EMC TEST REPORT For CE

Test Report No.	:	KES-E2-19T0011
Date of Issue	:	Feb. 15, 2019
Product name	:	NVR
Model/Type No.	:	TRM-410S
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. D-TECH CO.,LTD. 2. HANWHA TECHWIN(TIANJIN) CO., LTD 3. HANWHA TECHWIN SECURITY VIETNAM CO.,LTD.
Manufacturer Address	:	1. 173-25, Saneop-ro, Gwonseon-gu, Suwon-si, Gyeonggi- do, Korea (Suwon Industrial Complex) 2. No.11 Weiliu Rd,Micro-Electronic Industrial Park, TEDA,Tianjin, 300385,People's Republic of China 3. Lot O-2, Que Vo Industrial Zone extended area, Nam Son commune, Bac Ninh city, Bac Ninh province, Vietnam
Date of Receipt	:	Dec. 18, 2018
Test date	:	Jan. 19, 2019 ~ Jan. 24, 2019
Test Results	:	☒ **In Compliance** ☐ **Not in Compliance**

Tested by

Dae Hyun, Kim
EMC Test Engineer

Reviewed by

Dong-Hun, Jang
EMC Technical Manager

REPORT REVISION HISTORY

Date	Test Report No.	Revision History
Feb. 15, 2019	KES-E2-19T0011	Issued

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1.0 General Product Description

Main Specifications of E.U.T are:

Item		Details	
		TRM-410S	TRM-810S/810M
Display			
Network Camera	Inputs	Max. 4CH (4 PoE, RJ-45)	Max. 8CH (8 PoE) TRM-810S: Max. 8CH (8 PoE, RJ-45) TRM-810M: Max. 8CH (8 PoE, M12 D-Code)
	Resolution	CIF ~ 8MP	
	Protocols	Wisenet(SUNAPI), ONVIF	
Live	Local Display	HDMI / VGA	
	Multi-Channel Display	[Local Monitor] 1 / 2H / 2V / 3V / 4 / Auto sequence [Web] 4 / Auto sequence	[Local Monitor] 1 / 2H / 2V / 3V / 4 / 6 / 8 / 9 / Auto sequence [Web] 1 / 4 / 9 / 1+5 / 1+7 / 2H / 2V / 3V / 6 / 12 / Auto sequence
	Performance	[Local Monitor] 8MP(60fps), 5MP(90fps), 3MP(120fps), 2MP(120fps), 720p(120fps), D1(120fps)	
Performance			
Operating System	Embedded	Linux	
Record	Compression	H.265, H.264, MJPEG, WiseStream(H.265, H.264)	
	Recording Bandwidth	Max. 50Mbps	Max. 80Mbps
	Resolution	CIF ~ 8MP	
	Type	Normal, Schedule(Continuous/Event), Event (Pre/Post), Emergency	
	Retention	Retention per channel (1~400 days)	
	Event Trigger	Alarm Input (6), Video Loss, Camera Event(Sensor, MD, Video Analytics, Defocus Camera), G-Sensor(3 Axis)	
	Event Action	e-Mail, Alarm Out, Buzzer, Monitor Out	

Item		Details	
		TRM-410S	TRM-810S/810M
Search & Play	Playback Bandwidth	32Mbps(4ch simultaneously)	32Mbps(8ch 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. 4 channels(Local Monitor, CMS)	Max. 8 channels(Local Monitor, CMS)
Search & Play	Resolution	CIF ~ 8MP	
	Fisheye Dewarping	Web / CMS	
	Playback Control	Fast/Slow Forward/Backward, Move one step up/down	
Storage	Built-In	No HDD (supporting the installation of 2 HDDs per tray)	
	Internal HDD	2 SATA(Front-Swap) - Max. 2TB(HDD, Non-RAID Mode) - Max. 4TB(SSD, Non-RAID Mode)	
	RAID	-	RAID-1
Backup	File backup	Exe(GUI), JPG/AVI(excluding GPS information)(Network)	
	Function	Multi channel(Upto 4CH) Play, Date-Time/Title/GPS display	Multi channel(Upto 8CH) Play, Date-Time/Title/GPS display
	Type	Auto(Wi-Fi), Manual(HDD/SSD)	
	Wifi Backup Performance	MAX. 50Mbps	MAX. 80Mbps
Sensor	I/O	6/4	
Audio	Input	4 channels (network)	8 channels (network)
	Compression	G.711, G.726, AAC(16/48KHz)	
	Audio Communication	2-Way	

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 ☐ 220 Vac ☐ 230 Vac ☒ 24 Vdc ☐ 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-410S	-	D-TECH CO.,LTD.	EUT
GPS Antenna	-	-	-	EUT
Control Box	-	-	-	EUT

1.5 Support Equipments

Description	Model Number	Serial Number	Manufacturer	Remarks
Monitor 1	LS23C340	ZXPCHTMF A02346H	Samsung Electronics Co., Ltd.	-
Monitor 1 Adapter	A2514_DPN	CN07BN4400591B SK28F5NK904	11ssan Elecom(shen yang) Co., Ltd	-
Monitor 2	27UK850	805NTGYCH455	LG Electronics Inc.,	-
Monitor 2 Adapter	A16-140P1A	ZJ5CS64929301C3 04	LG Electronics Inc.,	-
Speaker	BR1000A Cuve Black 2	-	DONGGUAN EDIFIER TECHNOLOGY Co., Ltd	-
Alarm Zig 1	-	-	-	-
Alarm Zig 2	-	-	-	-
Network Camera 1	SNV-L6013	-	Hanwha Techwin(TIANJIN) Co., Ltd	-
Network Camera 2	SNV-L6013	-	Hanwha Techwin(TIANJIN) Co., Ltd	-
Mouse	1113	-	Microsoft	-
Notebook	LG15N54	410NZXE015458	LG Electronics Inc.,	-
Notebook Adapter	ADP-90WH B	84ZW19F1747	DELTA ELECTRONICS(JIANGS U) LTD.	-
Wireless Router	A2004plus	-	IpTIME	-
Wireless Router Adapter	TY-2007	-	Zioncoin Electronics (Shenzhen) Ltd.	-

1.6 External I/O Cabling

Start		END		Cable Spec.	
Description	**I/O Port**	**Description**	**I/O Port**	**Length**	**Shield**
NVR (EUT)	D-SUB	Monitor 1	D-SUB	1.3	U
	HDMI	Monitor 1	HDMI	1.4	U
	RJ-45 (RS-232)	Control Box	RJ-45	3.1	U
	RJ-45 (Alarm In)	Alarm Zig 1	4 Pin	3.0	U
	RJ-45 (Alarm Out)	Alarm Zig 2	4 Pin	3.2	U
	RJ-45 (PoE)	Network Camera 1	RJ-45 (PoE)	3.0	U
	RJ-45 (PoE)	Network Camera 2	RJ-45 (PoE)	3.2	U
	USB	Mouse	USB	1.8	U
	3.5 mm (Audio)	Speaker	3.5 mm	1.4	U
	4 Pin	GPS Antenna	4 Pin	4.0	U
	RJ-45 (Viewer)	Notebook	RJ-45	5.0	U
	Wireless	Wireless Router	Wireless	-	-
Wireless Router	Wireless	Notebook	Wireless	-	-

* Unshielded = U, Shielded = S

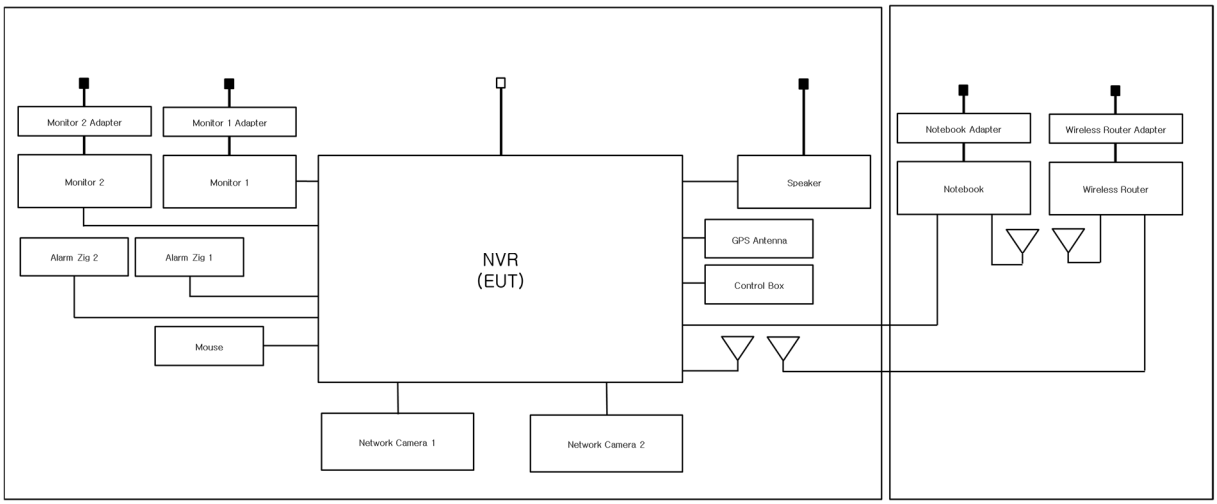
1.7 EUT Operating Mode(s)

Test mode	operating
OP	Confirmed the operation of the camera through WebViewer and network Ping Test.

E.U.T Test operating S/W		
Name	Version	Manufacture Company
Web Viewer	-	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, Yeoju-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	Logo
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

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 : 2017**		
☐ 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	☒ Class A	☐ Class B
☐ EN 301 489-3 V1,6,1		
☐ EN 301 489-9 V1,4,1		
☒ EN 301 489-17 V3,1,1		
☐ EN 60945:2002		
☒ EN 61000-3-2:2014		
☒ EN 61000-3-3:2013		

2.1 Conducted Emissions at Mains Power Ports

Test Date
Jan. 20, 2019

Test Location
Electro wave Shieldroom #6

Test Equipment

Used	Description	Model Number	Manufacturer	Serial Number	Cal. Due
☒	EMI Test S/W	EMC32	R & S	9.12.00	-
☒	EMI TEST RECEIVER	ESR3	R & S	101781	04, 25, 2019
☒	LISN	ENV216	R & S	101787	01, 04, 2020
☒	LISN	ESH2-Z5	R & S	100450	04, 25, 2019
☒	PULSE LIMITER	ESH3-Z2	R & S	101915	11, 26, 2019

Test Conditions
Temperature: 24.2 ℃
Relative Humidity: 55.3 % R.H.

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Frequency Range of Measurement
150 ㎑ to 30 ㎒

Instrument Settings
IF Band Width: 9 ㎑

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
Jan. 20, 2019

Test Location
Electro wave Shieldroom #6

Test Equipment

Used	Description	Model Number	Manufacturer	Serial Number	Cal. Due
☒	EMI Test S/W	EMC32	R & S	9.12.00	-
☒	EMI TEST RECEIVER	ESR3	R & S	101781	04, 25, 2019
☒	LISN	ENV216	R & S	101787	01, 04, 2020
☒	LISN	ESH2-Z5	R & S	100450	04, 25, 2019
☒	PULSE LIMITER	ESH3-Z2	R & S	101915	11, 26, 2019
☒	8-WIRE ISN CAT3,5	ENY81	R & S	100174	01, 07, 2020
☒	8-WIRE ISN CAT6	ENY81-CAT6	R & S	101665	01, 07, 2020
☐	ISN	ISN S8	SCHWARZBECK	ISN-S8-0019	05, 09, 2019
☐	CDN	CDNS502A	TESEQ	40431	01, 08, 2020

Test Conditions
Temperature: 24.2 ℃
Relative Humidity: 55.3 % R.H.

Frequency Range of Measurement
150 ㎑ to 30 ㎒

Instrument Settings
IF Band Width: 9 ㎑

Test Results
The requirements are:

☒ PASS
☐ NOT PASS
☐ NOT APPLICABLE

Remarks
N/A

2.3 Radiated Electric Field Emissions(Below 1 ㎓)

Test Date
Jan. 21, 2019

Test Location
☐ Open Area Test Site #2 ☒ Semi Anechoic Chamber #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, 11, 2019
☒	AMPLIFIER	SCU 01	R & S	100603	11, 26, 2019
☒	TRILOG-BROADBAND ANTENNA	VULB9163	Schwarzbeck	715	11, 29, 2020
☒	ATTENUATOR	8491A	HP	32173	03, 21, 2019

Test Conditions
Temperature: 24.1 ℃
Relative Humidity: 51,8 % R.H.

Frequency Range of Measurement
30 ㎒ to 1 ㎓

Instrument Settings
IF Band Width: 120 ㎑

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 ㎓)

Test Date
Jan. 24, 2019

Test Location
Semi Anechoic Chamber #3

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	ESR7	R & S	101190	08, 06, 2019
☒	PREAMPLIFIER	8449B	AGILENT	3008A01967	05, 31, 2019
☒	ATTENUATOR	8491A	HP	35496	03, 21, 2019
☒	DOUBLE RIDGED HORN ANTENNA	SAS-571	A.H.SYSTEM,INC	781	05, 02, 2019

Test Conditions
Temperature: 24.3 ℃
Relative Humidity: 51.0 % R.H.

Frequency Range of Measurement
1 ㎓ to 6 ㎓

Instrument Settings
IF Band Width: 1 ㎒

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	08, 08, 2019
☐	POWER SOURCE	ACS 500N6	EM TEST	V1024106760	-

Test Conditions
Temperature: ℃
Relative Humidity: % R.H.

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
It is not tested apply because it is powered by 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	08, 08, 2019
☐	POWER SOURCE	ACS 500N6	EM TEST	V1024106760	-

Test Conditions
Temperature: ℃
Relative Humidity: % R.H.

Test Results
The requirements are:

☐ PASS
☐ NOT PASS
☒ NOT APPLICABLE

Remarks
It is not tested apply because it is powered by 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.

Confirmed the operation of the camera through WebViewer and network Ping Test.

Performance criteria for Transient phenomena applied to Transmitters (TT)

The EUT shall not unintentional transmission after the test.

Confirmed the operation of the camera through WebViewer and network Ping Test.

The performance criteria B shall apply, except for voltage dips of 100 ㎳ and voltage interruptions of 5 000 ㎳ 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.

Confirmed the operation of the camera through WebViewer and network Ping Test.

Performance criteria for Transient phenomena applied to Receivers (TR)

The EUT shall not unintentional transmission after the test.

Confirmed the operation of the camera through WebViewer and network Ping Test.

The performance criteria B shall apply, except for voltage dips of 100 ㎳ and voltage interruptions of 5 000 ㎳ 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
Jan. 19, 2019

Test Location
EMS-ESD: Electro wave Shieldroom #7

Test Equipment

Used	Description	Model Number	Manufacturer	Serial Number	Cal. Due
☒	ESD SIMULATOR	ESS-2000	Noise Ken	ESS01Z0454	10, 11, 2019
☒	HCP	-	Noise Ken	-	-
☒	VCP	-	Noise Ken	-	-

Test Conditions

Temperature: 23.2 ℃
Relative Humidity: 51.6 % R.H.
Atmospheric Pressure: 101.2 kPa

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: more than 10 time

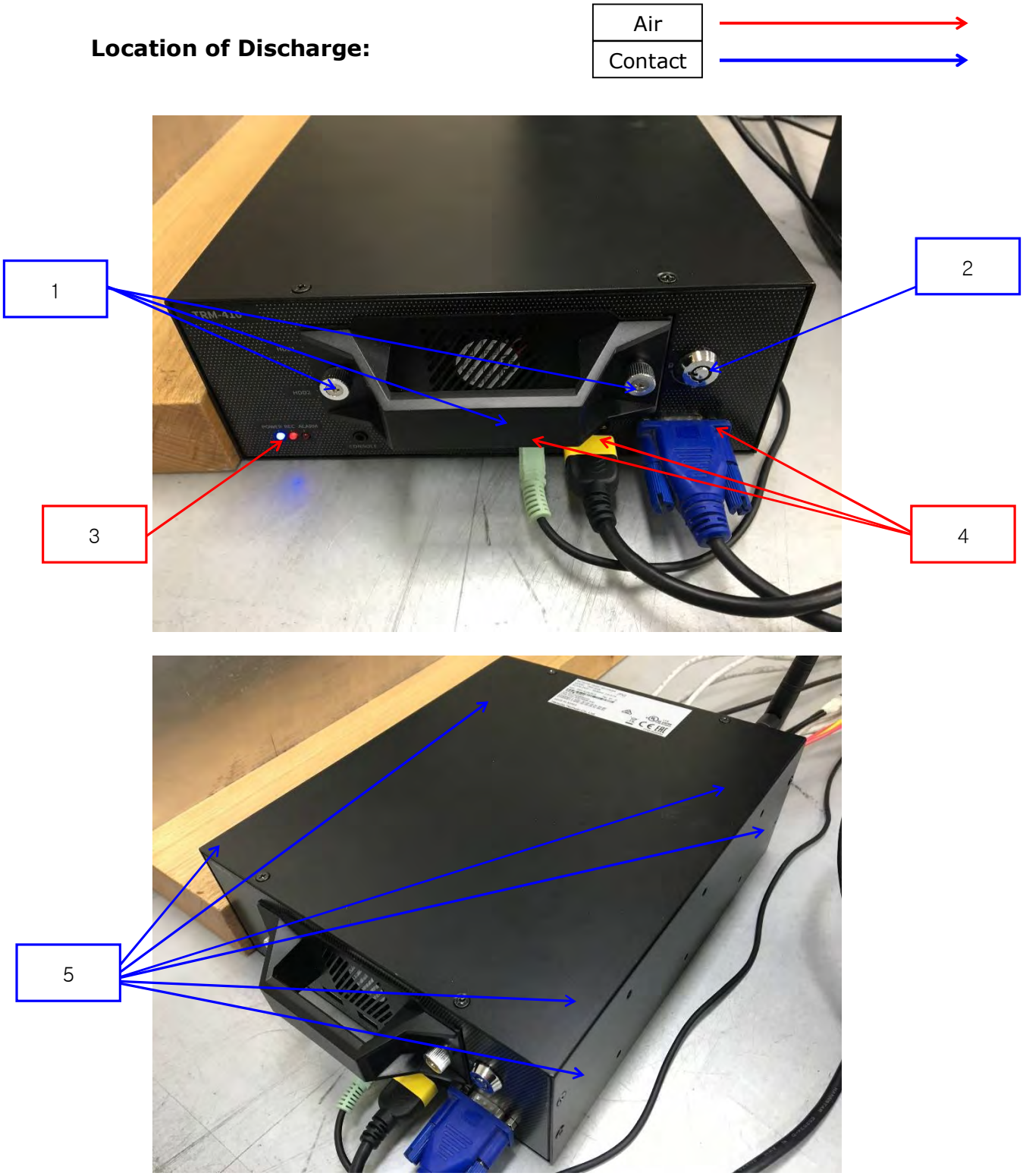
Discharge Voltage:

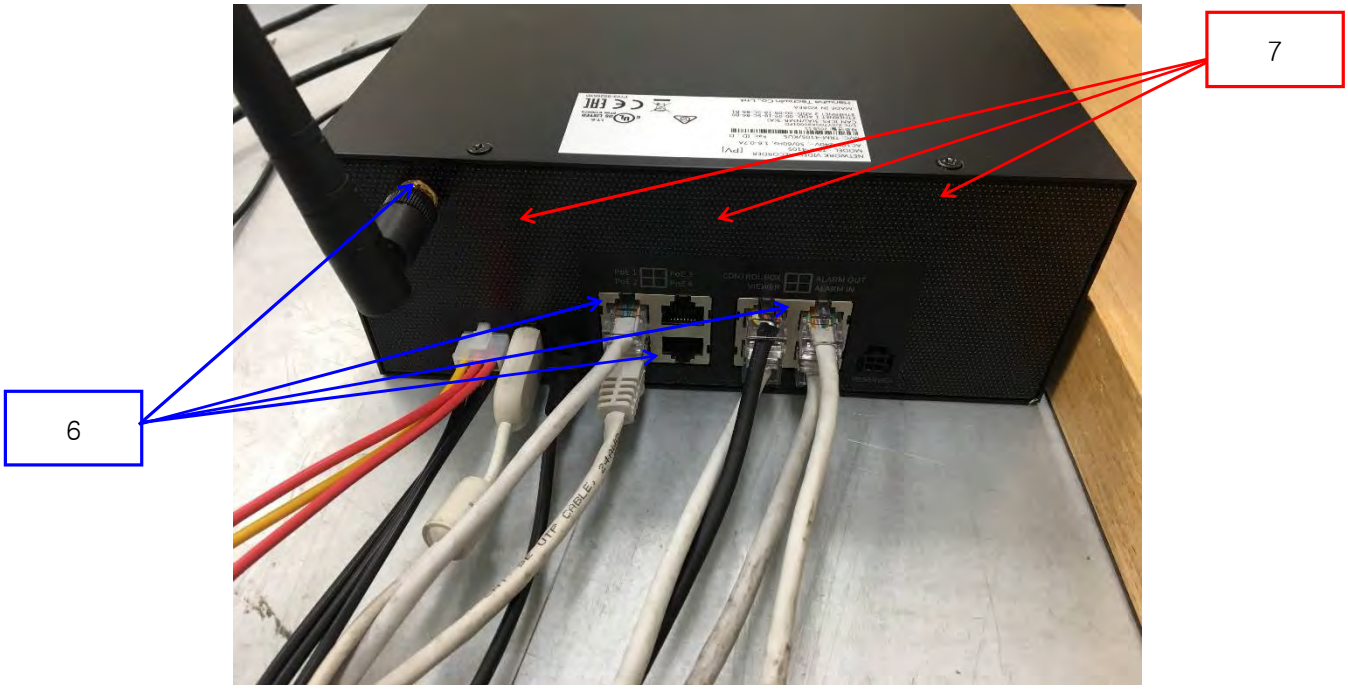
Contact	Air	HCP	VCP
☒ 2 kV	☒ 2 kV	☒ 2 kV	☒ 2 kV
☒ 4 kV	☒ 4 kV	☒ 4 kV	☒ 4 kV
☐ 6 kV	☐ 6 kV	☐ 6 kV	☐ 6 kV
☐ 8 kV	☒ 8 kV	☐ 8 kV	☐ 8 kV
☐ 15 kV	☐ 15 kV	☐ 15 kV	☐ 15 kV

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

Required Performance Criteria: ☒ B

Location of Discharge:





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	HDD Case	Contact Discharge	B	A	-
2	Key Slot	Contact Discharge	B	A	-
3	LED	Air Discharge	B	A	-
4	Front Ports	Air Discharge	B	A	-
5	Enclosure	Contact Discharge	B	A	-
6	Rear Ports	Contact Discharge	B	A	-
7	Rear Enclosure	Air Discharge	B	A	-

Direct Discharge

Note: "Blank" = Not performed

Results:
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

N/A

3.2 Radiated Electric Field Immunity

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

Test Date
Jan. 24, 2019

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	EMC32	R & S	10.10.02	-
☒	SIGNAL GENERATOR	SMB 100A	R & S	177586	08, 06, 2019
☒	BROADBAND AMPLIFIER	BBA100	R & S	101239	08, 06, 2019
☒	BROADBAND AMPLIFIER	100S1G6M1	AR	579931	08, 06, 2019
☒	POWER METER	NRP2	R & S	103475	08, 06, 2019
☒	AVG POWER SENSOR	NRP-Z91	R & S	102526	08, 06, 2019
☒	AVG POWER SENSOR	NRP-Z91	R & S	102527	08, 06, 2019
☒	STACKED DOUBLE LOG-PER- ANTENNA	STPL9128 E	Schwarzbeck	9128ES-121	-
☒	DIRECTIONAL COUPLER	KYDC-D1070-DX40	KY TELECOM	KY150001	08, 06, 2019
☒	DOUBLE RIDGED HORN ANTENNA	SAS-571	A.H.SYSTEM,INC	781	05, 02, 2019

Test Conditions

Temperature:	24.3 ℃
Relative Humidity:	51.0 % R.H.
Atmospheric Pressure:	101.7 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 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

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

Results:
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

N/A

3.3 Electrical Fast Transients/Bursts

Reference Standard
EN 61000-4-4:2012

Test Date
Jan. 23, 2019

Test Location
EMS-EFT: Electro wave Shieldroom #7

Test Equipment

Used	Description	Model Number	Manufacturer	Serial Number	Cal. Due
☒	EMS Test S/W	iec.control	EM TEST	5.4.7	-
☒	ULTRA COMPACT SIMULATOR	UCS 500N7	EM TEST	P1608172950	11, 27, 2019
☐	MOTOR VARIAC	MV2616	EM TEST	P1552169719	11, 27, 2019
☒	CAPACITIVE COUPLING CLAMP	HFK	EM TEST	P1633183115	11, 26, 2019

Test Conditions

Temperature:	24.3 ℃
Relative Humidity:	53.9 % R.H.
Atmospheric Pressure:	100.4 ㎪

Test Specifications

Pulse Amplitude & Polarity: (Power Lines)	☒ ± 0.5 ㎸ ☐ ± 2.0 ㎸	☐ ± 1.0 ㎸ ☐ ± 4.0 ㎸
Pulse Amplitude & Polarity: (Signal Lines)	☒ ± 0.5 ㎸ ☐ ± 2.0 ㎸	☐ ± 1.0 ㎸
Burst Period:	☒ 300 ㎳	☐ 2 s
Repetition Rate:	☒ 5 ㎑	☐ 100 ㎑
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 (㎸)	(-) Burst (㎸)
-	B	-	-

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

Mode of Application	Performance Criteria	Results	
		(+) Burst (㎸)	(-) Burst (㎸)
L1	B	A	A
L2	B	A	A
L1 – L2	B	A	A

☒ Signal ports and telecommunication ports – Coupling Clamp used

Mode of Application	Performance Criteria	Results	
		(+) Burst (㎸)	(-) Burst (㎸)
RJ-45 (Control Box)	B	A	A
RJ-45 (Alarm In)	B	A	A
RJ-45 (Alarm Out)	B	A	A
RJ-45 (PoE)	B	A	A
4 Pin (GPS)	B	A	A
RJ-45 (Viewer)	B	A	A

Note: "Blank" = Not performed

Results:
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

N/A

3.4 Surge Transients

Reference Standard
EN 61000-4-5:2014

Test Date
N/A

Test Location
EMS-Surge: 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, 2019
☐	MOTOR VARIAC	MV2616	EM TEST	V0936105123	06, 26, 2019
☐	CDN	CNV 508N1	EM TEST	P1551168979	04, 25, 2019
☐	CDN	CNV 508T5	EM TEST	P1549168422	04, 25, 2019

Test Conditions
Temperature: ℃
Relative Humidity: % R.H.
Atmospheric Pressure: 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

☐ Line to Line – Differential Mode

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

☐ Line to Earth – Common Mode

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

Signal Lines

☐ Line to Earth – Common Mode

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

Results:
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

It is not tested apply because it is powered by DC.

3.5 Conducted Disturbance

Reference Standard
EN 61000-4-6:2014

Test Date
Jan. 22, 2019

Test Location
EMS-CS: Electro wave Shieldroom #6

Test Equipment

Used	Description	Model Number	Manufacturer	Serial Number	Cal. Due
☒	EMS Test S/W	icd.control	EM TEST	5.3.11	-
☒	CONTINUOUS WAVE SIMULATOR	CWS 500N1.4	EM TEST	P1602169880	11, 26, 2019
☒	ATTENUATOR	ATT 6/80	EM TEST	P1614178148	11, 26, 2019
☒	CDN	CDN M016	TESEQ	43694	11, 26, 2019
☒	CDN	CDN T800	TESEQ	42800	11, 26, 2019
☒	EM CLAMP	KEMZ 801A	TESEQ	44099	11, 27, 2019

Test Conditions

Temperature: 23.9 ℃
Relative Humidity: 54.6 % R.H.
Atmospheric Pressure: 100.8 kPa

Test Specifications

Frequency range: ☒ 150 kHz to 80 MHz ☐ 10 kHz to 30 MHz
☐ 150 kHz to 230 MHz ☐ 10 kHz to 100 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: ☒ A

Test Data

☐ Input a.c. power ports

Coupling Location (Line Stressed)	Coupling Method	Performance Criteria	Results
-	-	-	-

☒ Input d.c. power ports

Coupling Location (Line Stressed)	Coupling Method	Performance Criteria	Results
L1 – L2	CDN	A	A

☒ Signal ports and telecommunication ports

Coupling Location (Line Stressed)	Coupling Method	Performance Criteria	Results
RJ-45 (Control Box)	Clamp	A	A
RJ-45 (Alarm In)	Clamp	A	A
RJ-45 (Alarm Out)	Clamp	A	A
RJ-45 (PoE)	CDN	A	A
4 Pin (GPS)	Clamp	A	A
RJ-45 (Viewer)	CDN	A	A

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

Results:
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

N/A

3.6 Power Frequency Magnetic Field Immunity

Reference Standard
EN 61000-4-8:2010

Test Date
N/A

Test Location
EMS-Magnetic: Electro wave Shieldroom

Test Equipment

Used	Description	Model Number	Manufacturer	Serial Number	Cal. Due
☐	EMS Test S/W	iec.control	EM TEST	5.4.7	-
☐	ULTRA COMPACT SIMULATOR	UCS 500N7	EM TEST	P1608172950	11, 27, 2019
☐	MOTOR VARIAC	MV2616	EM TEST	P1552169719	11, 27, 2019
☐	MAGNETIC FIELD COIL	MS 100N	EM TEST	P1536163691	11, 26, 2019
☐	CURRENT TRANSFORMER	MC 2630	EM TEST	P1629182219	11, 26, 2019

Test Conditions

Temperature: ℃
Relative Humidity: % R.H.
Atmospheric Pressure: ㎪

Test Specifications

Field Strength: ☐ 1 A/m ☐ 3 A/m ☐ 30 A/m

Frequency: ☐ 50 ㎐ ☐ 60 ㎐

Required Performance Criteria: ☐ A

Test Data

☐ Immersion method

Coil orientation	Observation
X - axis	-
Y - axis	-
Z - axis	-

☐ Proximity method

Coil orientation	Observation
-	-
-	-
-	-

Note: "blank" = Not performed

Results:
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

N/A : Not affected by magnetic fields.

3.7 Voltage Dips and Short Interruptions

Reference Standard
EN 61000-4-11:2004

Test Date
N/A

Test Location
EMS-Voltage dip: Electro wave Shieldroom

Test Equipment

Used	Description	Model Number	Manufacturer	Serial Number	Cal. Due
☐	EMS Test S/W	iec.control	EM TEST	5.4.7	-
☐	ULTRA COMPACT SIMULATOR	UCS 500N7	EM TEST	P1608172950	11, 27, 2019
☐	MOTOR VARIAC	MV2616	EM TEST	P1552169719	11, 27, 2019

Test Conditions
Temperature: ℃
Relative Humidity: % R.H.
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)
B for Voltage Dips (30%, 25 T)
C for Voltage Interruptions (100 %, 250 T)

Test Data

Voltage Dips

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

Short Interruptions

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

Results:
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

It is not tested apply because it is powered by DC.

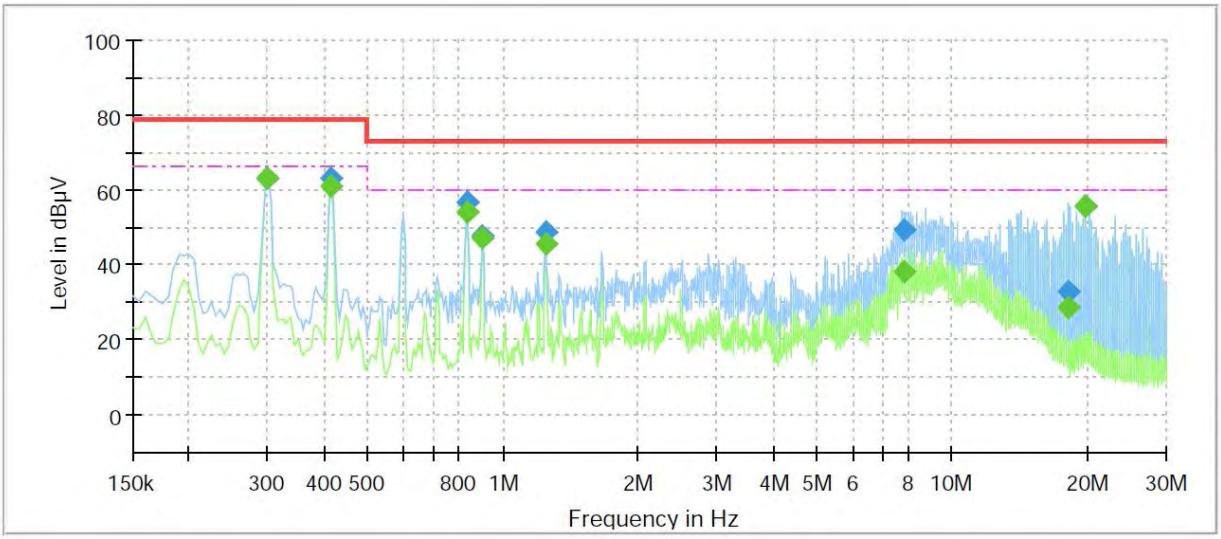
APPENDIX A – TEST DATA

Conducted Emissions at Mains Power Ports

[HOT]

Common Information

Test Description:	Conducted Emission
Model No.:	TRM-410S
Mode	(+)
Operator Name:	KES



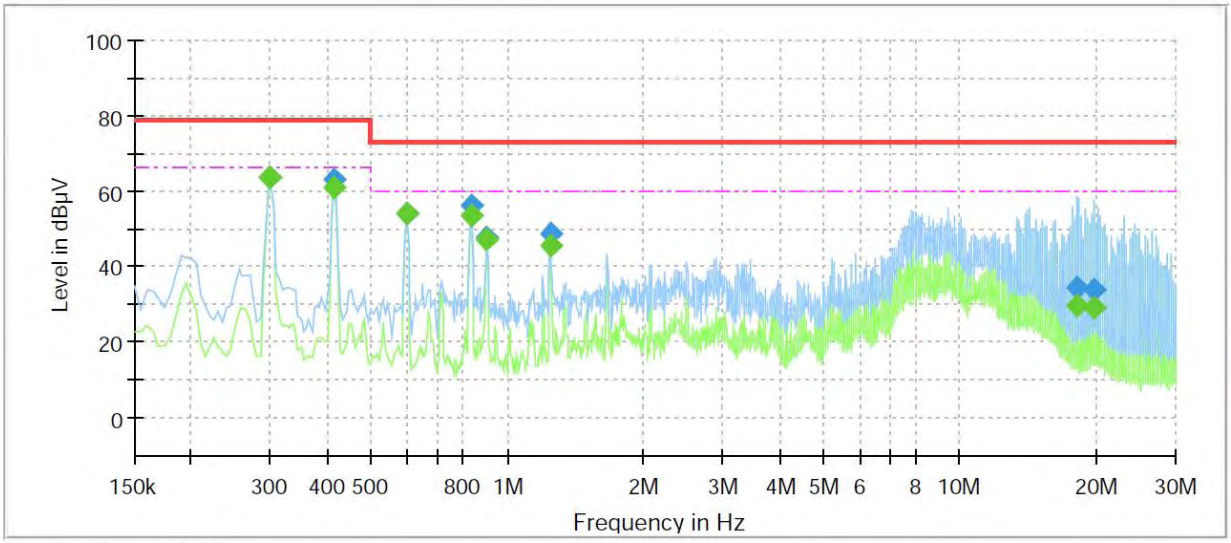
Final_Result

Frequency (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.300000	63.14	---	79.00	15.86	1000.0	9.000	L1	19.6
0.300000	---	63.07	66.00	2.93	1000.0	9.000	L1	19.6
0.415000	---	60.98	66.00	5.02	1000.0	9.000	L1	19.7
0.415000	62.85	---	79.00	16.15	1000.0	9.000	L1	19.7
0.830000	56.46	---	73.00	16.54	1000.0	9.000	L1	20.0
0.830000	---	54.07	60.00	5.93	1000.0	9.000	L1	20.0
0.900000	---	47.09	60.00	12.91	1000.0	9.000	L1	20.1
0.900000	47.43	---	73.00	25.57	1000.0	9.000	L1	20.1
1.250000	48.62	---	73.00	24.38	1000.0	9.000	L1	20.2
1.250000	---	45.48	60.00	14.52	1000.0	9.000	L1	20.2
7.825000	49.35	---	73.00	23.65	1000.0	9.000	L1	19.7
7.825000	---	38.32	60.00	21.68	1000.0	9.000	L1	19.7
18.245000	---	28.54	60.00	31.46	1000.0	9.000	L1	20.1
18.245000	32.98	---	73.00	40.02	1000.0	9.000	L1	20.1
19.710000	---	55.42	60.00	4.58	1000.0	9.000	L1	20.2
19.710000	55.57	---	73.00	17.43	1000.0	9.000	L1	20.2

[NEUTRAL]

Common Information

Test Description:	Conducted Emission
Model No.:	TRM-410S
Mode	(-)
Operator Name:	KES



Final_Result

Frequency (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.300000	63.31	---	79.00	15.69	1000.0	9.000	N	19.6
0.300000	---	63.25	66.00	2.75	1000.0	9.000	N	19.6
0.415000	62.72	---	79.00	16.28	1000.0	9.000	N	19.7
0.415000	---	60.86	66.00	5.14	1000.0	9.000	N	19.7
0.600000	54.18	---	73.00	18.82	1000.0	9.000	N	19.8
0.600000	---	53.86	60.00	6.14	1000.0	9.000	N	19.8
0.830000	56.22	---	73.00	16.78	1000.0	9.000	N	20.0
0.830000	---	53.65	60.00	6.35	1000.0	9.000	N	20.0
0.900000	---	47.03	60.00	12.97	1000.0	9.000	N	20.1
0.900000	47.42	---	73.00	25.58	1000.0	9.000	N	20.1
1.250000	---	45.54	60.00	14.46	1000.0	9.000	N	20.2
1.250000	48.71	---	73.00	24.29	1000.0	9.000	N	20.2
18.245000	---	29.81	60.00	30.19	1000.0	9.000	N	20.2
18.245000	34.62	---	73.00	38.38	1000.0	9.000	N	20.2
19.710000	---	29.13	60.00	30.87	1000.0	9.000	N	20.3
19.710000	33.75	---	73.00	39.25	1000.0	9.000	N	20.3

◆ Calculation
QuasiPeak[dB uV] / CAverage [dB uV] = Reading Value[dB uV] + Corr. [dB]
QuasiPeak / CAverage : The Final Value
Reading Value : Not shown in the table.
Corr. : Correction values (LISN FACTOR + (Cable Loss + Pulse Limiter FACTOR))

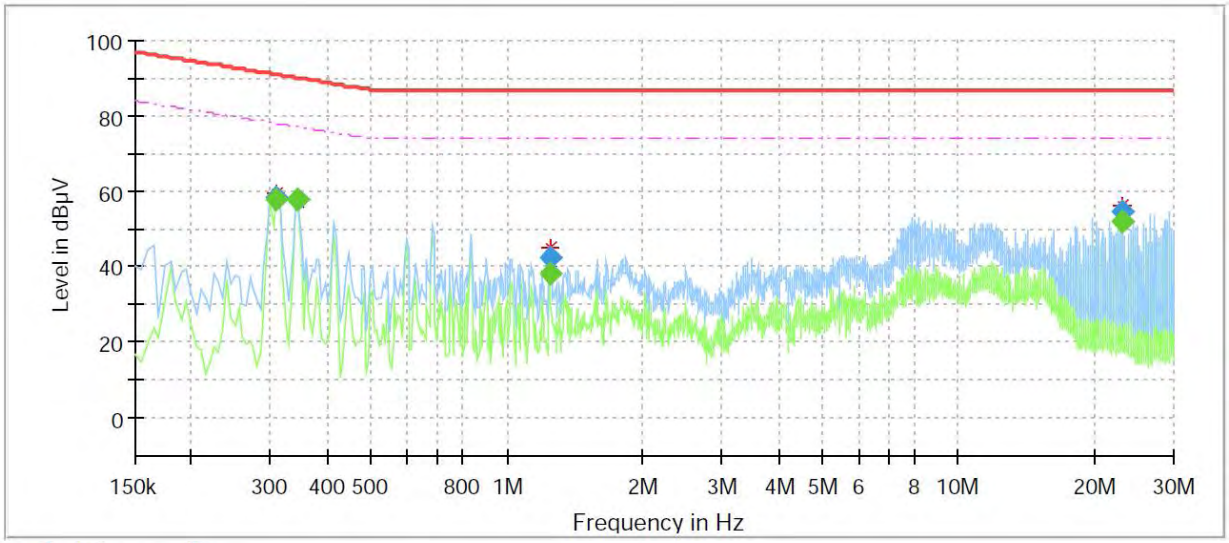
Conducted Emissions at Telecommunication Ports

■ LAN MODE

[1 000 Mbps]

Common Information

Test Description:	Telecommunication Emission
Model No.:	TRM-410S
Mode	LAN / 1 000 Mbps
Operator Name:	KES



Final_Result

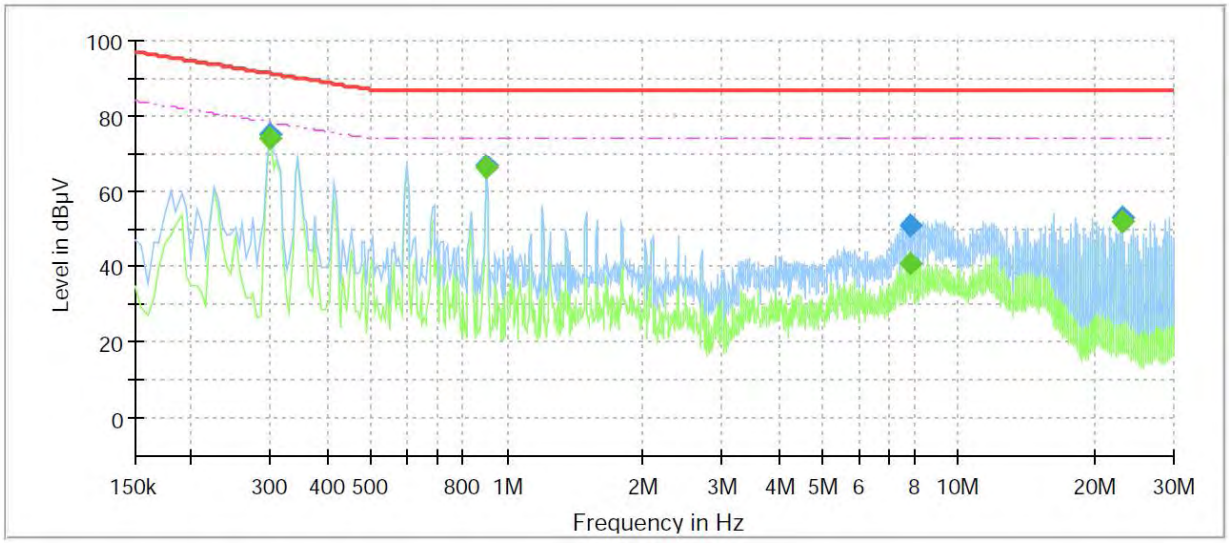
Frequency (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.310000	---	57.86	77.97	20.11	1000.0	9.000	Single Line	19.8
0.310000	58.33	---	90.97	32.64	1000.0	9.000	Single Line	19.8
0.345000	---	57.68	77.08	19.40	1000.0	9.000	Single Line	19.8
0.345000	57.80	---	90.08	32.28	1000.0	9.000	Single Line	19.8
1.250000	---	38.38	74.00	35.62	1000.0	9.000	Single Line	20.1
1.250000	42.28	---	87.00	44.72	1000.0	9.000	Single Line	20.1
23.130000	---	52.11	74.00	21.89	1000.0	9.000	Single Line	20.0
23.130000	54.72	---	87.00	32.28	1000.0	9.000	Single Line	20.0

■ PoE MODE

[100 Mbps]

Common Information

Test Description:	Telecommunication Emission
Model No.:	TRM-410S
Mode	PoE / 100 Mbps
Operator Name:	KES



Final_Result

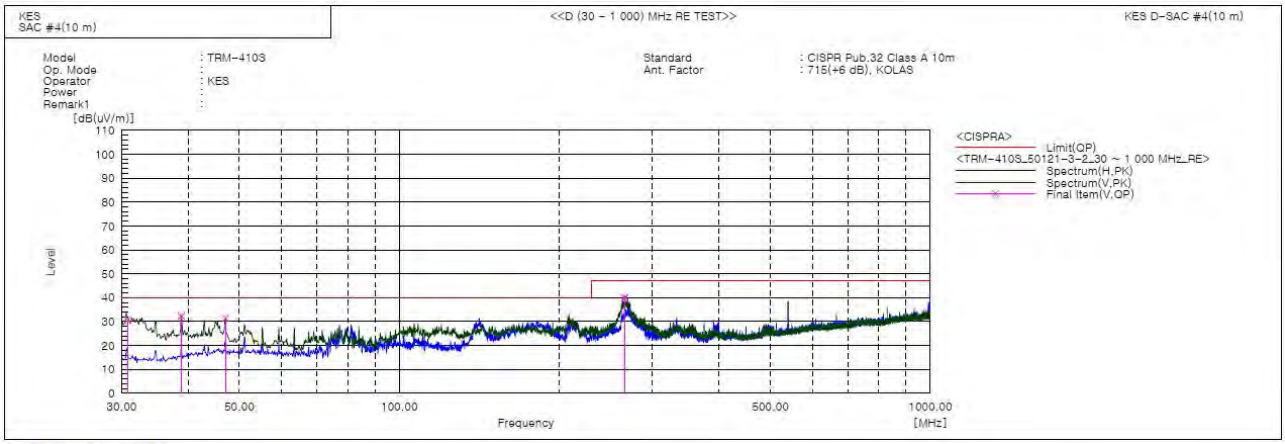
Frequency (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.300000	---	74.11	78.24	4.13	1000.0	9.000	Single Line	19.8
0.300000	75.04	---	91.24	16.20	1000.0	9.000	Single Line	19.8
0.900000	---	66.20	74.00	7.80	1000.0	9.000	Single Line	20.0
0.900000	66.43	---	87.00	20.57	1000.0	9.000	Single Line	20.0
7.830000	---	40.66	74.00	33.34	1000.0	9.000	Single Line	19.5
7.830000	50.79	---	87.00	36.21	1000.0	9.000	Single Line	19.5
23.130000	---	52.05	74.00	21.95	1000.0	9.000	Single Line	20.2
23.130000	52.78	---	87.00	34.22	1000.0	9.000	Single Line	20.2

◆ 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)

* LAN Mode Communication maximum speed : 1 000 Mbps
  PoE Mode Communication maximum Speed : 100 Mbps

Radiated Electric Field Emissions(Below 1 ㎓)

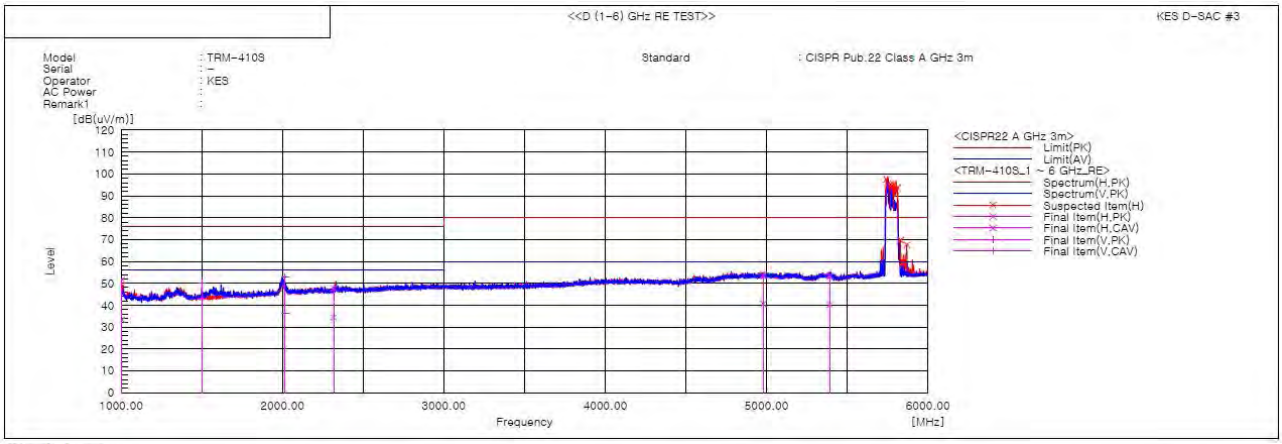


Final Result

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	30.844	V	56.1	-25.3	30.8	40.0	9.2	116.0	43.0	
2	38.865	V	56.1	-23.7	32.4	40.0	7.6	100.0	91.0	
3	47.096	V	53.2	-21.8	31.4	40.0	8.6	128.0	115.0	
4	266.074	V	59.9	-19.9	40.0	47.0	7.0	120.0	329.0	

◆ Calculation – SAC #4(10 m)
Result(QP) [㏈(㎶/m)] = (Reading(QP)[㏈(㎶)] + c.f[㏈(1/m)]
Margin(QP)[㏈] = Limit[㏈(㎶/m)] - Result(QP) [㏈(㎶/m)]
Reading(QP) : Reading value, Result(QP) : Reading value + Factor value
Limit(QP) : Limit value, c.f : (ANT Factor + Cable Loss - Preamp Factor), Margin: Marjin value

Radiated Electric Field Emissions(Above 1 ㎓)



Final Result

No.	Frequency [MHz]	(P)	Reading PK [dB(uV)]	Reading CAV [dB(uV)]	c.f [dB(1/m)]	Result PK [dB(uV/m)]	Result CAV [dB(uV/m)]	Limit PK [dB(uV/m)]	Limit AV [dB(uV/m)]	Margin PK [dB]	Margin CAV [dB]	Height [cm]	Angle [deg]	Remark
1	1005.031	H	53.5	35.3	-1.9	51.6	33.4	76.0	56.0	24.4	22.6	100.0	212.3	
2	1500.130	V	50.0	42.3	0.3	50.3	42.6	76.0	56.0	25.7	13.4	100.0	0.4	
3	2016.316	V	49.0	32.2	4.0	53.0	36.2	76.0	56.0	23.0	19.8	100.0	219.7	
4	2317.323	H	42.5	29.2	5.3	47.8	34.5	76.0	56.0	28.2	21.5	100.0	238.1	
5	4978.779	H	39.2	26.1	14.5	53.7	40.6	80.0	60.0	26.3	19.4	100.0	316.7	
6	5390.647	H	39.3	26.2	14.0	53.3	40.2	80.0	60.0	26.7	19.8	100.0	238.9	
7	5741.000	H	-------	-------	14.8	-------	-------	80.0	60.0	-------	-------	100.0	4.6	
8	5768.000	H	-------	-------	14.9	-------	-------	80.0	60.0	-------	-------	100.0	8.8	
9	5785.000	H	-------	-------	15.0	-------	-------	80.0	60.0	-------	-------	100.0	356.3	
10	5812.000	H	-------	-------	15.1	-------	-------	80.0	60.0	-------	-------	100.0	356.3	
11	5830.000	H	-------	-------	15.1	-------	-------	80.0	60.0	-------	-------	100.0	56.2	
12	5869.000	H	-------	-------	15.2	-------	-------	80.0	60.0	-------	-------	100.0	357.6	

◆ Calculation

Over Limit [㏈] = (Read Level[㏈㎶] + Ant Factor[㏈/m] + Cable Loss [㏈] – Preamp Factor [㏈]+ ATT[㏈]) – Limit Line[㏈㎶]

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

* Exclusion Band : 5.7 ㎓, 5.8 ㎓

Harmonic Current Emissions and Voltage Fluctuations and Flicker

Average harmonic current results

Hn	Ieff [A]	% of Limit	Limit [A]	Result
		N/A		

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	Ieff [A]	% of Limit	Limit [A]	Result
		N/A		

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

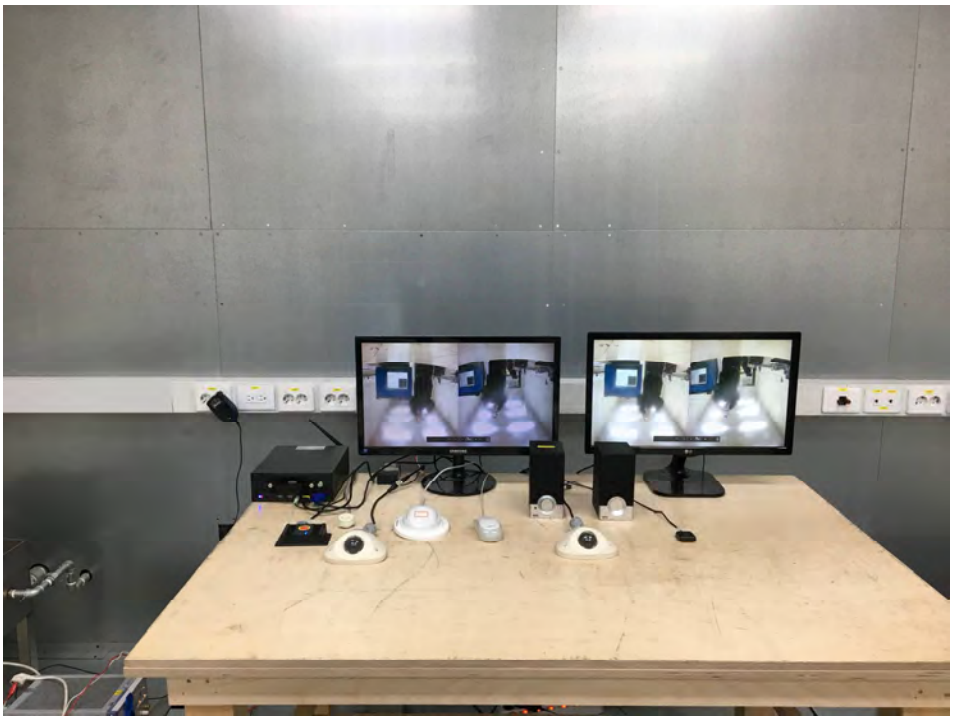
Maximum Flicker results

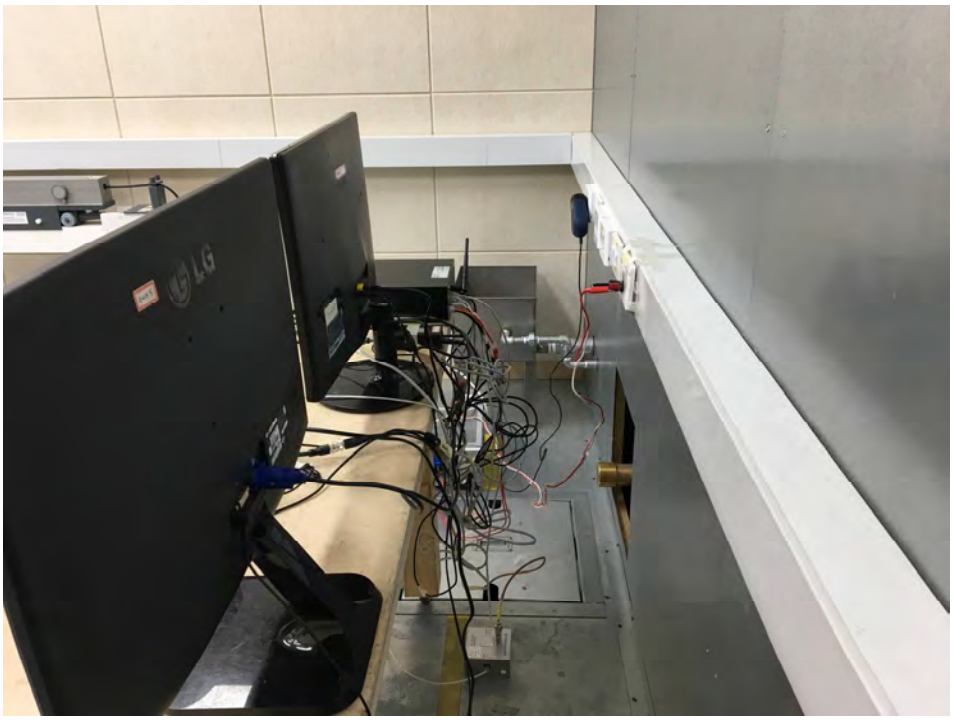
	EUT values	Limit	Result
Pst	N/A		
Plt			
dc [%]			
dmax [%]			
Tmax [s]			

Test Setup Photos and Configuration

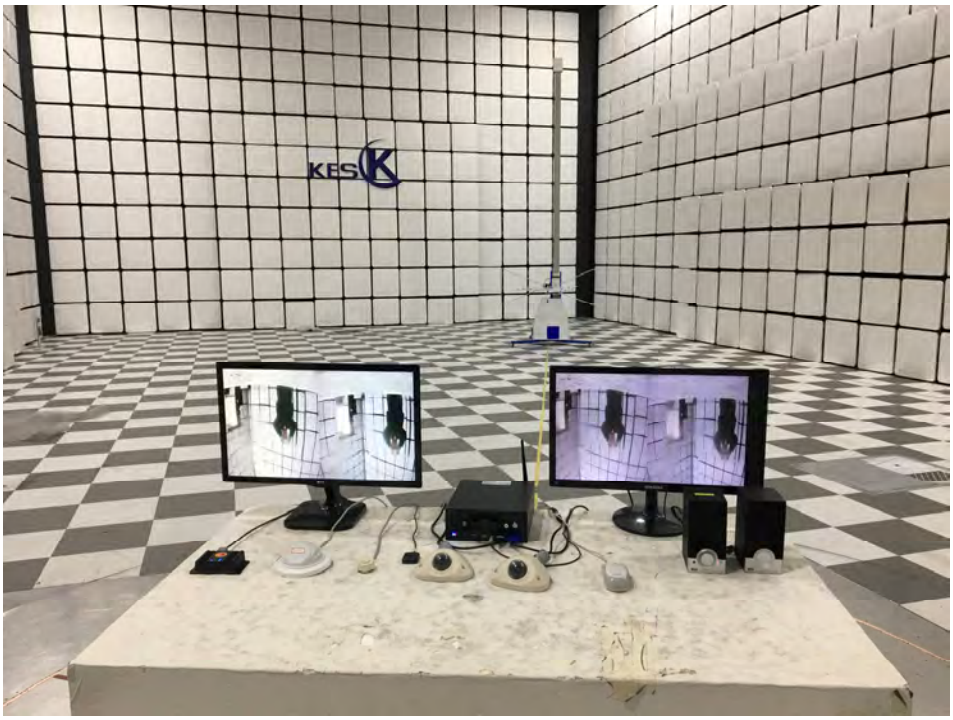
Conducted Voltage Emissions

Conducted Emissions at Telecommunication Ports





Radiated Electric Field Emissions(Below 1 ㎓)



Radiated Electric Field Emissions(Above 1 ㎓)

Harmonic Current Emissions and Voltage Fluctuations and Flicker

N/A

Electrostatic Discharge

Radiated Electric Field Immunity

Electrical Fast Transients/Bursts

Surge Transients

N/A

Conducted Disturbance

Power Frequency Magnetic Field Immunity

N/A

Voltage Dips and Short Interruptions

N/A

E.U.T External Photographs

(Top)

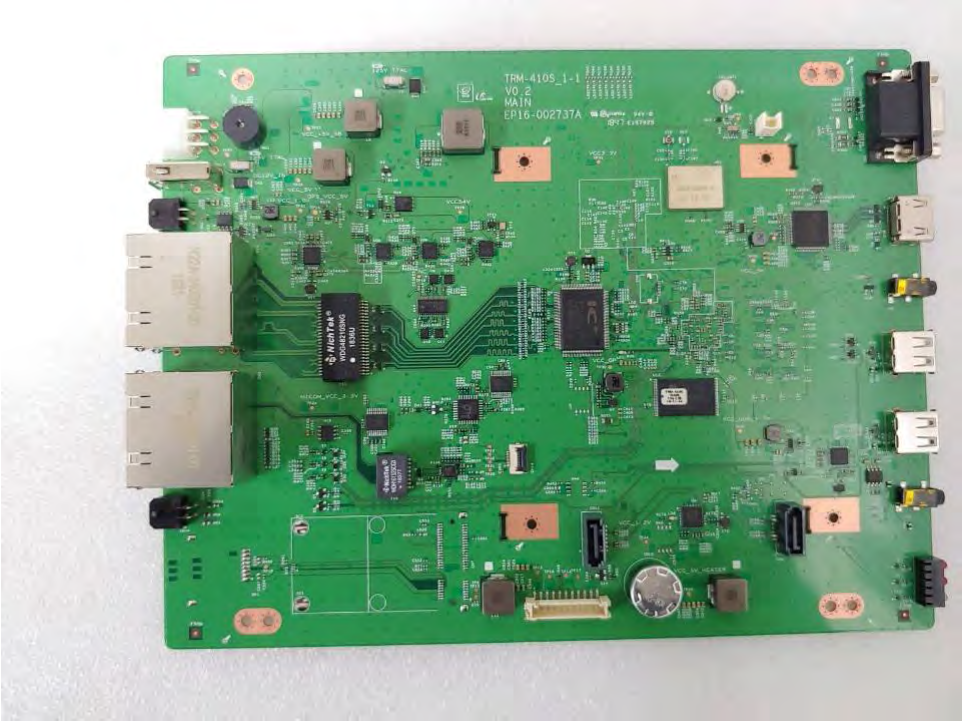
(Bottom)

E.U.T Internal Photographs

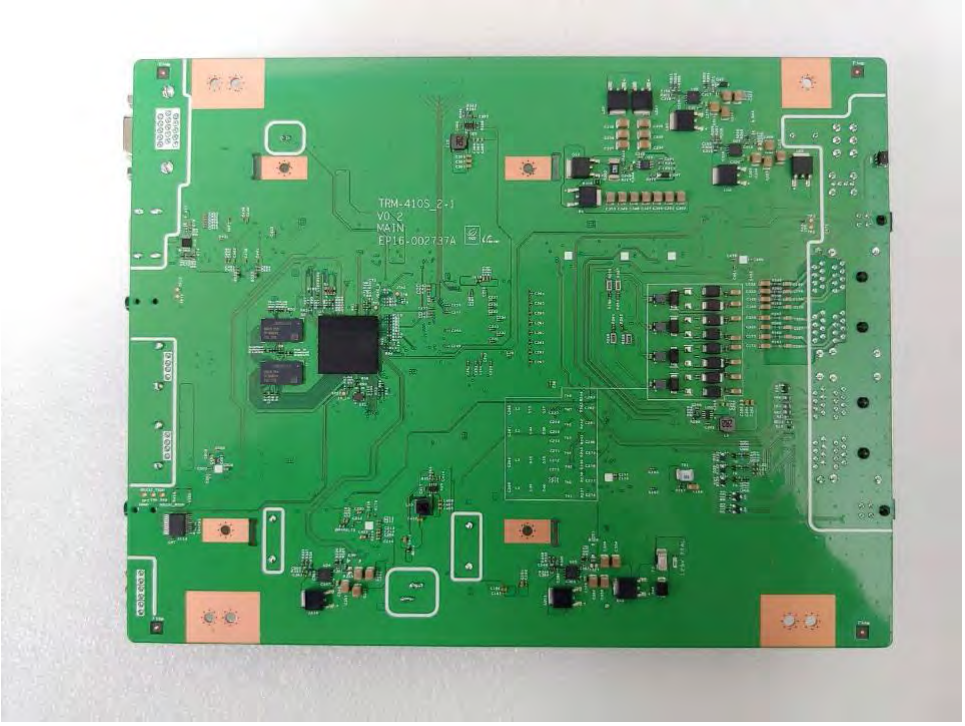
(Internal View)

EUT Internal View – Board 1

(Top)

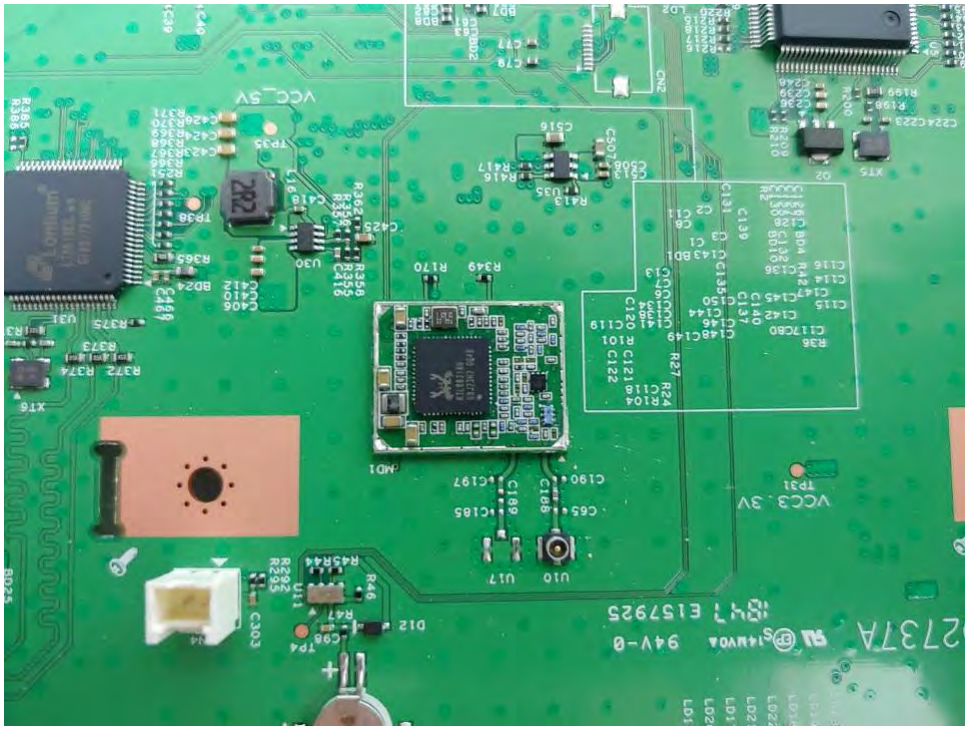


(Bottom)



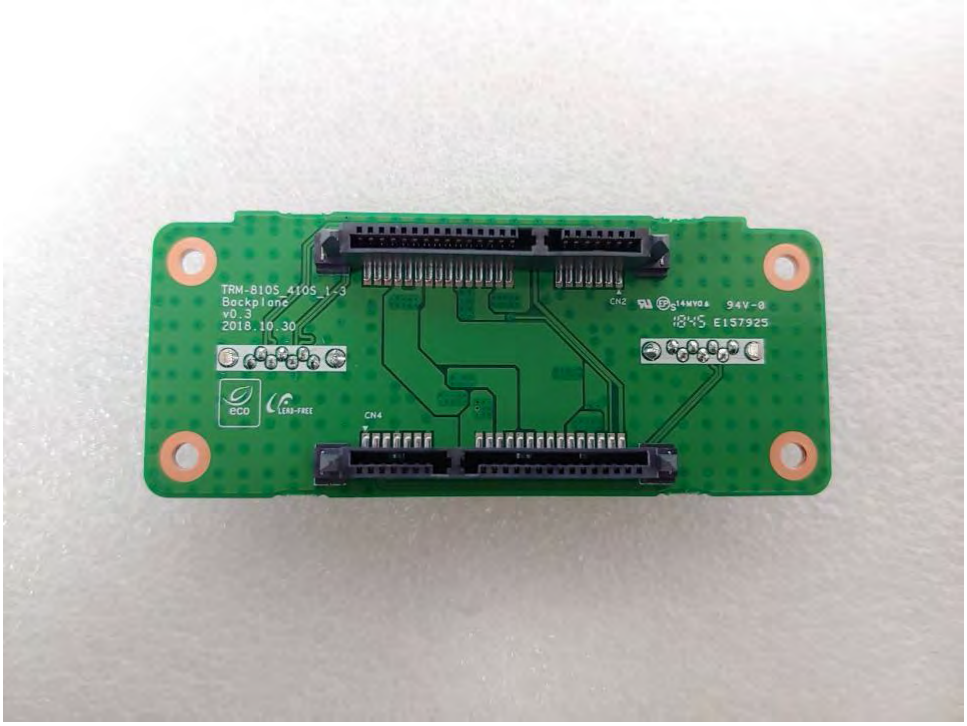
EUT Internal View – Board 2

(Top)

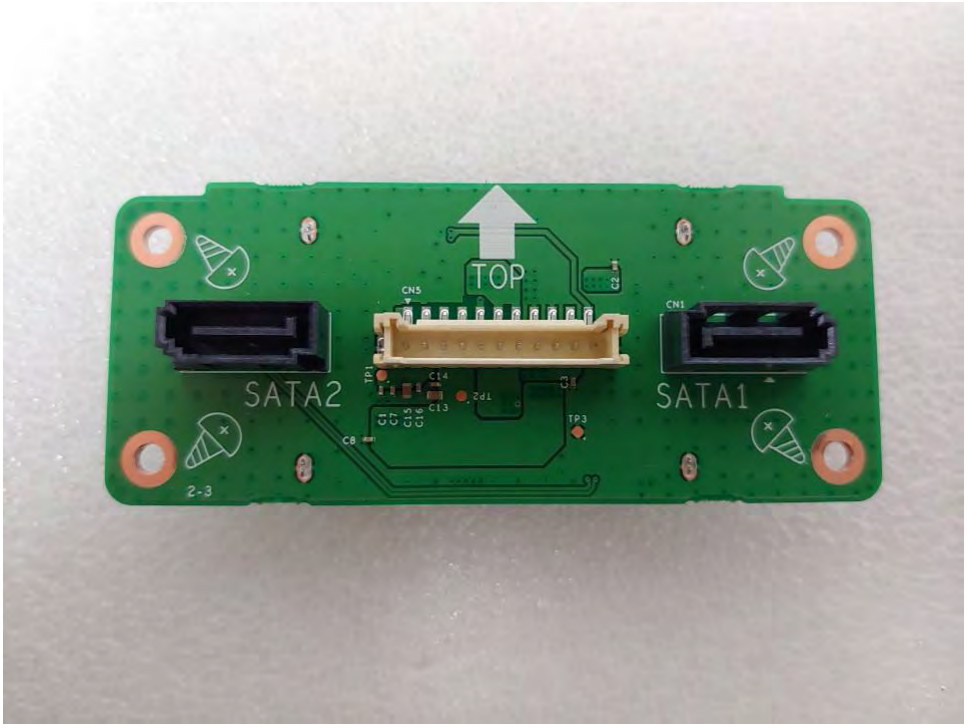


EUT Internal View – Board 3

(Top)



(Bottom)



Label and Location