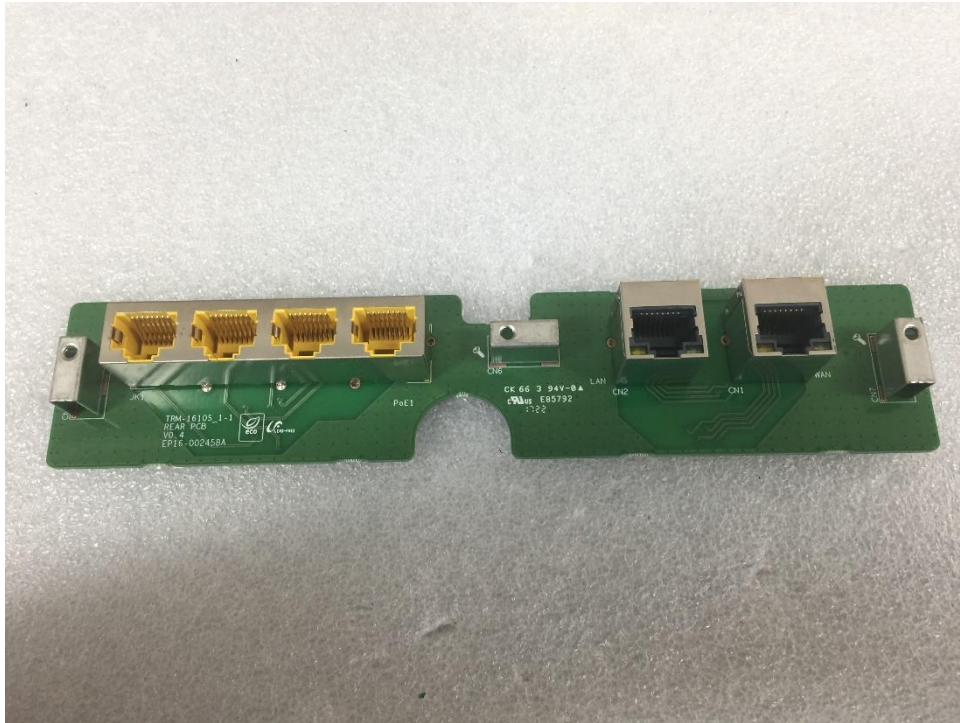
(Bottom)



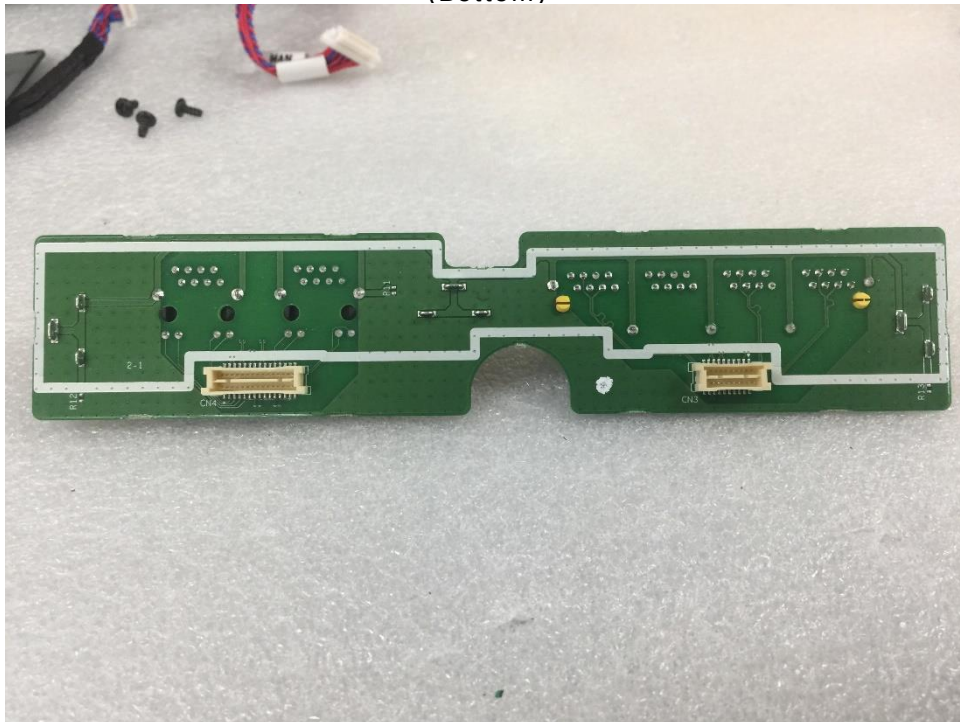
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EUT Internal View – Board 2

(Top)



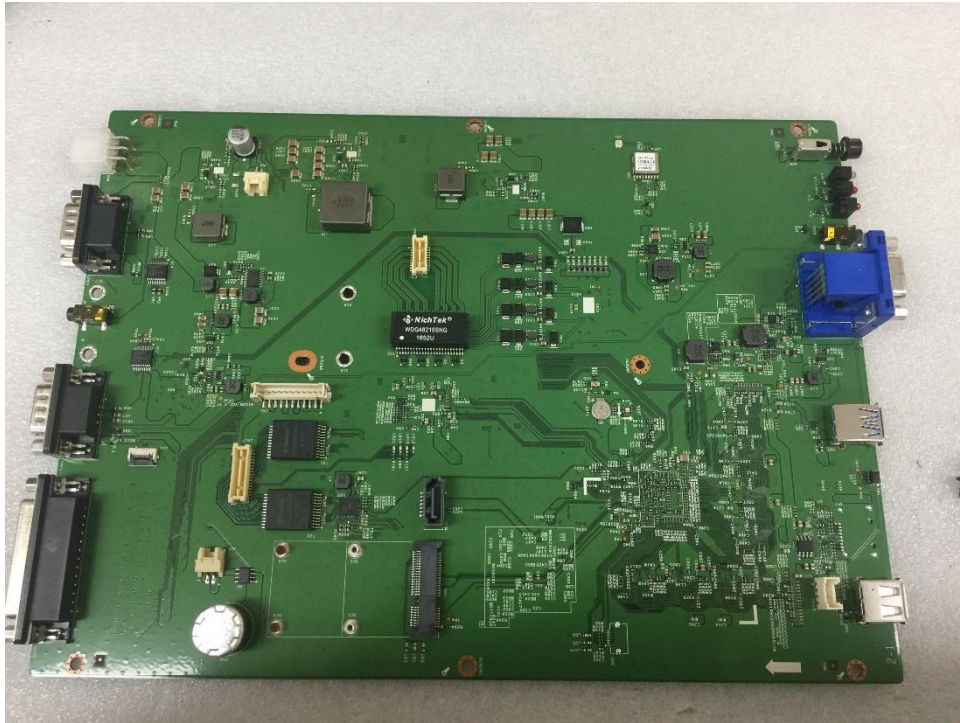
(Bottom)



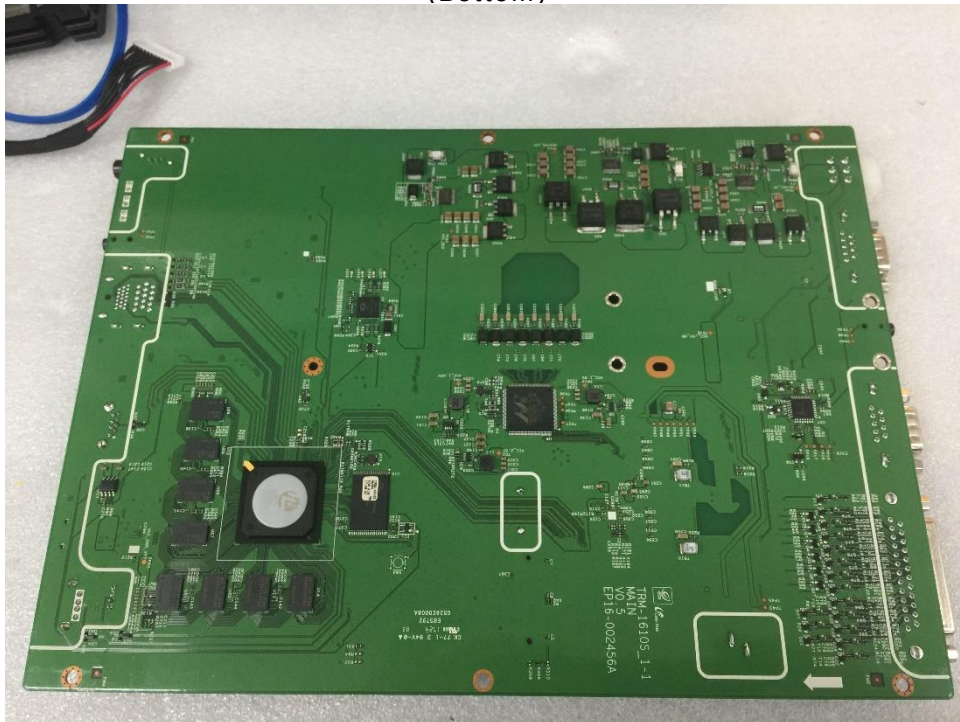
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EUT Internal View – Board 3

(Top)



(Bottom)



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EUT Internal View – Board 4

(Top)



(Bottom)



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Label and Location



NVR

Model No : TRM-1610S

Hanwha Techwin (Tianjin) Co.,Ltd.

Made in CHINA

