



EMC TEST REPORT For CE

Test Report No. : KES-E2-17T0059-R1

Date of Issue : May. 01, 2018

Product name : NVR

Model/Type No. : TRM-1610S

Variant Model : -

Applicant : Hanwha Techwin Co., Ltd.

Applicant Address : 6, Pangyo-ro 319 Beon-gil, Bundang-gu, Seongnam-si,
Gyeonggi-do, 13488, KOREA

Manufacturer : 1. HANWHA TECHWIN(TIANJIN) CO., LTD
2. HANWHA TECHWIN SECURITY VIETNAM CO.,LTD.
3. D-TECH CO.,LTD.

Manufacturer Address : 1. No.11 Weiliu Rd, Micro-Electronic Industrial Park, TEDA, Tianjin,
300385, People's Republic of China
2. Lot O-2, Que Vo Industrial Zone extended area,
Nam Son commune, Bac Ninh city, Bac Ninh province, Vietnam
3. 173-25, Saneop-ro, Gwonseon-gu, Suwon-si, Gyeonggi-do,
Korea (Suwon Industrial Complex)

Date of Receipt : Jul. 17, 2017

Test date : Sep. 01, 2017 – Sep. 04, 2017

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

Tested by

Kang Hyun, Kim
EMC Test Engineer

Reviewed by

Dong-Hun, Jang
EMC Technical Manager

This test report is not related to KOLAS.

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Test report No.:

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REPORT REVISION HISTORY

Date	Test Report No.	Revision History
Sep. 07, 2017	KES-E2-17T0059	Issued
May. 01, 2018	KES-E2-17T0059-R1	Re-issue due to manufacturer change

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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-1610S	-	HANWHA TECHWIN (TIANJIN) CO., LTD	E.U.T

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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	CN07BN4400591BS K28F5NK904	11ssan Elecom(shen yang) Co., Ltd	-
Laptop1	LG15N54	410NZXE015458	LG	-
Laptop1 Adapter	ADP-90WH B	84ZW19F1747	DELTA ELECTRONICS(JIANGSU) LTD.	-
Laptop2	X56K	HN11N5151FJ0045 W	HanSunG Corporation	-
Laptop2 Adapter	A12-120P1A	F180271552011758	CHICONY POWER TECHNOLOGY CO.,LTD.	-
Speaker	BR10000A CUVE	-	BEIJING EDIFIER HI-TECH GROUP.	-
Mouse	M-U0026	1505HS0687B8	Logitech	-
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	-

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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)

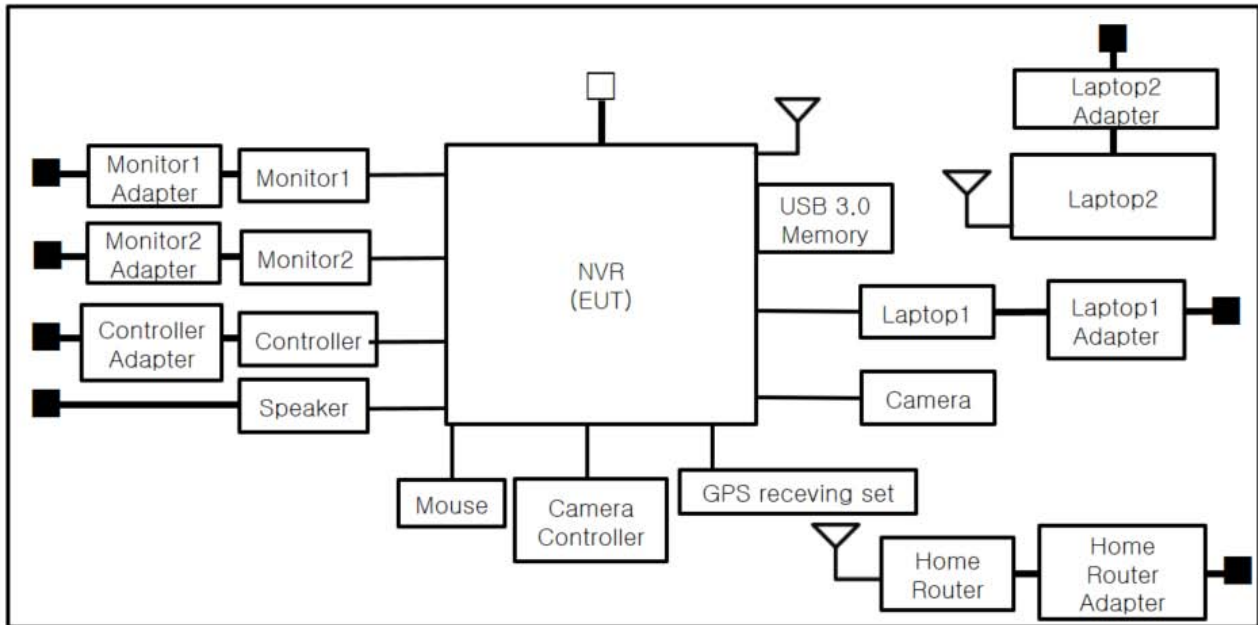
Test mode	operating
Operating	E.U.T Monitoring, Ping Test

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

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1.8 Configuration

■ AC Main
 □ DC Main



1.9 Remarks when standards applied

N/A

1.10 Calibration Details of Equipment Used for Measurement

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

1.11 Test Facility

The measurement facility is located at 473-21 Gayeo-ro, Yeosu-si, Gyeonggi-do, 12658, Korea. The sites are constructed in conformance with the requirements of ANSI C63.4:2014 and CISPR 16-1-4:2012.

1.12 Laboratory Accreditations and Listings

Country	Agency	Scope of Accreditation	Accreditation No
KOREA	RRA	EMI (3 m & 10 m Semi-Aechoic Chamber , 10 m Open Area and conducted test site) EMS (ESD, RS, EFT/Burst, Surge, CS, Magnetic, Dips and interruptions)	 KR0100
International	KOLAS	EMI (3 m & 10 m Semi-Aechoic Chamber , and conducted test site) EMS (ESD, RS, EFT/Burst, Surge, CS, Magnetic, Dips and interruptions)	 KT489
USA	FCC	3 m & 10 m Semi-Aechoic Chamber, 10 m Open Area and Conducted test site to perform FCC Part 15/18 measurements.	 KR0100
Canada	ISED	3 m & 10 m Semi-Aechoic Chamber and Conducted test site	 23298-1
JAPAN	VCCI	Mains Ports Conducted Interference Measurement, Telecommunication Ports Conducted Disturbance Measurement and Radiation 10 meter site, Facility for measuring radiated disturbance above 1 GHz	 R-4308, C-4798, T-2311, G-914
Europe	TÜV SÜD	EMI (3 m & 10 m Semi-Aechoic Chamber , 10 m Open Area and conducted test site) EMS (ESD, RS, EFT/Burst, Surge, CS, Magnetic, Dips and interruptions)	 CARAT 17 07 01633 001

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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



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☒ **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

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2.1 Conducted Emissions at Mains Power Ports

Test Date

Sep. 01, 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: 23,4 °C

Relative Humidity: 50,1 %

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.

2.2 Conducted Emissions at Telecommunication Ports

Test Date

Sep. 01, 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 ConditionsTemperature: 23,4 °C
Relative Humidity: 50,1 %**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

RemarksSee Appendix A for test data.



2.3 Radiated Electric Field Emissions(Below 1 GHz)

Test Date

Sep. 01, 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: 24,4 °C

Relative Humidity: 53,4 %

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

Remarks

See Appendix A for test data.



2.4 Radiated Electric Field Emissions(Above 1 GHz)

Test Date

Sep. 01, 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: 23,4 °C

Relative Humidity: 50,1 %

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 12 V(dc), 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. 04, 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	-	-

Test Conditions

Temperature: 24.7 °C
Relative Humidity: 51.7 %
Atmospheric Pressure: 99,5 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

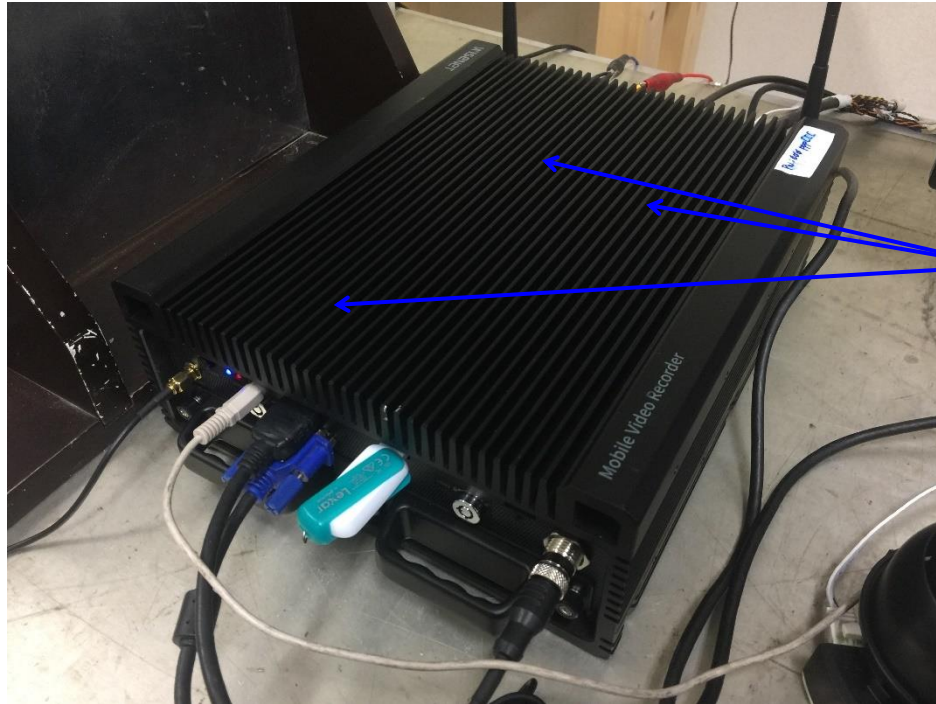
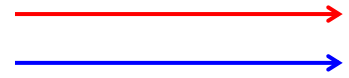
Notes: HCP: Horizontal coupling plane
VCP: Vertical coupling plane

Required Performance Criteria: ☒ Complied

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Location of Discharge:

Air
Contact



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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. 04, 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	EMC32	R & S	10.10.02	-
☒	SIGNAL GENERATOR	SMB 100A	R & S	177586	08, 07, 2018
☒	BROADBAND AMPLIFIER	BBA100	R & S	101239	08, 07, 2018
☒	BROADBAND AMPLIFIER	100S1G6M1	AR	579931	08, 07, 2018
☒	POWER METER	NRP2	R & S	103475	08, 07, 2018
☒	AVG POWER SENSOR	NRP-Z91	R & S	102526	08, 07, 2018
☒	AVG POWER SENSOR	NRP-Z91	R & S	102527	08, 07, 2018
☒	HYBRID LOG-PERIODIC ANTENNA	HLP-2603	TDK	100400	-
☒	DIRECTIONAL COUPLER	KYDC-D1070-DX40	KY TELECOM	KY150001	08, 07, 2018
☒	DOUBLE RIDGED HORN ANTENNA	SAS-571	A.H.SYSTEM, INC	781	05, 02, 2019

Test Conditions

Temperature: 24,7 °C
Relative Humidity: 51,7 %
Atmospheric Pressure: 99,5 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 6 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

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3.3 Electrical Fast Transients/Bursts

Reference Standard

EN 61000-4-4:2012

Test Date

Sep. 04, 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	02, 08, 2018

Test Conditions

Temperature: 24.7 °C
Relative Humidity: 51.7 %
Atmospheric Pressure: 99.5 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

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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

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3.4 Surge Transients

Reference Standard

EN 61000-4-5:2014

Test Date

Sep. 04, 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	02, 08, 2018
☒	CDN	CNV 508N1	EM TEST	P1551168979	04, 26, 2018
☐	CDN	CNV 508T5	EM TEST	P1549168422	04, 26, 2018

Test Conditions

Temperature: 24.7 °C
Relative Humidity: 51.7 %
Atmospheric Pressure: 99.5 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

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. 04, 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: 24,7 °C
Relative Humidity: 51,7 %
Atmospheric Pressure: 99,5 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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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

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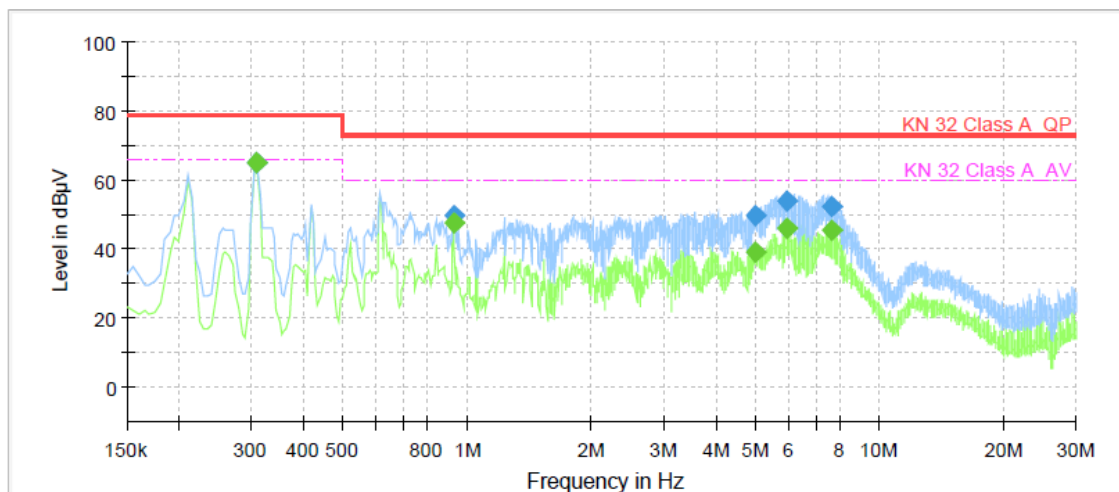
APPENDIX A – TEST DATA

Conducted Emissions at Mains Power Ports

[HOT]

Common Information

Test Description: Telecommunication Emission
 Model No.: TRM-1610S
 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	---	64.85	66.00	1.15	1000.0	9.000	Single Line	10.1
0.310000	65.01	---	79.00	13.99	1000.0	9.000	Single Line	10.1
0.925000	---	47.57	60.00	12.43	1000.0	9.000	Single Line	10.2
0.925000	49.51	---	73.00	23.49	1000.0	9.000	Single Line	10.2
5.015000	---	39.03	60.00	20.97	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



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[NEUTURAL]

Common Information

Test Description:

Model No.:

Mode

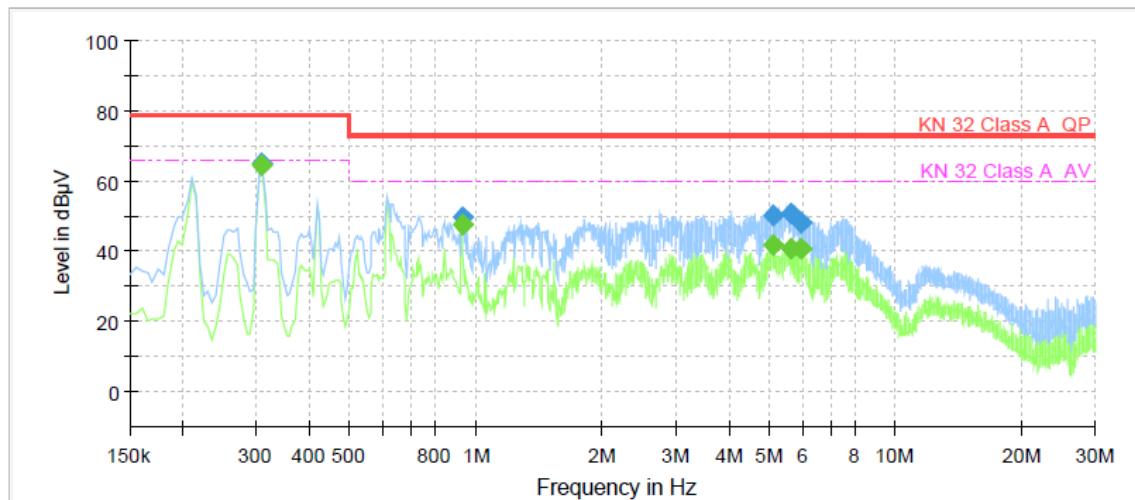
Operator Name:

Telecommunication Emission

TRM-1610S

-

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))

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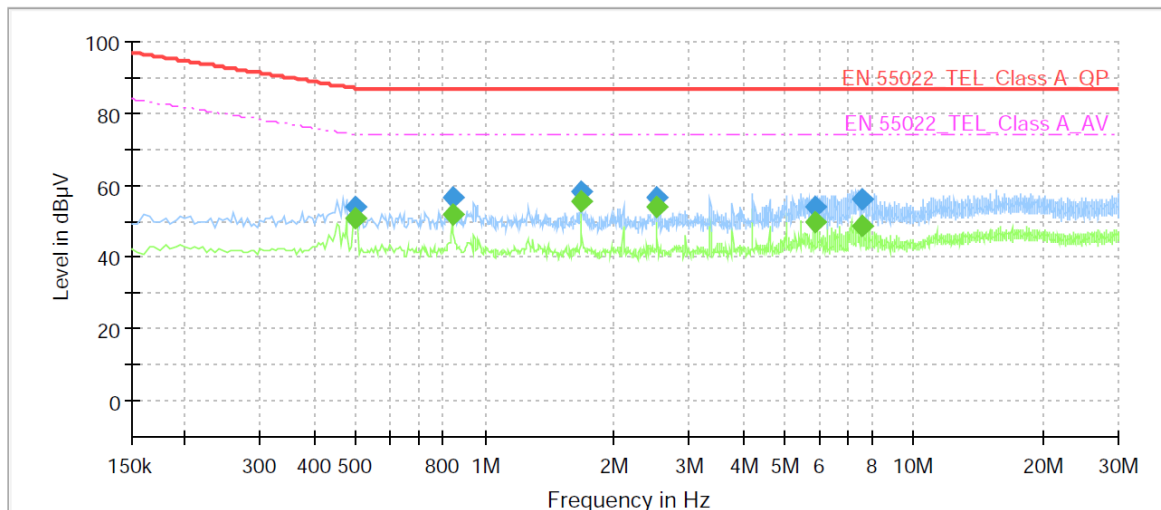


Conducted Emissions at Telecommunication Ports

[10 Mbps]

Common Information

Test Description: Telecommunication Emission
Model No.: TRM-1610S
Mode: 10
Operator Name: KES



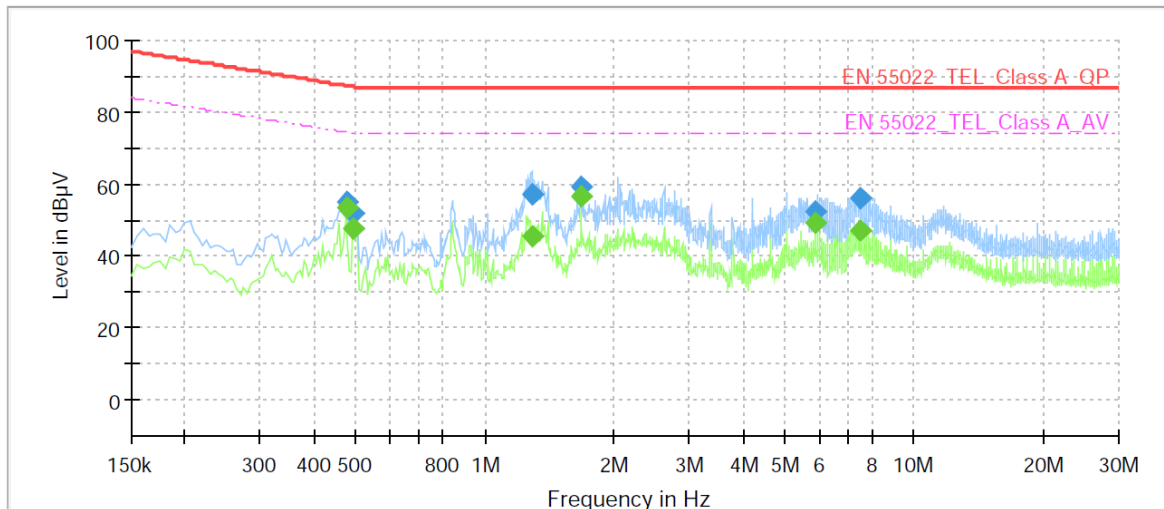
Final Result

Frequency (MHz)	QuasiPeak (dBμV)	CAverage (dBμV)	Limit (dBμV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.500000	---	50.94	74.00	23.06	1000.0	9.000	Single Line	19.9
0.500000	54.19	---	87.00	32.81	1000.0	9.000	Single Line	19.9
0.840000	---	51.68	74.00	22.32	1000.0	9.000	Single Line	20.0
0.840000	56.82	---	87.00	30.18	1000.0	9.000	Single Line	20.0
1.680000	---	55.61	74.00	18.39	1000.0	9.000	Single Line	20.0
1.680000	58.05	---	87.00	28.95	1000.0	9.000	Single Line	20.0
2.520000	---	53.92	74.00	20.08	1000.0	9.000	Single Line	20.0
2.520000	56.65	---	87.00	30.35	1000.0	9.000	Single Line	20.0
5.875000	---	49.88	74.00	24.12	1000.0	9.000	Single Line	19.9
5.875000	54.06	---	87.00	32.94	1000.0	9.000	Single Line	19.9
7.540000	---	48.49	74.00	25.51	1000.0	9.000	Single Line	19.8
7.540000	56.37	---	87.00	30.63	1000.0	9.000	Single Line	19.8

[1000 Mbps]

Common Information

Test Description:	Telecommunication Emission
Model No.:	TRM-1610S
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)
0.475000	---	53.31	74.43	21.12	1000.0	9.000	Single Line	19.3
0.475000	54.80	---	87.43	32.63	1000.0	9.000	Single Line	19.3
0.495000	---	47.59	74.08	26.49	1000.0	9.000	Single Line	19.3
0.495000	51.89	---	87.08	35.19	1000.0	9.000	Single Line	19.3
1.285000	---	45.74	74.00	28.26	1000.0	9.000	Single Line	19.5
1.285000	57.21	---	87.00	29.79	1000.0	9.000	Single Line	19.5
1.680000	---	56.53	74.00	17.47	1000.0	9.000	Single Line	19.5
1.680000	59.52	---	87.00	27.48	1000.0	9.000	Single Line	19.5
5.875000	---	49.18	74.00	24.82	1000.0	9.000	Single Line	19.3
5.875000	52.39	---	87.00	34.61	1000.0	9.000	Single Line	19.3
7.475000	---	46.98	74.00	27.02	1000.0	9.000	Single Line	19.3
7.475000	55.88	---	87.00	31.12	1000.0	9.000	Single Line	19.3

◆ 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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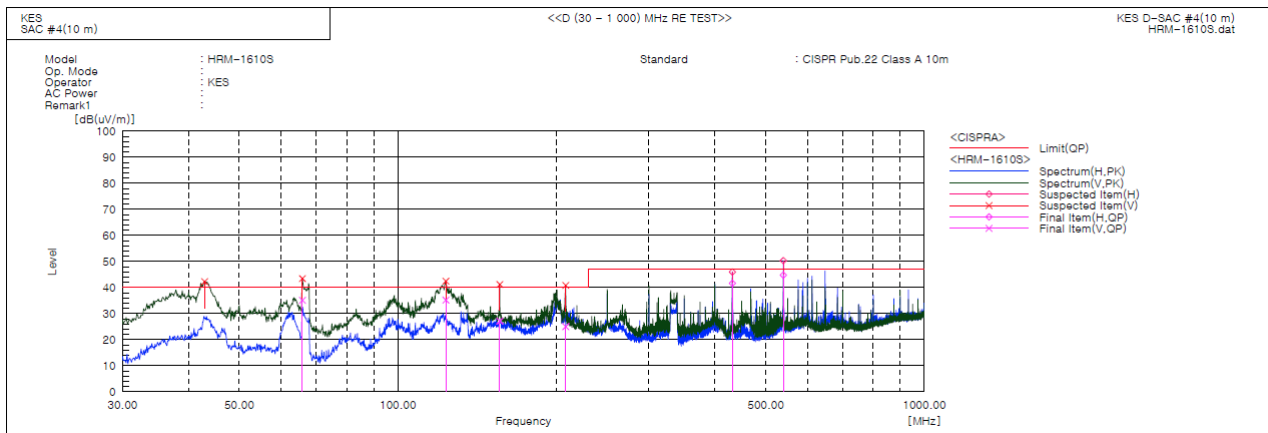
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Radiated Electric Field Emissions(Below 1 GHz)



Final Result

No.	Frequency [MHz]	(P)	Reading QP [dB(μV)]	c.f [dB(1/m)]	Result QP [dB(μV/m)]	Limit QP [dB(μV/m)]	Margin QP [dB]	Height [cm]	Angle [deg]	Remark
1	65.890	V	65.6	-30.5	35.1	40.0	4.9	100.0	179.0	
2	123.363	V	66.5	-31.3	35.2	40.0	4.8	100.0	143.0	
3	156.221	V	58.1	-31.0	27.1	40.0	12.9	150.0	118.0	
4	208.359	V	51.5	-26.5	25.0	40.0	15.0	150.0	266.0	
5	432.065	H	61.0	-19.4	41.6	47.0	5.4	200.0	9.0	
6	539.978	H	60.8	-16.0	44.8	47.0	2.2	200.0	140.0	

◆ 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)]

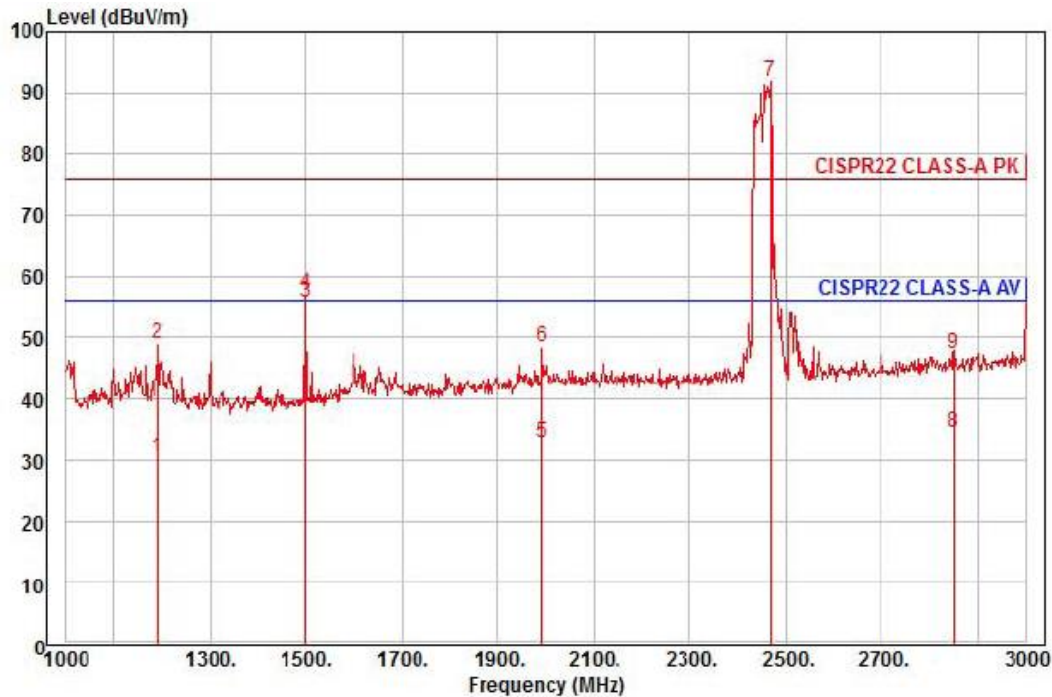
Reading(QP) : Reading value, Result(QP) : Reading value + Factor value

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

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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 : TRM-1610S
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	1192.00	30.09	23.08	7.26	35.89	64	56.00	-25.37	horizontal	Average
2	1192.00	48.43	23.08	7.26	35.89	64	76.00	-27.03	horizontal	Peak
3 av	1500.00	53.03	24.02	8.22	35.61	106	56.00	-0.24	horizontal	Average
4	1500.00	54.49	24.02	8.22	35.61	106	76.00	-18.78	horizontal	Peak
5	1990.00	26.41	25.97	9.62	35.18	118	56.00	-23.08	horizontal	Average
6	1990.00	41.87	25.97	9.62	35.18	118	76.00	-27.62	horizontal	Peak
7 pp	2468.00	82.92	27.43	10.75	35.35	115	76.00	15.86	horizontal	Peak
8	2852.00	23.04	29.09	11.75	35.50	169	56.00	-21.51	horizontal	Average
9	2852.00	35.88	29.09	11.75	35.50	169	76.00	-28.67	horizontal	Peak



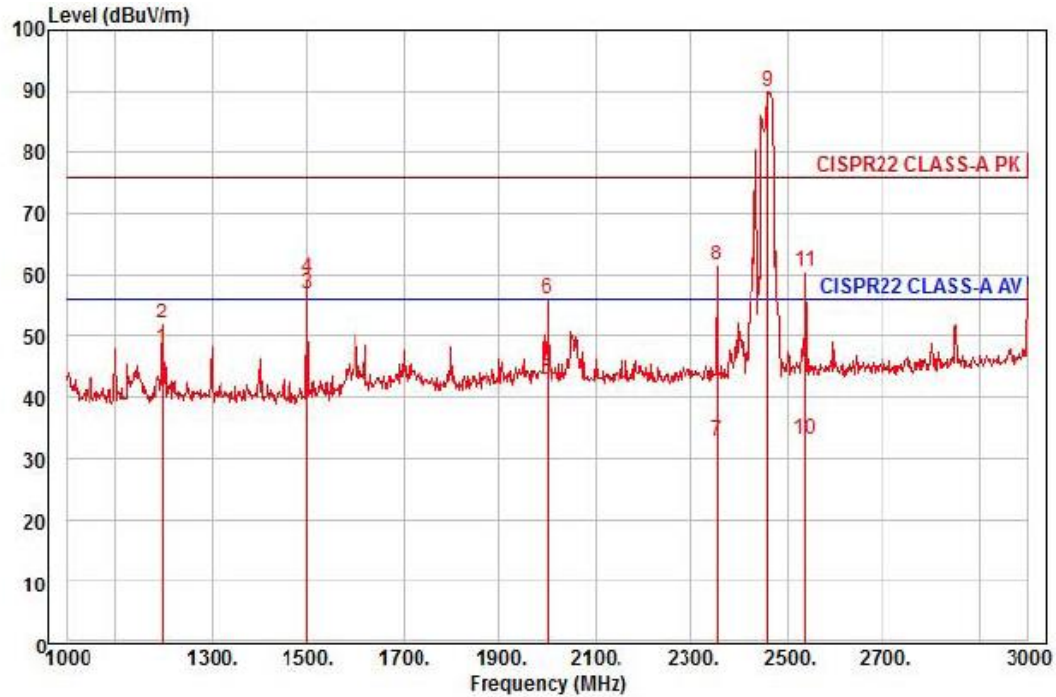
KES Co., Ltd.

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

Test report No.:

KES-E2-17T0059-R1

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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 : TRM-1610S
Mode : CE
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	1200.00	47.48	23.11	7.28	35.88	311	56.00	-7.92	vertical	Average
2	1200.00	51.51	23.11	7.28	35.88	311	76.00	-23.89	vertical	Peak
3 av	1500.00	54.27	24.02	8.22	35.61	13	56.00	1.00	vertical	Average
4	1500.00	56.64	24.02	8.22	35.61	13	76.00	-16.63	vertical	Peak
5	2000.00	36.55	26.01	9.65	35.17	290	56.00	-12.86	vertical	Average
6	2000.00	49.59	26.01	9.65	35.17	290	76.00	-19.82	vertical	Peak
7	2354.00	24.66	27.09	10.49	35.31	320	56.00	-22.96	vertical	Average
8	2354.00	53.10	27.09	10.49	35.31	320	76.00	-14.52	vertical	Peak
9 pp	2460.00	81.09	27.41	10.73	35.35	288	76.00	13.99	vertical	Peak
10	2536.00	23.91	27.69	10.91	35.38	302	56.00	-22.76	vertical	Average
11	2536.00	51.29	27.69	10.91	35.38	302	76.00	-15.38	vertical	Peak

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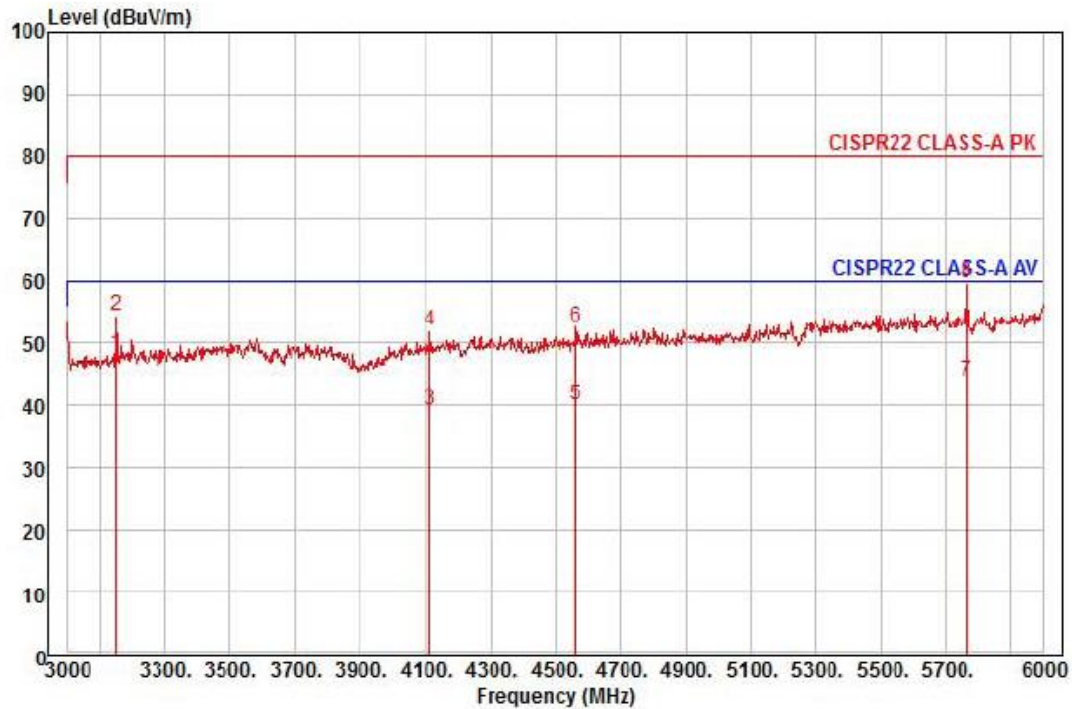
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Test report No.:

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Site : chamber
Condition: CISPR22 CLASS-A PK 3m STLP9149(RRA CAL 2017-05-18) horizontal
: RBW:1000.000kHz VBW:1000.000kHz SWT:Auto
Project :
Model : TRM-1610S
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 pp	3150.00	34.97	30.16	12.53	35.52	223	60.00	-11.75	horizontal	Average
2	3150.00	41.19	30.16	12.53	35.52	223	80.00	-25.53	horizontal	Peak
3	4116.00	21.54	32.47	14.27	35.32	264	60.00	-20.90	horizontal	Average
4	4116.00	34.39	32.47	14.27	35.32	264	80.00	-28.05	horizontal	Peak
5	4563.00	21.81	32.49	15.06	35.48	107	60.00	-19.96	horizontal	Average
6	4563.00	34.33	32.49	15.06	35.48	107	80.00	-27.44	horizontal	Peak
7	5766.00	20.56	35.77	17.00	35.68	323	60.00	-16.18	horizontal	Average
8 pk	5766.00	36.40	35.77	17.00	35.68	323	80.00	-20.34	horizontal	Peak

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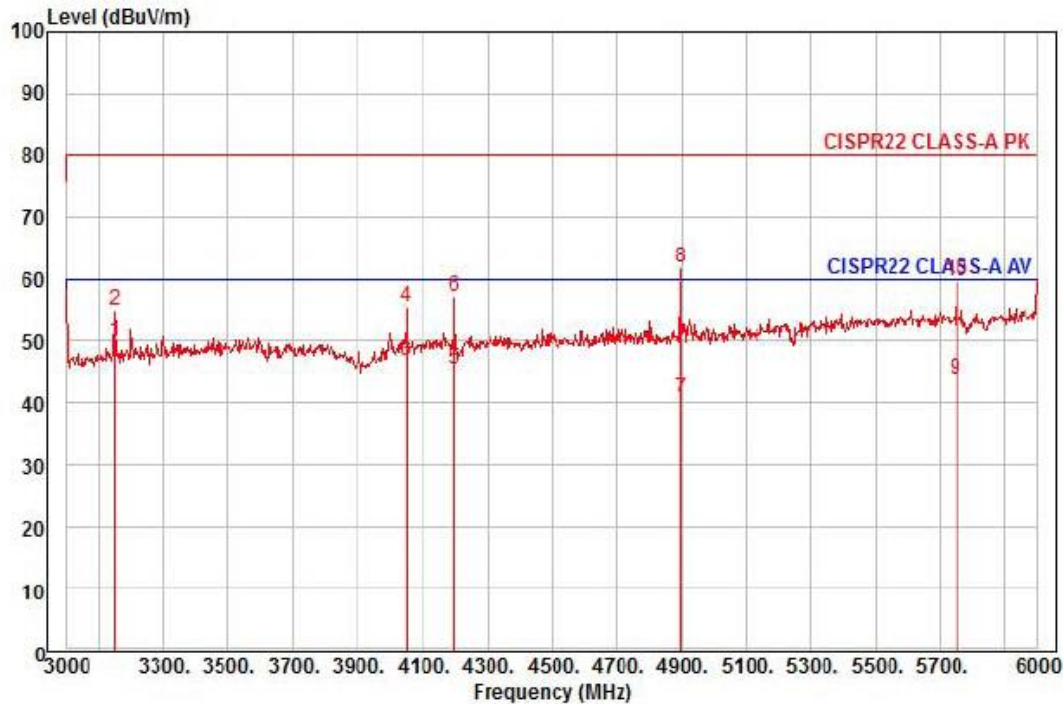
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Test report No.:

KES-E2-17T0059-R1

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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 : TRM-1610S
Mode : CE
Memo : 3 ~ 6 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	3150.00	36.54	30.16	12.53	35.52	292	60.00	-10.18	vertical	Average
2	3150.00	41.67	30.16	12.53	35.52	292	80.00	-25.05	vertical	Peak
3	4050.00	29.53	32.49	14.15	35.30	222	60.00	-13.00	vertical	Average
4	4050.00	38.18	32.49	14.15	35.30	222	80.00	-24.35	vertical	Peak
5	4200.00	27.84	32.44	14.41	35.35	236	60.00	-14.52	vertical	Average
6	4200.00	39.57	32.44	14.41	35.35	236	80.00	-22.79	vertical	Peak
7	4899.00	21.42	33.20	15.64	35.59	31	60.00	-19.15	vertical	Average
8 pk	4899.00	42.48	33.20	15.64	35.59	31	80.00	-18.09	vertical	Peak
9	5751.00	20.65	35.75	16.98	35.68	257	60.00	-16.13	vertical	Average
10	5751.00	36.36	35.75	16.98	35.68	257	80.00	-20.42	vertical	Peak

◆ Calculation

Over Limit [dB] = (Read Level[dB μ V] + Ant Factor[dB/m] + Cable Loss [dB] - Preamp Factor [dB] + ATT[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, ATT : Attenuator Factor

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Test Data - Voltage Fluctuations**Maximum Flicker results**

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

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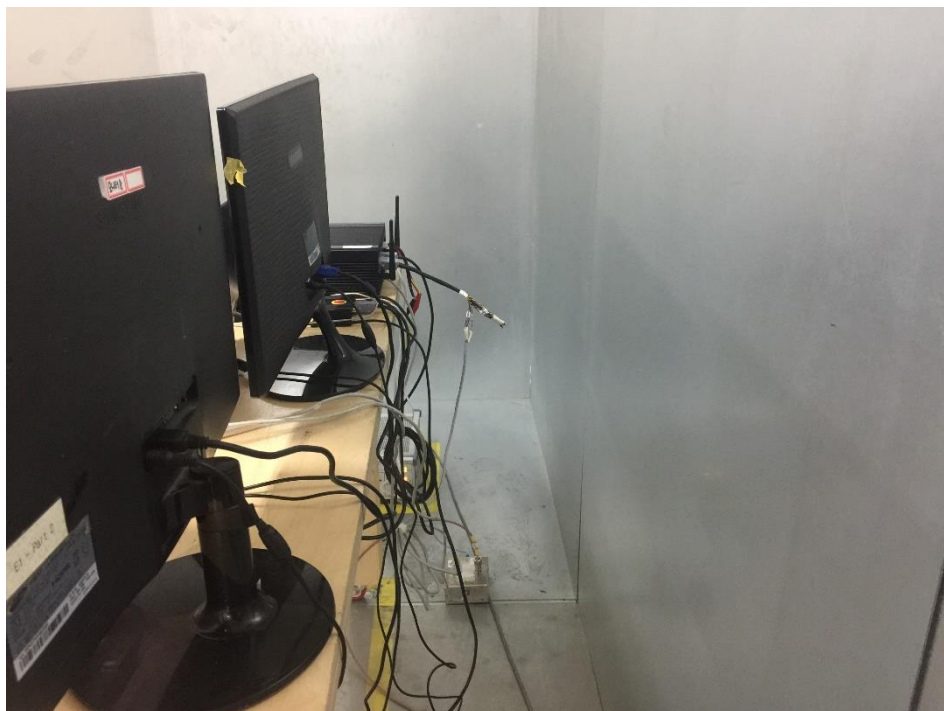
Test Setup Photos and Configuration

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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Test report No.:
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Page (53) of (63)

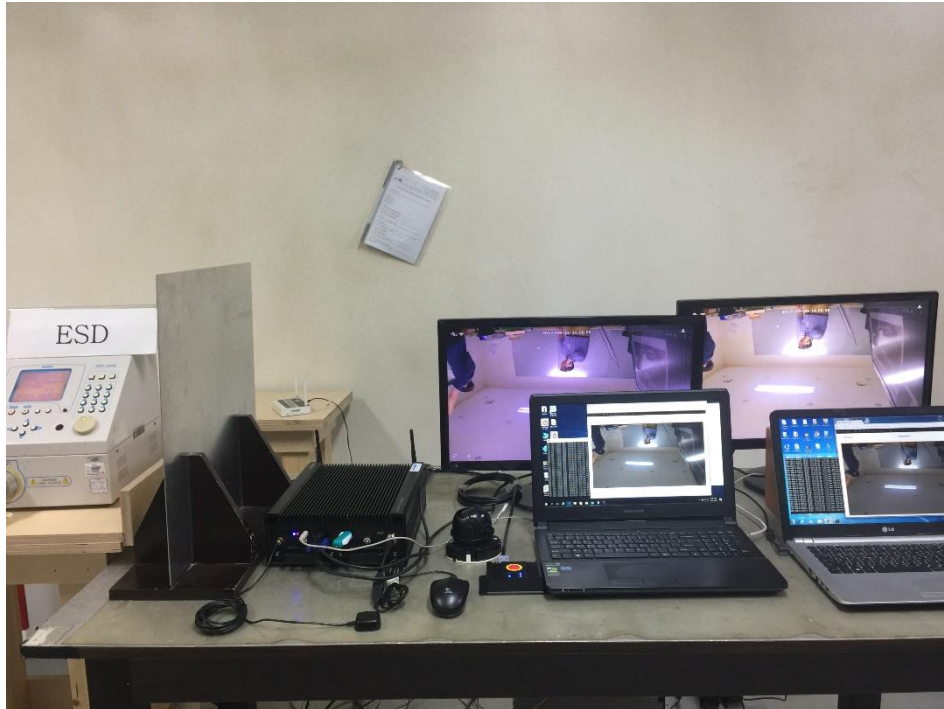
Harmonic Current Emissions and Voltage Fluctuations and Flicker

N/A

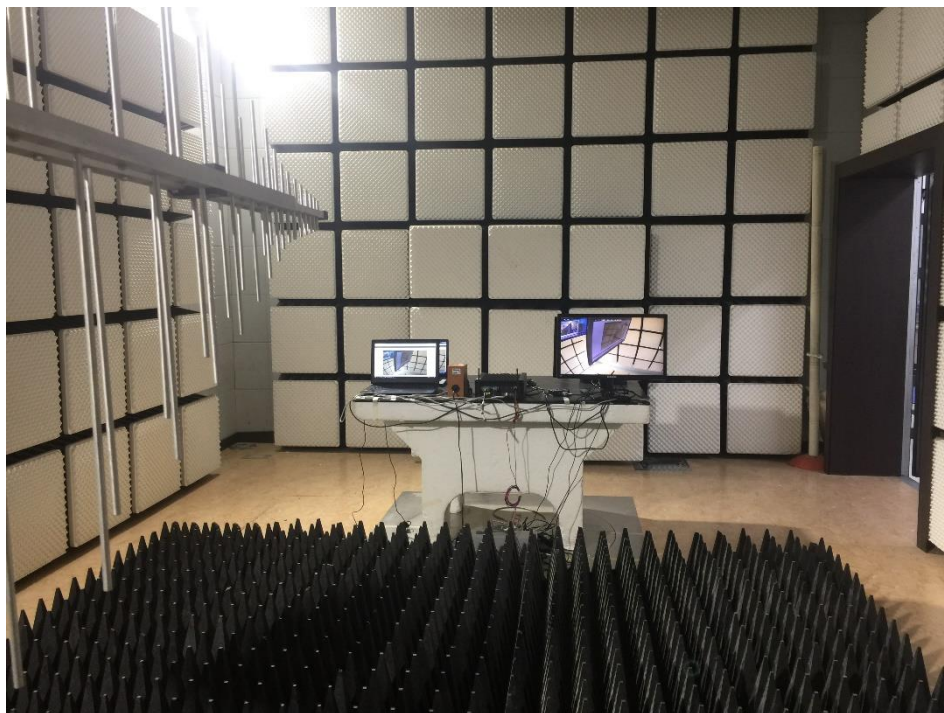
N/A

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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

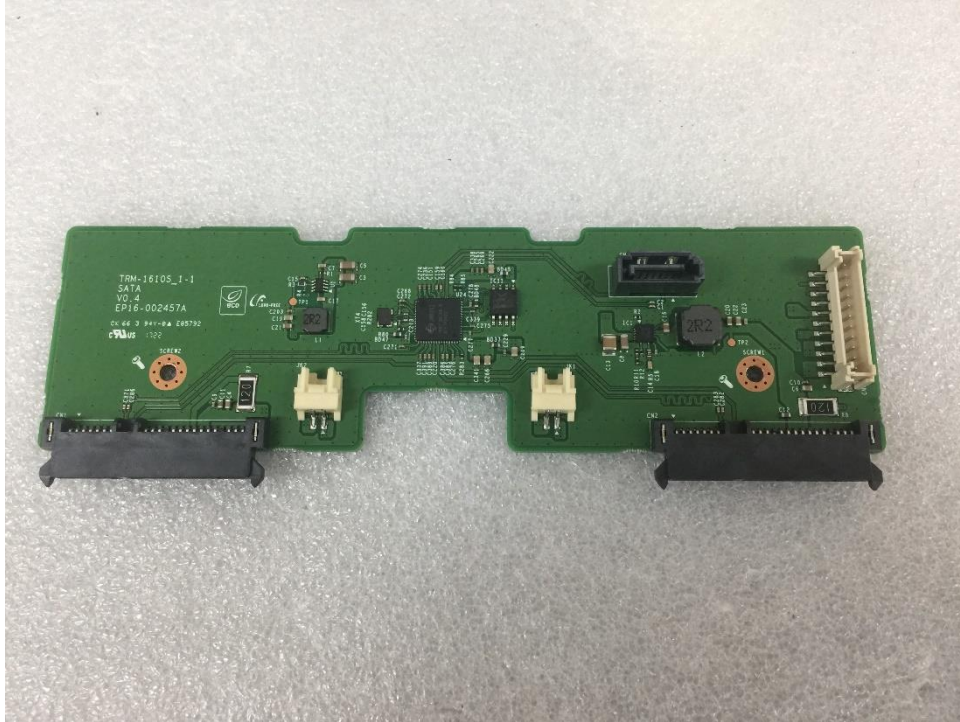
(Internal View)



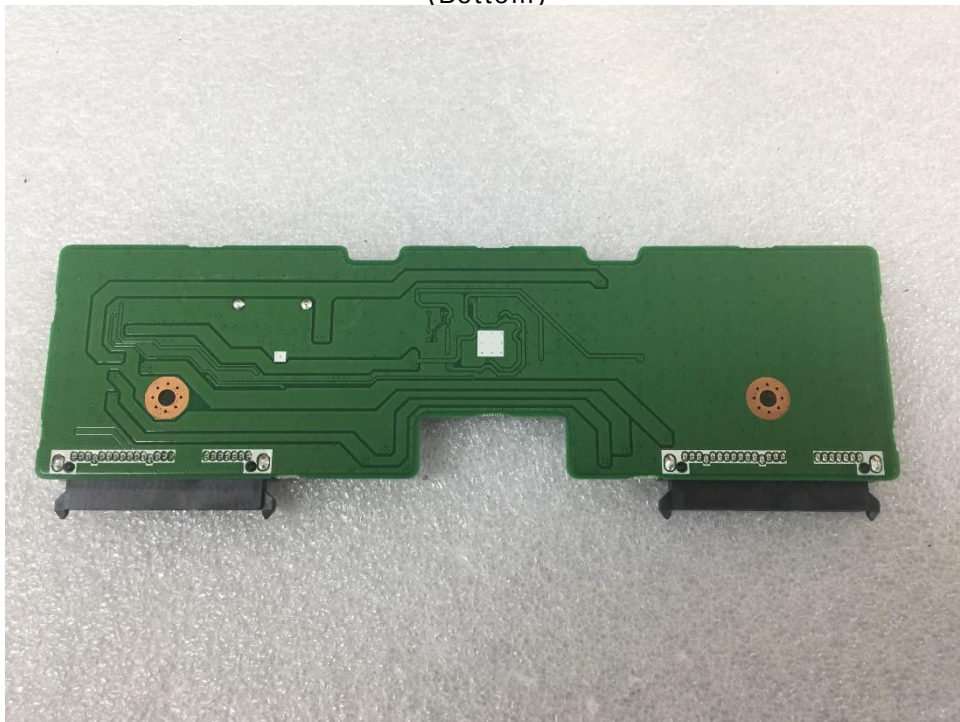
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EUT Internal View – Board 1

(Top)

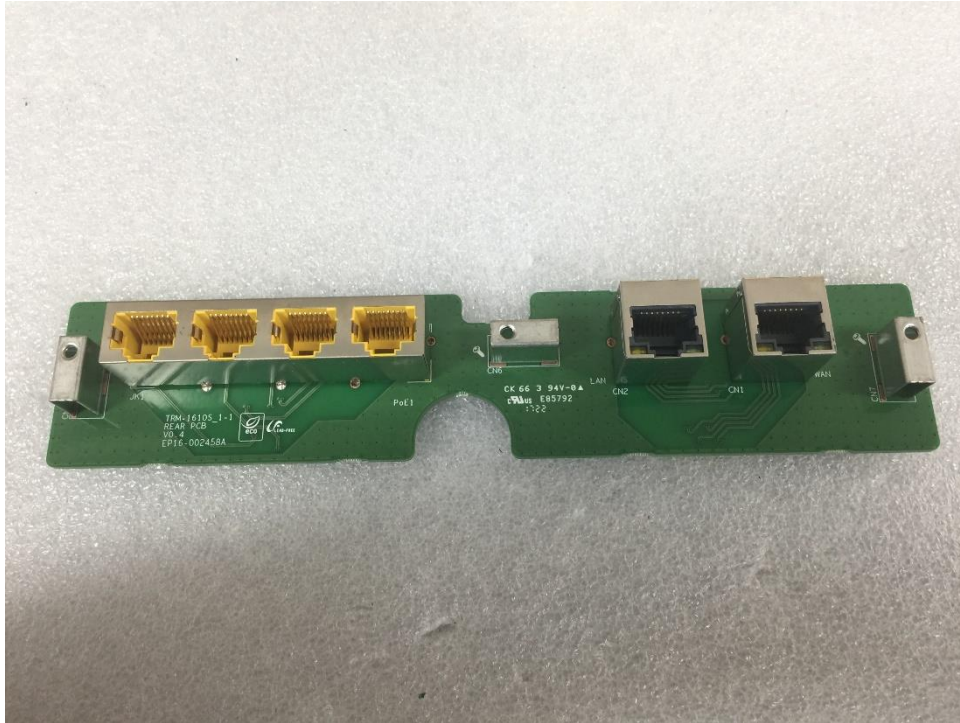


(Bottom)

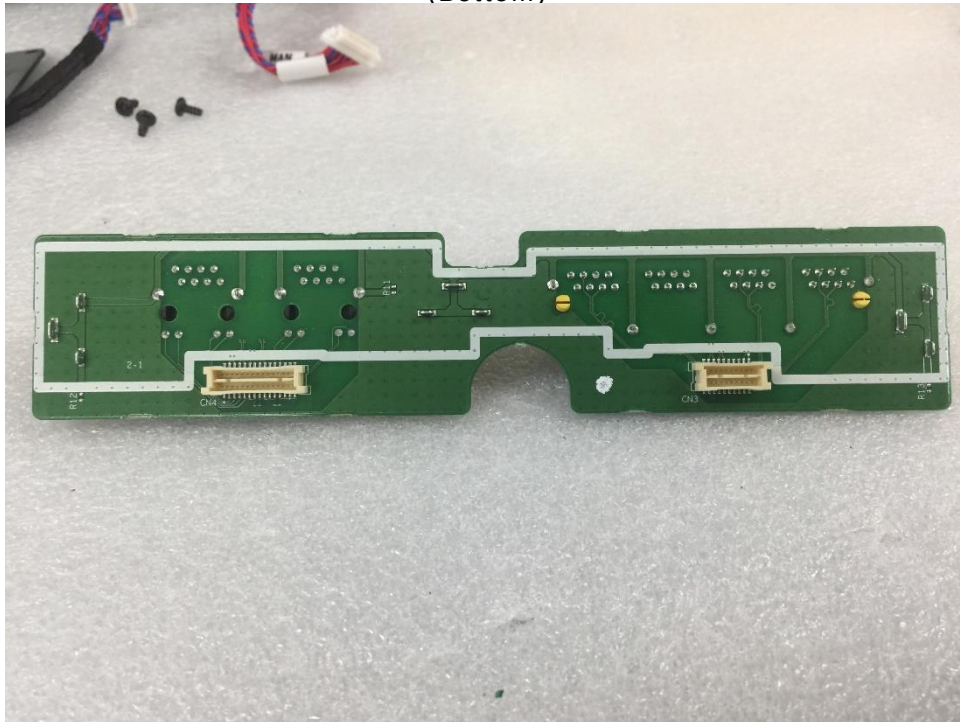


EUT Internal View – Board 2

(Top)



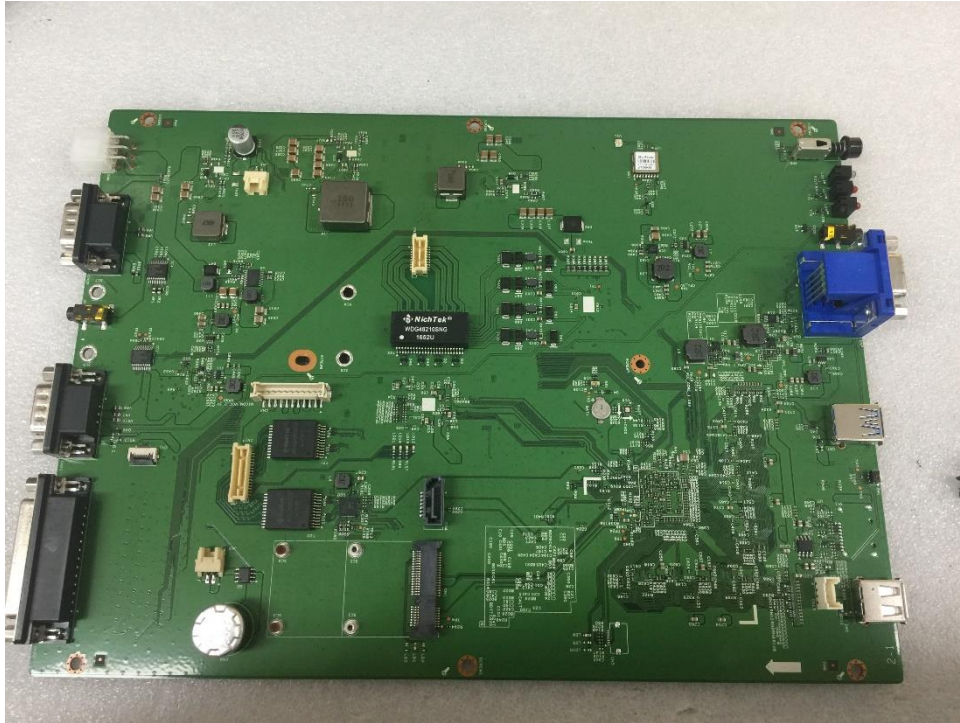
(Bottom)



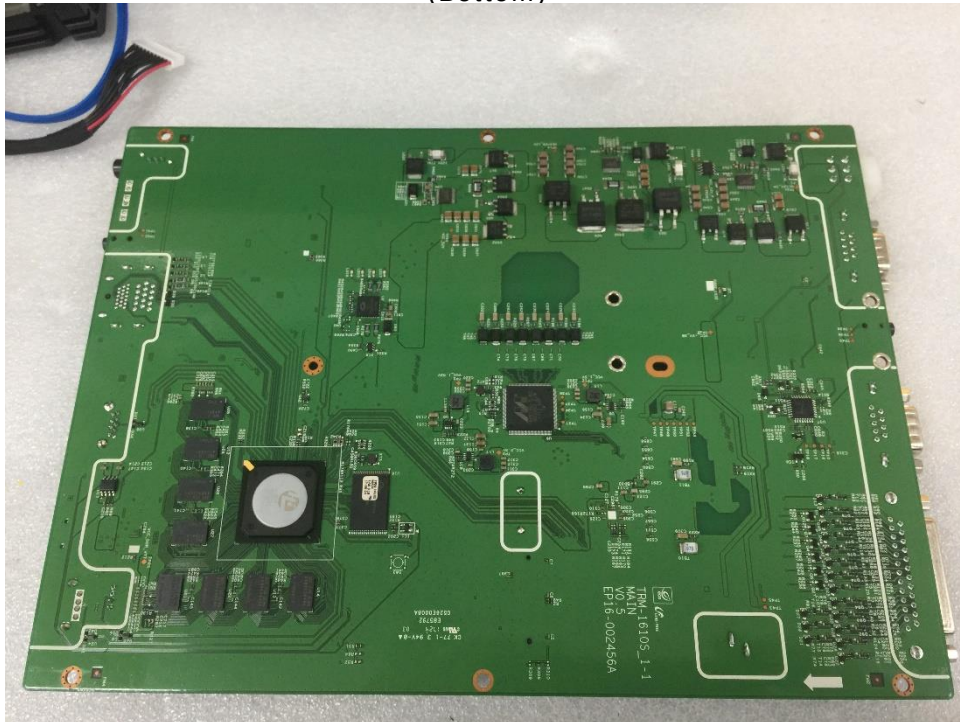
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EUT Internal View – Board 3

(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

Manufacturer : HANWHA TECHWIN(TIANJIN)CO., LTD..

Made in CHINA

