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EMC TEST REPORT

Test Report No.	:	KES-EM-22T0678-R1
Date of Issue	:	Feb. 24, 2023
Product name	:	THERMAL CAMERA
Model/Type No.	:	TNO-4051T
Variant Model	:	TNO-4041T
Applicant	:	Hanwha Vision Co., Ltd
Applicant Address	:	6, Pangyo-ro 319Beon-gil, Bundang-gu, Seongnam-si, Gyeonggi-do, Republic of Korea
Manufacturer	:	1. HANWHA VISION VIETNAM COMPANY LIMITED 2. D-TECH CO.,LTD.
Manufacturer Address	:	1. Lot O-2, Que Vo Industrial Zone extended area, Nam Son commune, Bac Ninh city, Bac Ninh province, Vietnam 2. 173-25, Saneop-ro, Gwonseon-gu, Suwon-si, Gyeonggi- do, Korea (Suwon Industrial Complex)
Date of Receipt	:	Jul. 21, 2022
Test date	:	Jul. 22, 2022 ~ Jul. 26, 2022
Test Results	:	☒ **In Compliance** ☐ **Not in Compliance**

Tested by

Kang-Hyeon, Kim
EMC Test Engineer

Reviewed by

Dong-Hun, Jang
EMC Technical Manager

This test report is not related to KS Q ISO/IEC 17025 and KOLAS.

REPORT REVISION HISTORY

Date	Test Report No.	Revision History
Aug. 08, 2022	KES-EM-22T0678	Issued
Feb. 24, 2023	KES-EM-22T0678-R1	Change the Applicant and manufacturer at the request of the customer

TABLE OF CONTENTS

1.0 General Product Description

Main Specifications of EUT are:

Specifications

Video	
Imaging Device	Uncooled micro bolometer
Resolution	640x480, 640x360, 320x240
Max. Framerate	H.265/H.264: Max. 30fps/25fps(60Hz/50Hz) MJPEG: Max. 30fps/25fps(60Hz/50Hz)
NETD	<50mK
Pixel Size	17μm
Video Out	CVBS: 1.0 Vp-p / 75Ω composite, 720x480(N), 720x576(P) for installation

Lens	
Focal Length (Zoom Ratio)	35mm fixed focal
Max. Aperture Ratio	F1.0
Angular Field of View	H: 17.2° / V: 13° / D: 22°
Min. Object Distance	36m(118.11ft)
Focus Control	Fixed

Operational	
Camera Title	Displayed up to 85 characters
Digital Image Stabilization	Support(built-in gyro sensor)
Motion Detection	8ea, 8point polygonal zones
Privacy Masking	32ea, polygonal zones - Color: Grey/Green/Red/Blue/Black/White - Mosaic
Video Rotation	Flip, Mirror, Hallway view(90°/270°)
Analytics	Directional detection, Motion detection, Appear/Disappear, Enter/Exit, Loitering, Tampering, Virtual line, Audio detection, Temperature ditection, Sound classification, Shock detection
Serial Interface	RS-485/422(Samsung-T, Pelco-D/P, Panasonic, Bosch, AD, GE, Vicon, Honeywell)
Alarm I/O	Input 1ea / Output 2ea
Alarm Triggers	Analytics, Network disconnect, Alarm input
Alarm Events	File upload via FTP and e-mail Notification via e-mail SD/SDHC/SDXC or NAS recording at event triggers Alarm output Handover
Audio In	Selectable(mic in/line in) Supply voltage: 2.5VDC(4mA), Input impedance: 2K Ohm
Audio Out	Line out, Max.output level: 1Vrms

Network	
Ethernet	RJ-45(10/100BASE-T)
Video Compression	H.265/H.264: Main/Baseline/High, MJPEG
Audio Compression	G.711 u-law /G.726 Selectable G.726(ADPCM) 8KHz, G.711 8KHz G.726: 16Kbps, 24Kbps, 32Kbps, 40Kbps AAC-LC: 48Kbps at 16KHz
Smart Codec	Manual(5ea area), WiseStream II
Bitrate Control	H.264/H.265: CBR or VBR MJPEG: VBR

Streaming	Unicast(20 users) / Multicast Multiple streaming(Up to 10 profiles)
Protocol	IPv4, IPv6, TCP/IP, UDP/IP, RTP(UDP), RTP(TCP), RTCP,RTSP, NTP, HTTP, HTTPS, SSL/TLS, DHCP, FTP, SMTP, ICMP, IGMP, SNMPv1/v2c/v3(MIB-2), ARP, DNS, DDNS, QoS, PIM-SM, UPnP, Bonjour, LLDP, SRTP
Security	HTTPS(SSL) Login Authentication Digest Login Authentication IP Address Filtering User access log 802.1X Authentication(EAP-TLS, EAP-LEAP)
Application Programming Interface	ONVIF Profile S/G/T SUNAPI(HTTP API) Wisenet open platform

General

Web Viewer	Supported OS: Windows 7, 8.1, 10, Mac OS X 10.10, 10.11, 10.12 Recommended Browser: Google Chrome Supported Browser: MS Explorer11, MS Edge, Mozilla Firefox(Window 64bit only), Apple Safari(Mac OS X only)
Edge Storage	Micro SD/SDHC/SDXC 1slot 256GB
Memory	1024MB RAM, 256MB Flash

Environmental & Electrical

Operating Temperature / Humidity	-40°C ~ +60°C (-40°F ~ +140°F) / Less than 90% RH
Storage Temperature / Humidity	-50°C ~ +60°C (-58°F ~ +140°F) / Less than 90% RH
Certification	IP66, IK10, NEMA4X
Input Voltage	PoE(IEEE802.3af, Class3), 24VAC, 12VDC
Power Consumption	PoE: Max. 10W, typical 8.6W 12VDC: Max. 9W, typical 7.5W 24VAC: Max. 10.5W, typical 8.9W

Mechanical

Color / Material	White / Aluminum
RAL Code	RAL9003
Product Dimensions / Weight	Φ101.97x309mm(4.01x12.17") / 2452g(5.41lb)

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.

☒ AC 230 V, 50 Hz ☒ PoE

1.2 Variant Model Differences

Lens size difference.

1.3 Device Modifications

Not applicable

1.4 Equipment Under Test

Description	Model Number	Serial Number	Manufacturer	Remarks
THERMAL CAMERA	TNO-4051T	-	HANWHA VISION VIETNAM COMPANY LIMITED	EUT

1.5 Support Equipments

Description	Model Number	Serial Number	Manufacturer	Remarks
AC/AC ADAPTER	DY-2425AC	-	Daeyou	-
AC/DC ADAPTER	2ACB022F	-	Channel Well Technology (Guangzhou) Co., Ltd.	-
PoE ADAPTER	MA-INJ-4	-	Changzhou Wujin Hong Guang radio Factory Co.,LTD	-
Notebook	LG15N54	503NZWY038929	LG Electronics	-
Notebook Adaptor	PA-1900-14	OF2R263348701 7764	LITE-ON TECHNOLOGY COPORATION	-
Button Alarm	-	-	-	-
Alarm	-	-	-	-
Controller	SPC-1010	C50E67WG10100 F	SamSung Techwin Co.,Ltd.	-
Controller ADAPTER	AD0481-1503000KB	-	Shenzhen ABP Technology Co.,Ltd.	-
Smartphone	-	-	APPLE INCORPORATED	-
Headset	K550	-	Britz®	-
Micro SD Card	-	-	Sandisk	8 GB

1.6 External I/O Cabling

■ AC Mode

Start		END		Cable Spec.	
Description	**I/O Port**	**Description**	**I/O Port**	**Length**	**Shield**
NETWORK CAMERA (EUT)	RJ-45 (LAN)	Notebook	RJ-45 (LAN)	3.0	U
	Slot	Micro SD Card	Slot	-	-
	Alarm OUT	Alarm	Alarm IN	3.0	U
	Alarm IN	Button Alarm	Alarm OUT	3.0	U
	RS-485	Controller	RS-485	3.0	U
	Audio IN	Headset	Audio OUT	1.7	U
	Audio OUT		Audio IN	1.7	U
	2 Pin	AC/AC ADAPTER	2 Pin	1.6	U
Notebook	3.5 mm	Smartphone	3.5 mm	0.8	U
	JACK	Notebook Adaptor	JACK	1.7	U
Controller	JACK	Controller ADAPTER	JACK	1.5	U

* Unshielded=U, Shielded=S

■ DC Mode

Start		END		Cable Spec.	
Description	**I/O Port**	**Description**	**I/O Port**	**Length**	**Shield**
NETWORK CAMERA (EUT)	RJ-45 (LAN)	Notebook	RJ-45 (LAN)	3.0	U
	Slot	Micro SD Card	Slot	-	-
	Alarm OUT	Alarm	Alarm IN	3.0	U
	Alarm IN	Button Alarm	Alarm OUT	3.0	U
	RS-485	Controller	RS-485	3.0	U
	Audio IN	Headset	Audio OUT	1.7	U
	Audio OUT		Audio IN	1.7	U
	2 Pin	AC/DC ADAPTER	2 Pin	1.6	U
Notebook	3.5 mm	Smartphone	3.5 mm	0.8	U
	JACK	Notebook Adaptor	JACK	1.7	U
Controller	JACK	Controller ADAPTER	JACK	1.5	U

* Unshielded=U, Shielded=S

■ PoE Mode

Start		END		Cable Spec.	
Description	**I/O Port**	**Description**	**I/O Port**	**Length**	**Shield**
NETWORK CAMERA (EUT)	RJ-45 (PoE)	PoE ADAPTER	RJ-45 (PoE)	3.0	U
	Slot	Micro SD Card	Slot	-	-
	Alarm OUT	Alarm	Alarm IN	3.0	U
	Alarm IN	Button Alarm	Alarm OUT	3.0	U
	RS-485	Controller	RS-485	3.0	U
	Audio IN	Headset	Audio OUT	1.7	U
	Audio OUT		Audio IN	1.7	U
Notebook	3.5 mm	Smartphone	3.5 mm	0.8	U
	JACK	Notebook Adaptor	JACK	1.7	U
	RJ-45 (LAN)	PoE ADAPTER	RJ-45 (LAN)	3.0	U
Controller	JACK	Controller ADAPTER	JACK	1.5	U

* Unshielded=U, Shielded=S

1.7 EUT Operating Mode(s)

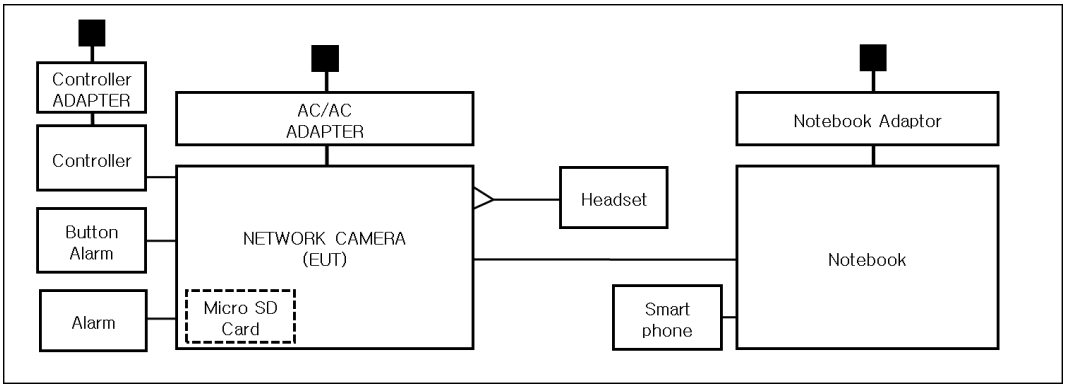
Test Mode	operating
AC, DC Mode	1. Check the camera video output on the laptop 2. Check if the network status is operating normally during PING TEST 3. Check the output of the 1 kHz tone output from the smartphone and the microphone input from the headset 4. Press the button alarm button to check the normal operation of the alarm. 5. Checked the files stored in the Micro SD Card after testing.
PoE Mode	

EUT Test operating S/W		
Name	**Version**	**Manufacture Company**
Web Viewer	-	Hanwha Vision Co., Ltd

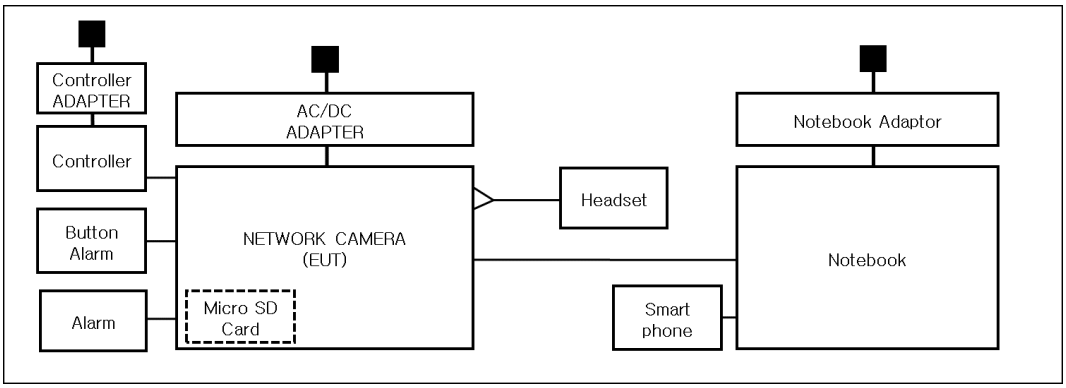
1.8 Configuration

■ AC Main
□ DC Main

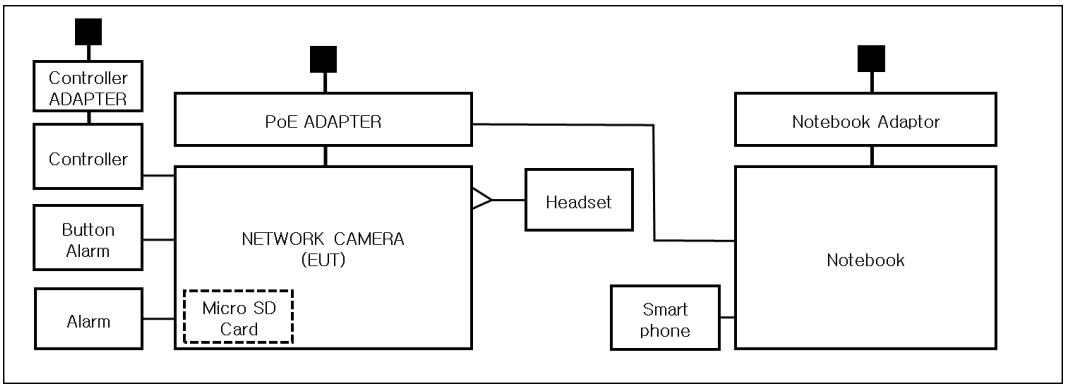
■ AC Mode



■ DC Mode



■ PoE Mode



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, Republic of. The sites are constructed in conformance with the requirements of ANSI C63.4a-2017 and CISPR 16-1-4:2019

1.12 Laboratory Accreditations and Listings

Country	Agency	Scope of Accreditation	Logo
KOREA	**RRA**	EMI (3 m & 10 m Semi-Anechoic Chamber and conducted test site) EMS (ESD, RS, EFT/Burst, Surge, CS, Magnetic, Dips and interruptions)	KR0100
International	**KOLAS**	EMI (3 m & 10 m Semi-Anechoic Chamber and conducted test site) EMS (ESD, RS, EFT/Burst, Surge, CS, Magnetic, Dips and interruptions)	KT489
USA	**FCC**	3 m & 10 m Semi-Anechoic Chamber Conducted test site to perform FCC Part 15/18 measurements.	KR0100
Canada	**ISED**	3 m & 10 m Semi-Anechoic Chamber and Conducted test site	23298
JAPAN	**VCCI**	EMI (3 m & 10 m Semi-Anechoic Chamber and conducted test site)	C-20136, T-20137, R-20181, G-20176
Europe	**TÜV SÜD**	EMI (3 m & 10 m Semi-Anechoic Chamber and conducted test site) EMS (ESD, RS, EFT/Burst, Surge, CS, Magnetic, Dips and interruptions)	CARAT 001633 0004

2.0 Test Regulations

The emissions tests were performed according to following regulations:

☒ **EMC – Directive 2014/30/EU**

☒ EN 55032:2015/A11:2020 ☒ Class A ☐ Class B

☒ EN 50130-4:2011

☒ EN 61000-3-2:2014

☒ EN 61000-3-3:2013

☒ **EMC – Regulations 2016**

☒ EN 55032:2015/A11:2020 ☒ Class A ☐ Class B

☒ EN 50130-4:2011

☒ EN 61000-3-2:2014

☒ EN 61000-3-3:2013

2.1 Conducted Emissions at Mains Power Ports

Test Date
Jul. 22, 2022

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	101783	12, 28, 2022
☒	LISN	ENV216	R & S	101787	12, 27, 2022
☒	LISN	ESH2-Z5	R & S	100450	12, 27, 2022
☒	PULSE LIMITER	ESH3-Z2	R & S	101915	12, 27, 2022

Test Conditions
Temperature: (24,3 ± 0,3) ℃
Relative Humidity: (44,8 ± 0,3) % 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
See Appendix A for test data.

2.2 Conducted Emissions at Telecommunication Ports

Test Date
Jul. 22, 2022

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	101783	12, 28, 2022
☒	LISN	ENV216	R & S	101787	12, 27, 2022
☒	LISN	ESH2-Z5	R & S	100450	12, 27, 2022
☒	PULSE LIMITER	ESH3-Z2	R & S	101915	12, 27, 2022
☒	8-WIRE ISN CAT3,5	ENY81	R & S	100174	12, 28, 2022
☐	8-WIRE ISN CAT6	ENY81-CAT6	R & S	101665	12, 28, 2022

Test Conditions
Temperature: (24,3 ± 0,3) ℃
Relative Humidity: (44,8 ± 0,3) % 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
- See Appendix A for test data.
- For Ethernet interfaces, measurements are required at the highest data rate supported by the interface.

2.3 Radiated Electric Field Emissions(Below 1 ㎓)

Test Date
Jul. 22, 2022

Test Location
☐ OPEN AREA TEST SITE #2 ☒ SEMI ANECHOIC CHAMBER #4(10m)

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	03, 31, 2023
☒	AMPLIFIER	SCU 01	R & S	100603	11, 24, 2022
☒	TRILOG-BROADBAND ANTENNA	VULB9163	Schwarzbeck	715	12, 08, 2022
☒	ATTENUATOR	8491A	HP	32173	03, 08, 2023

Test Conditions
Temperature: (24,8 ± 0,3) ℃
Relative Humidity: (45,3 ± 0,3) % 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
Jul. 22, 2022

Test Location
SEMI ANECHOIC CHAMBER #5

Test Equipment

Used	Description	Model Number	Manufacturer	Serial Number	Cal. Due
☒	EMI Test S/W	ES10/RE	TOYO Corporation	2022.01.000	-
☒	EMI TEST RECEIVER	ESU26	Rohde & Schwarz	100552	03, 31, 2023
☒	HORN ANTENNA	BBHA 9120D	SCHWARZBECK	9120D-1802	12, 16, 2023
☒	PREAMPLIFIER	8449B	HP	3008A00538	06, 02, 2023

Test Conditions
Temperature: (25,1 ± 0,2) ℃
Relative Humidity: (46,2 ± 0,2) % 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.
The Average of the test data is the cispr average result.

2.5 Harmonic Current Emissions

Test Date
Jul. 23, 2022

Test Location
Electro wave Shieldroom #3

Test Equipment

Used	Description	Model Number	Manufacturer	Serial Number	Cal. Due
☒	EMI Test S/W	net.control	EM TEST	2.1.4	-
☒	DIGITAL POWER ANALYZER	DPA 500N	EM TEST	V1024106759	04, 06, 2023
☒	POWER SOURCE	ACS 500N6	EM TEST	V1024106760	-

Test Conditions
Temperature: (24,5 ± 0,1) ℃
Relative Humidity: (47,5 ± 0,1) % 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
See Appendix A for test data.

2.6 Voltage Fluctuations and Flicker

Test Date
Jul. 23, 2022

Test Location
Electro wave Shieldroom #3

Test Equipment

Used	Description	Model Number	Manufacturer	Serial Number	Cal. Due
☒	EMI Test S/W	net.control	EM TEST	2.1.4	-
☒	DIGITAL POWER ANALYZER	DPA 500N	EM TEST	V1024106759	04, 06, 2023
☒	POWER SOURCE	ACS 500N6	EM TEST	V1024106760	-

Test Conditions
Temperature: (24,5 ± 0,6) ℃
Relative Humidity: (47,5 ± 0,6) % R.H.

Test Results
The requirements are:

☒ PASS
☐ NOT PASS
☐ NOT APPLICABLE

Remarks
See Appendix A for test data.

3.0 Criteria for compliance

Criteria for compliance was based on the following guidelines:
EN 50130-4:2011 Alarm systems-Part 4: Electromagnetic compatibility Product family standard: Immunity requirements for components of fire, intruder and social alarm systems

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

If as a result of the application of the tests defined in this standard, the apparatus

becomes dangerous or unsafe then the apparatus shall be deemed to have failed the test.

A functional description and a definition of performance by the manufacture and noted in the test

report, based on the following criteria:

Electrostatic discharge

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

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

Radiated electromagnetic fields

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

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

which could be interpreted by associated equipment as a change, and no such

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

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

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

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

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

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

Fast transient burst / slow high energy voltage surge

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

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

That there is no residual is permissible, providing that there is no residual change in the EUT or any

change in outputs, which could be interpreted by associated equipment as a change.

Conducted RF immunity

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

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

That there is no residual is permissible, providing that there is no residual change in the EUT or any

change in outputs, which could be interpreted by associated equipment as a change,

and no such flickering of indicators oeuvres at U = 130 dBμV.

For component of CCTV systems, where the status is monitored by observing the TV picture,

then deterioration of the picture is allowed at U = 140 dBμV, providing:

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

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

(b) at U = 130 dBμV, any deterioration of the picture is so minor that the system could

still be used; and

(c) there in no observable deterioration of the picture at U = 120 dBμV.

Voltage dip/interruption / Voltage variation

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

Flickering of an indicator during the conditioning is permissible, providing that there is no residual

change in the EUT or any change in outputs, which could be interpreted by associated equipment

as a change. The EUT shall meet the acceptance criteria for the functional test, after the conditioning.

3.1 Electrostatic Discharge

Reference Standard
EN 61000-4-2:2009

Test Date
Jul. 23, 2022

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	02, 24, 2023
☒	HCP	-	KES	-	-
☒	VCP	-	Noise Ken	-	-

Test Conditions

Temperature: (24,7 ± 0,2) ℃
Relative Humidity: (45,3 ± 0,2) % R.H.
Atmospheric Pressure: (99,6 ± 0,0) 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: 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

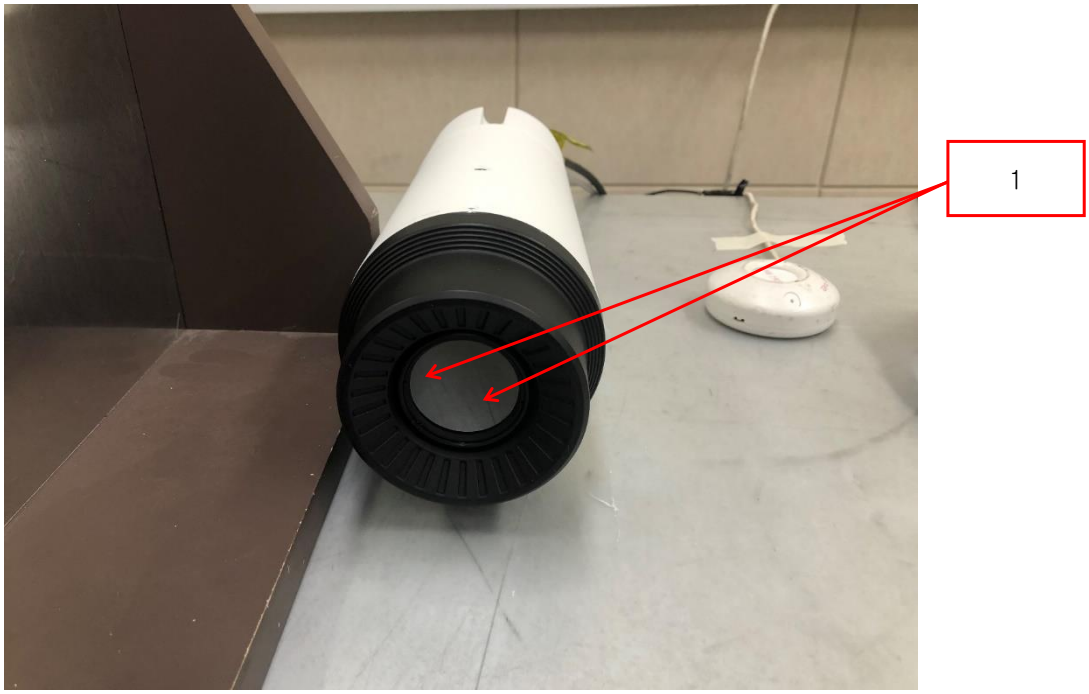
Notes: HCP: Horizontal coupling plane
VCP: Vertical coupling plane

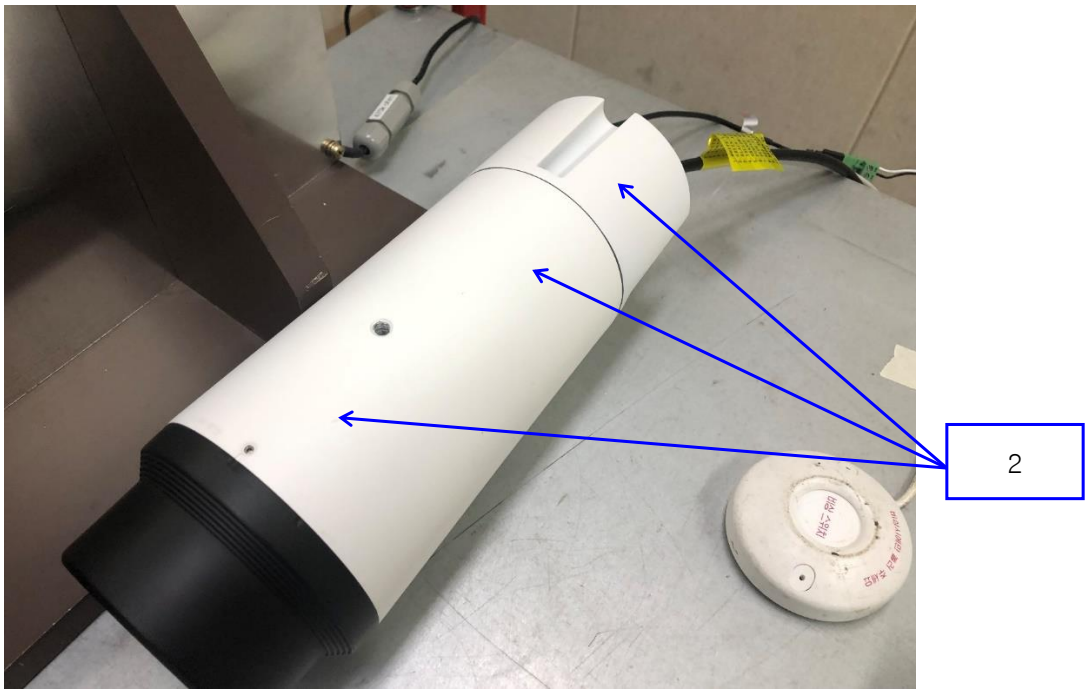
Required Performance Criteria: ☒ Complied

Location of Discharge:

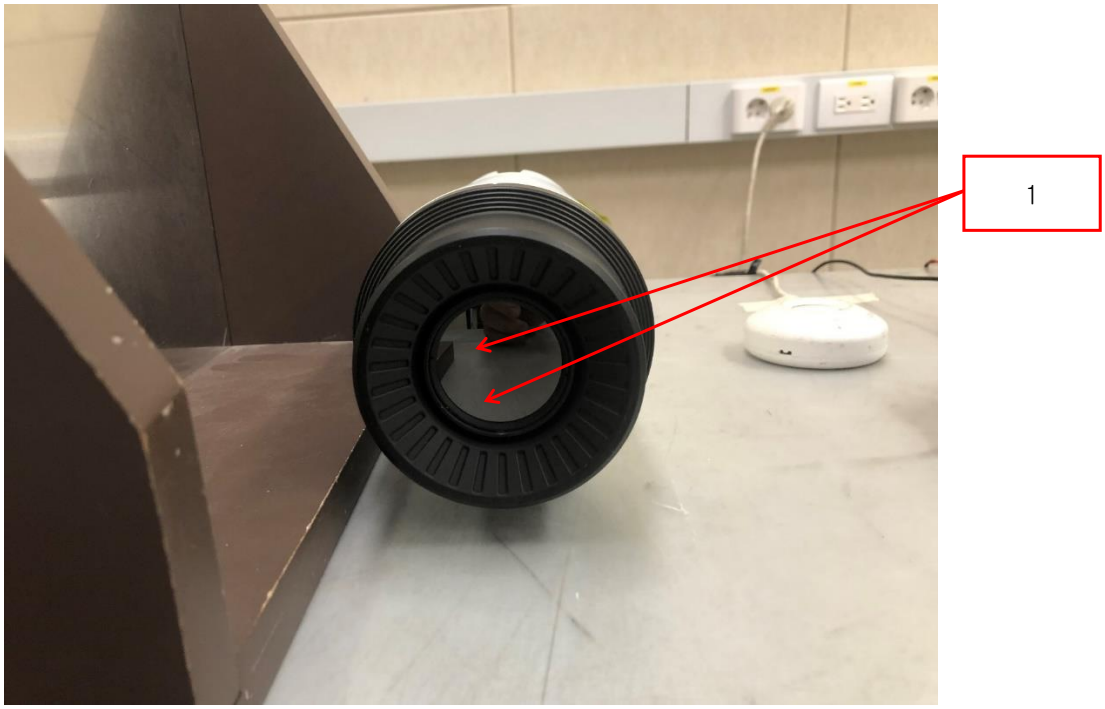
Air
Contact

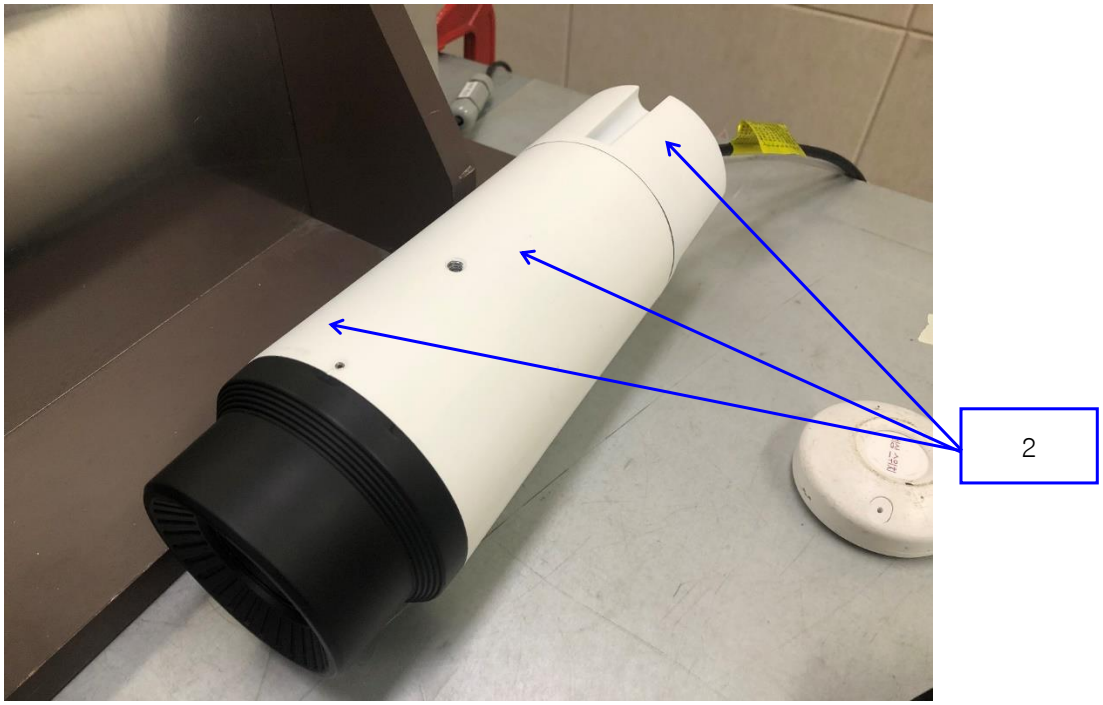
■ AC, DC Mode





■ PoE Mode





Test Data

■ AC Mode

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

Direct Discharge

No.	Test Point	Discharge Method	Observations	Remarks
1	Lens	Air Discharge	Complied	-
2	Enclosure	Contact Discharge	Complied	-

■ DC Mode

Indirect Discharge

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

Direct Discharge

No.	Test Point	Discharge Method	Observations	Remarks
1	Lens	Air Discharge	Complied	-
2	Enclosure	Contact Discharge	Complied	-

■ PoE Mode

Indirect Discharge

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

Direct Discharge

No.	Test Point	Discharge Method	Observations	Remarks
1	Lens	Air Discharge	Complied	-
2	Enclosure	Contact Discharge	Complied	-

Note: "Blank" = Not performed

Observations:
Complied – No degradation of function

Test Results

☒ PASS Required Performance Criteria
☐ NOT PASS Required Performance Criteria

Remarks

PASS Required Performance Criteria

3.2 Radiated Electric Field Immunity

Reference Standard
EN IEC 61000-4-3:2020

Test Date
Jul. 25, 2022

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	Rohde & Schwarz	108252	08, 01, 2023
☒	HIGH POWER DUAL AMP	SSA532	SUNGSAN	SSA532-001	-
☒	POWER METER	E4419B	Agilent	GB40203000	03, 31, 2023
☒	AVERAGE POWER SENSOR	E9301A	Agilent	MY52170007	04, 04, 2023
☒	AVERAGE POWER SENSOR	E9301A	Agilent	MY41498669	04, 04, 2023
☒	STACKED DOUBLE LOG-PER- ANTENNA	STPL9128 E	Schwarzbeck	9128ES-121	-
☒	DOUBLE RIDGED HORN ANTENNA	SAS-571	A.H.SYSTEM,INC	781	03, 03, 2023

Test Conditions
Temperature: (24,6 ± 0,6) ℃
Relative Humidity: (45,0 ± 0,6) % R.H.
Atmospheric Pressure: (99,9 ± 0,0) kPa

Test Specifications

Antenna Polarization: Horizontal & vertical unless indicated otherwise

Antenna Distance: ☒ 3 m

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

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

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

Frequency step: ☒ 1 % step

Dwell Time: ☐ 1 s ☒ 3 s

# of Sides Radiated: ☒ 4

Required Performance Criteria: ☒ Complied

Test Data

■ AC Mode

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

■ DC Mode

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

■ PoE Mode

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

Note: "Blank" = Not performed

Observations:
Complied – No degradation of function

Test Results

☒ PASS Required Performance Criteria
☐ NOT PASS Required Performance Criteria

Remarks

PASS Required Performance Criteria

3.3 Electrical Fast Transients/Bursts

Reference Standard
EN 61000-4-4:2012

Test Date
Jul. 23, 2022

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	5.4.8	-
☒	ULTRA COMPACT SIMULATOR	UCS 500N7	EM TEST	P1608172950	12, 03, 2022
☒	MOTOR VARIAC	MV2616	EM TEST	P1552169719	03, 31, 2023
☒	CAPACITIVE COUPLING CLAMP	HFK	EM TEST	P1633183115	12, 03, 2022

Test Conditions

Temperature: (24,7 ± 0,2) ℃
Relative Humidity: (45,3 ± 0,2) % R.H.
Atmospheric Pressure: (99,6 ± 0,0) ㎪

Test Specifications

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

Test Data

■ AC Mode

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

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

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

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

☒ Signal ports and telecommunication ports – Coupling Clamp used

Mode of Application	Observations	
	(+) Burst (㎸)	(-) Burst (㎸)
RJ-45 (LAN)	Complied	Complied
ALARM IN	Complied	Complied
ALARM OUT	Complied	Complied
RS-485	Complied	Complied

■ DC Mode

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

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

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

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

☒ Signal ports and telecommunication ports – Coupling Clamp used

Mode of Application	Observations	
	(+) Burst (㎸)	(-) Burst (㎸)
RJ-45 (LAN)	Complied	Complied
ALARM IN	Complied	Complied
ALARM OUT	Complied	Complied
RS-485	Complied	Complied

■ PoE Mode

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

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

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

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

☒ Signal ports and telecommunication ports – Coupling Clamp used

Mode of Application	Observations	
	(+) Burst (㎸)	(-) Burst (㎸)
RJ-45 (PoE)	Complied	Complied
ALARM IN	Complied	Complied
ALARM OUT	Complied	Complied
RS-485	Complied	Complied

Note: "Blank" = Not performed
Observations:
Complied – No degradation of function

Test Results

☒ PASS Required Performance Criteria
☐ NOT PASS Required Performance Criteria

Remarks

PASS Required Performance Criteria

3.4 Surge Transients

Reference Standard
EN 61000-4-5:2014/A1:2017

Test Date
Jul. 23, 2022

Test Location
EMS-Surge: Electro wave Shieldroom #7

Test Equipment

Used	Description	Model Number	Manufacturer	Serial Number	Cal. Due
☒	EMS Test S/W	iec.control	EM TEST	5.4.8	-
☒	ULTRA COMPACT SIMULATOR	UCS 500N7	EM TEST	P1608172950	12, 03, 2022
☒	MOTOR VARIAC	MV2616	EM TEST	P1552169719	03, 31, 2023
☒	CDN	CNV 508N1	EM TEST	P1610176296	12, 03, 2022

Test Conditions
Temperature: (24,7 ± 1,0) ℃
Relative Humidity: (45,3 ± 1,0) % R.H.
Atmospheric Pressure: (99,6 ± 0,0) ㎪

Test Specifications

AC Power Lines

Source Impedance:	12 ohm for common Mode and 2 ohm for differential Mode
Surge Amplitude :	Common Mode ☐ (0,5 / 1,0 / 2,0) kV Differential Mode ☒ (0,5 / 1,0) kV
Number of Surges:	☒ 5 surges per angle
Angle:	☒ 0°, 90°, 180°, 270° (input a.c. power port)
Polarity:	☒ Positive & Negative
Repetition Rate:	☐ 1 surge per min ☒ 1 surge per 30 sec.
Required Performance Criteria:	☒ Complied

Other supply / Signal Lines

Source Impedance:	42 ohm for common Mode
Surge Amplitude:	Common Mode ☒ (0,5 / 1,0) kV
Number of Surges:	☒ 5 Surges
Polarity:	☒ Positive & Negative
Repetition Rate:	☒ 1 surge per min ☐ 1 surge per 30 sec.
Required Performance Criteria:	☒ Complied

Test Data

■ AC Mode

☒ Line to Line – Differential Mode

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

☐ Line to Earth – Common Mode

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

Signal Lines

☒ Line to Earth – Common Mode

Mode of Application	Coupling Method	Observations	
		(+) Surge (㎸)	(-) Surge (㎸)
RJ-45 (LAN)	CDN	Complied	Complied
	LINE	Complied	Complied

■ DC Mode

☒ Line to Line – Differential Mode

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

☐ Line to Earth – Common Mode

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

Signal Lines

☒ Line to Earth – Common Mode

Mode of Application	Coupling Method	Observations	
		(+) Surge (㎸)	(-) Surge (㎸)
RJ-45 (LAN)	CDN	Complied	Complied
	LINE	Complied	Complied

■ PoE Mode
☐ Line to Line – Differential Mode

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

☐ Line to Earth – Common Mode

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

Signal Lines

☒ Line to Earth – Common Mode

Mode of Application	Coupling Method	Observations	
		(+) Surge (㎸)	(-) Surge (㎸)
RJ-45 (PoE)	CDN	Complied	Complied
	LINE	Complied	Complied

Note:"Blank" = Not performed
Observations:
Complied – No degradation of function

Test Results
☒ PASS Required Performance Criteria
☐ NOT PASS Required Performance Criteria

Remarks
PASS Required Performance Criteria

3.5 Conducted Disturbance

Reference Standard
EN 61000-4-6:2014

Test Date
Jul. 26, 2022

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	5.3.12	-
☒	CONTINUOUS WAVE SIMULATOR	CWS 500N1.4	EM TEST	P1602169880	11, 24, 2022
☒	ATTENUATOR	ATT 6/80	EM TEST	P1614178148	11, 24, 2022
☒	CDN	CDN M016	TESEQ	43694	11, 24, 2022
☒	CDN	CDN M016	TESEQ	43697	11, 24, 2022
☒	CDN	CDN T8RJ45	EM TEST	0909-09	08, 01, 2023
☐	CDN	CDN ST08A	TESEQ	43886	11, 24, 2022
☒	EM CLAMP	KEMZ 801A	TESEQ	44099	11, 25, 2022

Test Conditions

Temperature: (24,8 ± 1,2) ℃
Relative Humidity: (45,4 ± 1,1) % R.H.
Atmospheric Pressure: (99,8 ± 0,0) kPa

Test Specifications

Frequency range:	☒ 150 ㎑ to 100 ㎒	☐ 150 ㎑ to 80 ㎒
Voltage Level:	☐ 1 Vrms ☒ 10 Vrms	☐ 3 Vrms
Modulation:	☒ AM, 80 %, 1 ㎑ sine wave ☒ PM, 1 ㎐ (0,5 s ON : 0,5 s OFF)	
Frequency step:	☒ 1 % step	
Dwell Time:	☐ 1 s	☒ 3 s
Required Performance Criteria:	☒ Complied	

Test Data

■ AC Mode

☒ Input a.c. power ports

Coupling Location (Line Stressed)	Coupling Method	Observations
L – N	CDN	Complied

☐ Input d.c. power ports

Coupling Location (Line Stressed)	Coupling Method	Observations
-	-	-

☒ Signal ports and telecommunication ports

Coupling Location (Line Stressed)	Coupling Method	Observations
RJ-45 (LAN)	CDN	Complied
ALARM IN	Clamp	Complied
ALARM OUT	Clamp	Complied
RS-485	Clamp	Complied

■ DC Mode

☒ Input a.c. power ports

Coupling Location (Line Stressed)	Coupling Method	Observations
L – N	CDN	Complied

☐ Input d.c. power ports

Coupling Location (Line Stressed)	Coupling Method	Observations
-	-	-

☒ Signal ports and telecommunication ports

Coupling Location (Line Stressed)	Coupling Method	Observations
RJ-45 (LAN)	CDN	Complied
ALARM IN	Clamp	Complied
ALARM OUT	Clamp	Complied
RS-485	Clamp	Complied

■ PoE Mode

☐ Input a.c. power ports

Coupling Location (Line Stressed)	Coupling Method	Observations
-	-	-

☐ Input d.c. power ports

Coupling Location (Line Stressed)	Coupling Method	Observations
-	-	-

☒ Signal ports and telecommunication ports

Coupling Location (Line Stressed)	Coupling Method	Observations
RJ-45 (PoE)	CDN	Complied
ALARM IN	Clamp	Complied
ALARM OUT	Clamp	Complied
RS-485	Clamp	Complied

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

Observations:
Complied – No degradation of function

Test Results

☒ PASS Required Performance Criteria
☐ NOT PASS Required Performance Criteria

Remarks

PASS Required Performance Criteria

3.6 Voltage Dips and Short Interruptions

Reference Standard
EN IEC 61000-4-11:2020

Test Date
Jul. 23, 2022

Test Location
EMS-Voltage dip: Electro wave Shieldroom #7

Test Equipment

Used	Description	Model Number	Manufacturer	Serial Number	Cal. Due
☒	EMS Test S/W	iec.control	EM TEST	5.4.8	-
☒	ULTRA COMPACT SIMULATOR	UCS 500N7	EM TEST	P1608172950	03, 31, 2023
☒	MOTOR VARIAC	MV2616	EM TEST	P1552169719	03, 31, 2023

Test Conditions

Temperature: (24,7 ± 0,2) ℃
Relative Humidity: (45,3 ± 0,2) % R.H.
Atmospheric Pressure: (99,6 ± 0,0) kPa

Test Specifications & Observations/Remarks

■ AC, DC Mode

- Voltage Dips and Short Interruptions

Test Level	Duration [in period/ms (50 ㎐)]	Results
☒ 20 % dip	☒ 250 / 5 000	Complied
☒ 30 % dip	☒ 25 / 500	Complied
☒ 60 % dip	☒ 10 / 200	Complied
☒ 100 % dip	☒ 250 / 5 000	Degradation

- Voltage variations

☒ Unom + 10 %	☒ 253.0 V (ac)	Complied
☒ Unom - 15 %	☒ 195.5 V (ac)	Complied

Observations:
Complied – No degradation of function
Degradation - See "Remarks "

Test Results

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

Remarks

During the test(100%, 250cycle), EUT was turned off but after the test, it was recovered without operator's intervention.

APPENDIX A – TEST DATA

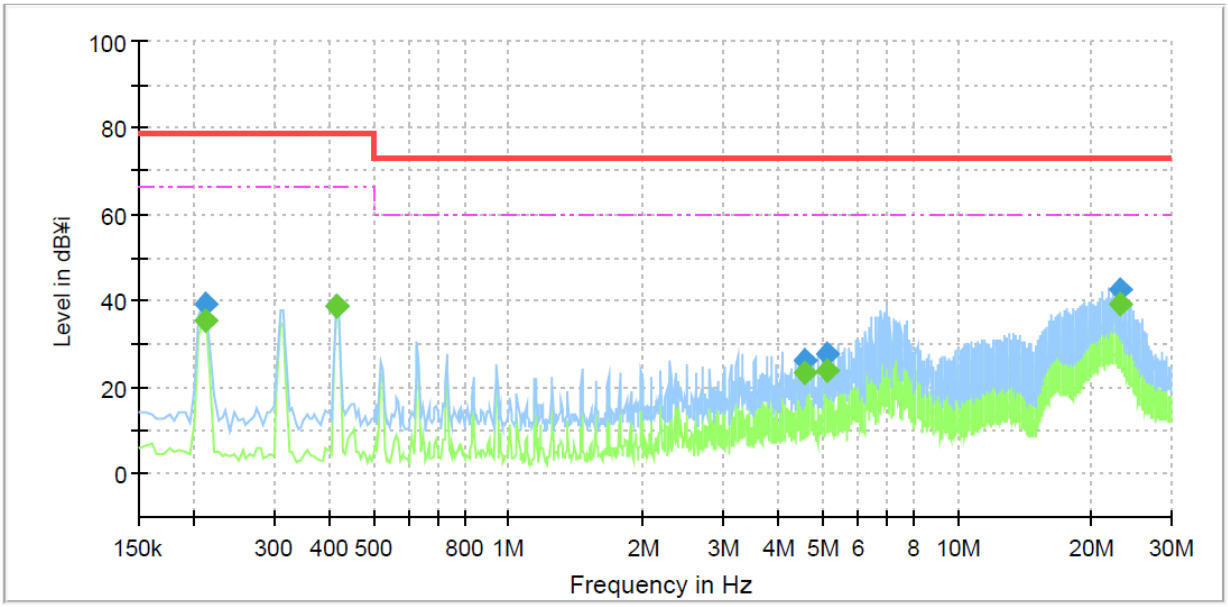
Conducted Emissions at Mains Power Ports

■ AC Mode

[HOT]

Common Information

Test Description:	Conducted Emission
Model No.:	TNO-4051T
Phase:	L1
Mode:	AC
Operator Name:	KES



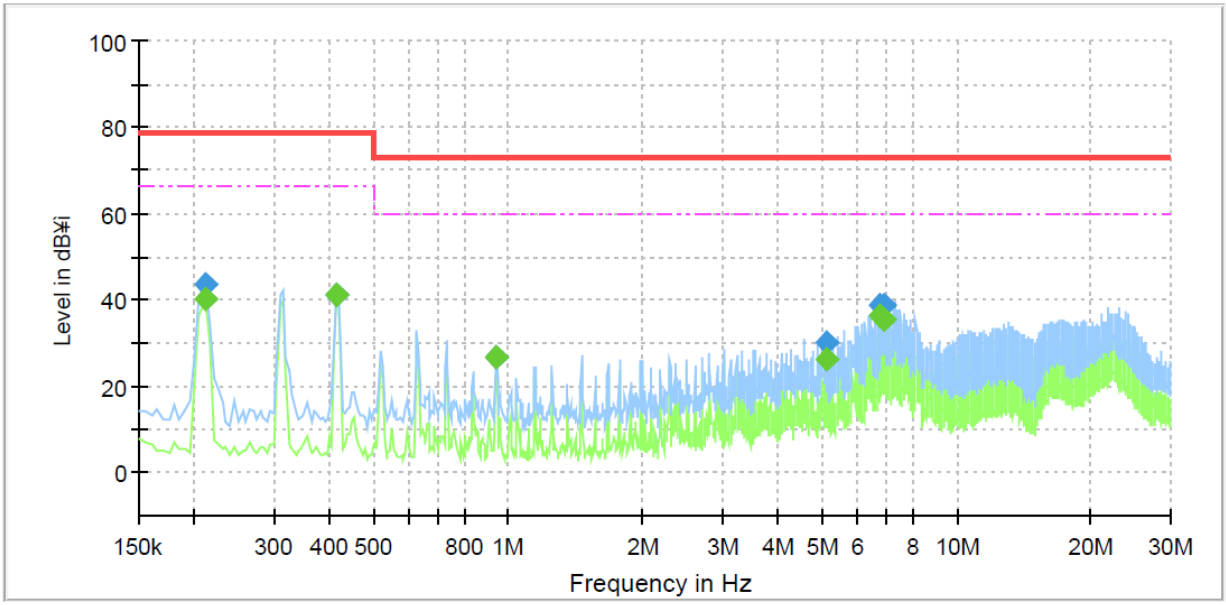
Final_Result

Frequency (MHz)	QuasiPeak (dB¥i V)	CAverage (dB¥i V)	Limit (dB¥i V)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.210000	---	35.56	66.00	30.44	1000.0	9.000	L1	19.4
0.210000	39.22	---	79.00	39.78	1000.0	9.000	L1	19.4
0.415000	---	38.82	66.00	27.18	1000.0	9.000	L1	19.6
0.415000	38.96	---	79.00	40.04	1000.0	9.000	L1	19.6
4.590000	---	23.38	60.00	36.62	1000.0	9.000	L1	19.7
4.590000	26.40	---	73.00	46.60	1000.0	9.000	L1	19.7
5.110000	---	24.00	60.00	36.00	1000.0	9.000	L1	19.6
5.110000	27.47	---	73.00	45.53	1000.0	9.000	L1	19.6
23.130000	---	39.08	60.00	20.92	1000.0	9.000	L1	20.1
23.130000	42.62	---	73.00	30.38	1000.0	9.000	L1	20.1

[NEUTRAL]

Common Information

Test Description:	Conducted Emission
Model No.:	TNO-4051T
Phase:	N
Mode:	AC
Operator Name:	KES



Final_Result

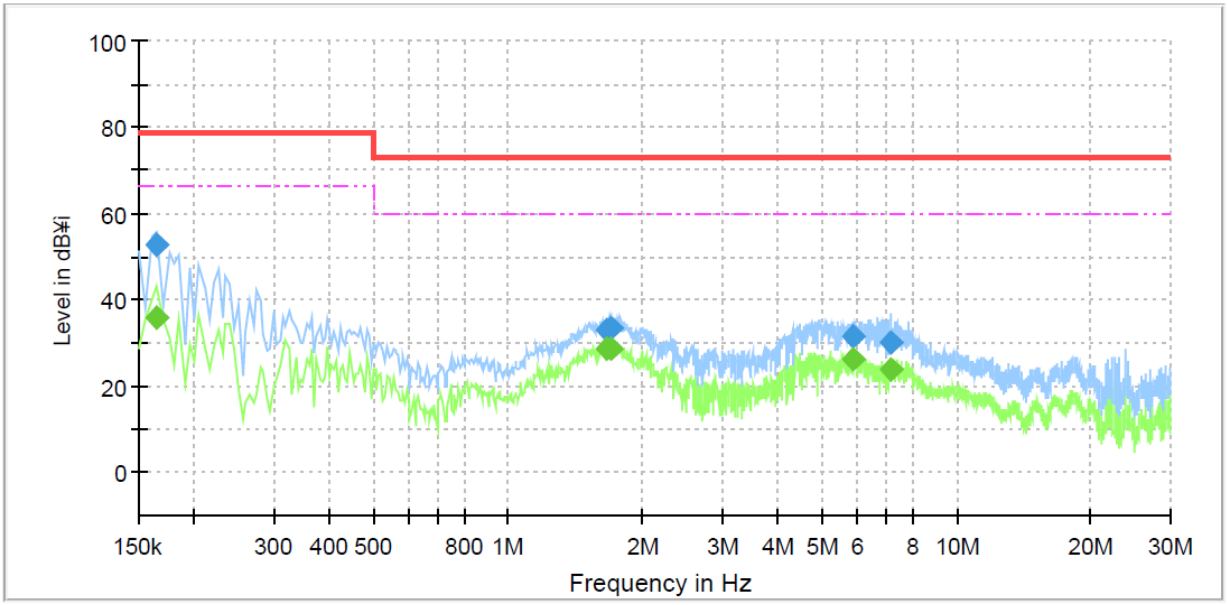
Frequency (MHz)	QuasiPeak (dB¥i V)	CAverage (dB¥i V)	Limit (dB¥i V)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.210000	---	40.40	66.00	25.60	1000.0	9.000	N	19.4
0.210000	43.36	---	79.00	35.64	1000.0	9.000	N	19.4
0.415000	---	40.95	66.00	25.05	1000.0	9.000	N	19.6
0.415000	41.10	---	79.00	37.90	1000.0	9.000	N	19.6
0.940000	---	26.66	60.00	33.34	1000.0	9.000	N	20.1
0.940000	26.69	---	73.00	46.31	1000.0	9.000	N	20.1
5.110000	---	26.37	60.00	33.63	1000.0	9.000	N	19.6
5.110000	30.09	---	73.00	42.91	1000.0	9.000	N	19.6
6.780000	---	36.36	60.00	23.64	1000.0	9.000	N	19.5
6.780000	38.84	---	73.00	34.16	1000.0	9.000	N	19.5
6.885000	---	35.20	60.00	24.80	1000.0	9.000	N	19.5
6.885000	38.81	---	73.00	34.19	1000.0	9.000	N	19.5

■ DC Mode

[HOT]

Common Information

Test Description:	Conducted Emission
Model No.:	TNO-4051T
Phase:	L1
Mode:	DC
Operator Name:	KES



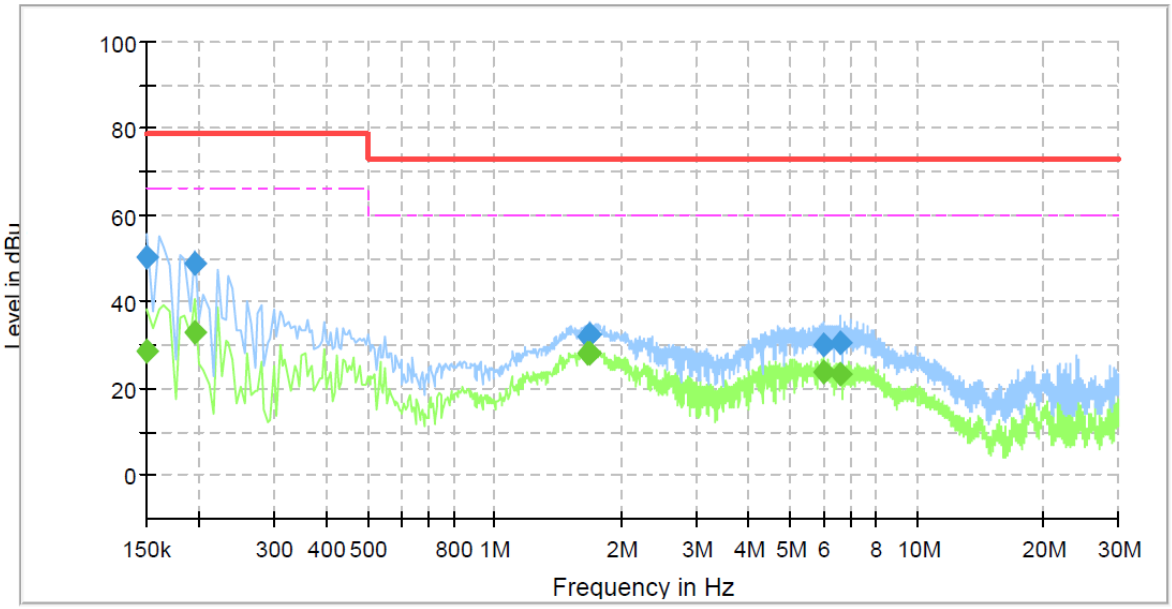
Final_Result

Frequency (MHz)	QuasiPeak (dB¥i V)	CAverage (dB¥i V)	Limit (dB¥i V)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.165000	---	35.96	66.00	30.04	1000.0	9.000	L1	19.4
0.165000	52.54	---	79.00	26.46	1000.0	9.000	L1	19.4
1.655000	---	28.55	60.00	31.45	1000.0	9.000	L1	20.3
1.655000	32.70	---	73.00	40.30	1000.0	9.000	L1	20.3
1.705000	---	28.83	60.00	31.17	1000.0	9.000	L1	20.3
1.705000	33.25	---	73.00	39.75	1000.0	9.000	L1	20.3
5.910000	---	26.11	60.00	33.89	1000.0	9.000	L1	19.5
5.910000	31.61	---	73.00	41.39	1000.0	9.000	L1	19.5
7.120000	---	23.84	60.00	36.16	1000.0	9.000	L1	19.5
7.120000	29.97	---	73.00	43.03	1000.0	9.000	L1	19.5

[NEUTRAL]

Common Information

Test Description:	Conducted Emission
Model No.:	TNO-4051T
Phase:	N
Mode:	DC
Operator Name:	KES



Final_Result

Frequency (MHz)	QuasiPeak (dB¥i V)	CAverage (dB¥i V)	Limit (dB¥i V)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.150000	---	28.70	66.00	37.30	1000.0	9.000	N	19.4
0.150000	50.11	---	79.00	28.89	1000.0	9.000	N	19.4
0.195000	---	32.94	66.00	33.06	1000.0	9.000	N	19.4
0.195000	48.93	---	79.00	30.07	1000.0	9.000	N	19.4
1.655000	---	28.01	60.00	31.99	1000.0	9.000	N	20.3
1.655000	32.15	---	73.00	40.85	1000.0	9.000	N	20.3
1.685000	---	28.26	60.00	31.74	1000.0	9.000	N	20.3
1.685000	32.64	---	73.00	40.36	1000.0	9.000	N	20.3
6.045000	---	23.92	60.00	36.08	1000.0	9.000	N	19.5
6.045000	30.17	---	73.00	42.83	1000.0	9.000	N	19.5
6.565000	---	23.16	60.00	36.84	1000.0	9.000	N	19.5
6.565000	30.31	---	73.00	42.69	1000.0	9.000	N	19.5

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

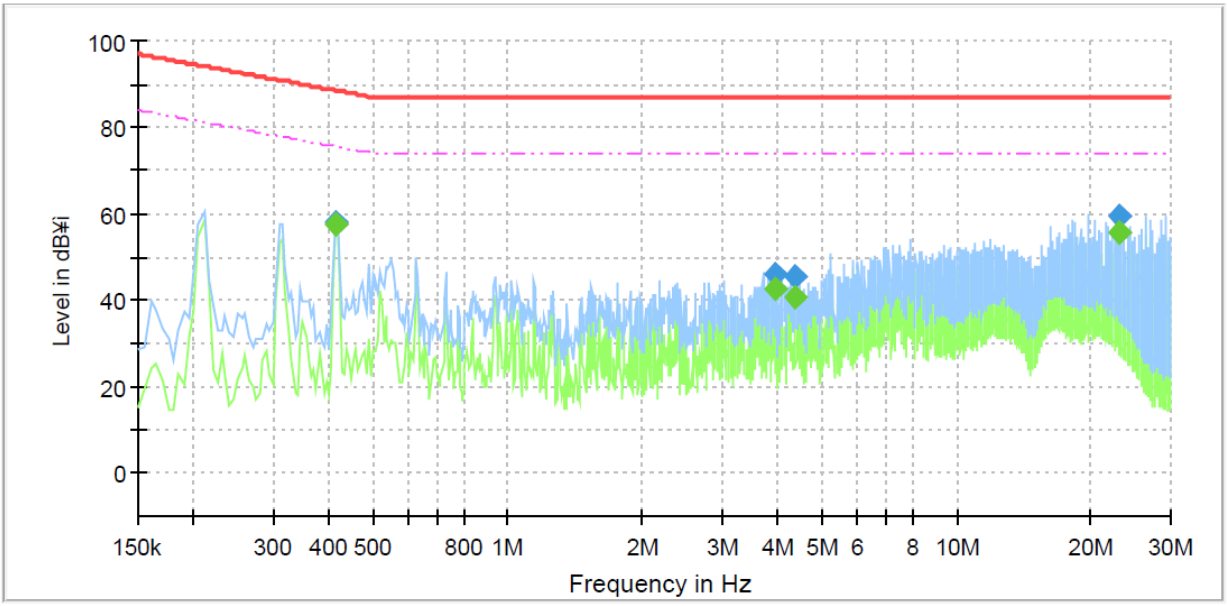
Conducted Emissions at Telecommunication Ports

■ AC Mode

[100 Mbps]

Common Information

Test Description:	Telecommunication Emission
Model No.:	TNO-4051T
Mode :	AC
Speed :	100
Operator Name:	KES



Final_Result

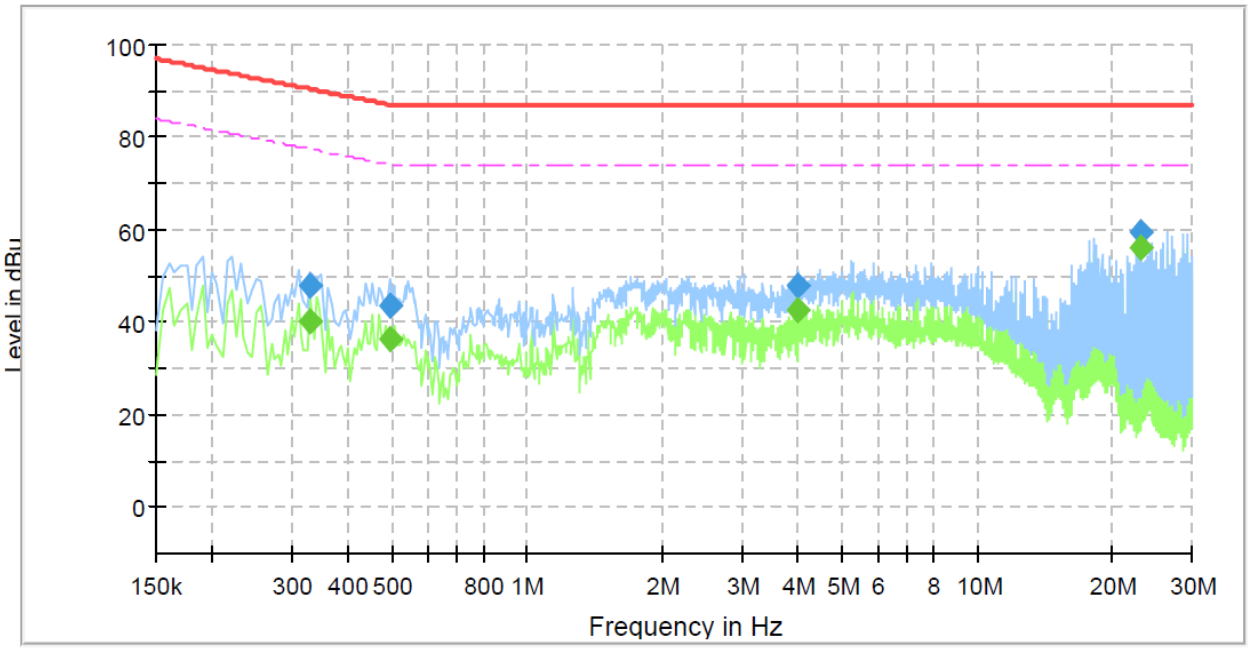
Frequency (MHz)	QuasiPeak (dB¥i V)	CAverage (dB¥i V)	Limit (dB¥i V)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.415000	---	57.58	75.55	17.97	1000.0	9.000	Single Line	19.7
0.415000	57.85	---	88.55	30.70	1000.0	9.000	Single Line	19.7
3.955000	---	42.37	74.00	31.63	1000.0	9.000	Single Line	19.7
3.955000	45.74	---	87.00	41.26	1000.0	9.000	Single Line	19.7
4.380000	---	40.76	74.00	33.24	1000.0	9.000	Single Line	19.6
4.380000	45.37	---	87.00	41.63	1000.0	9.000	Single Line	19.6
23.130000	---	55.56	74.00	18.44	1000.0	9.000	Single Line	20.1
23.130000	59.25	---	87.00	27.75	1000.0	9.000	Single Line	20.1

■ DC Mode

[100 Mbps]

Common Information

Test Description:	Telecommunication Emission
Model No.:	TNO-4051T
Mode :	DC
Speed :	100
Operator Name:	KES



Final_Result

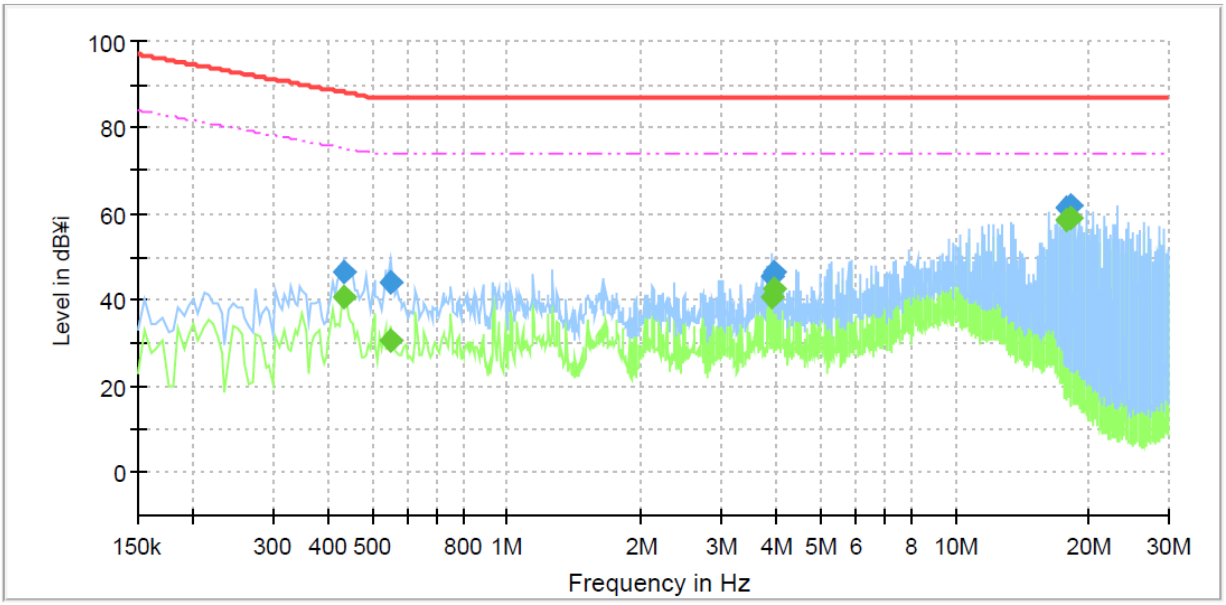
Frequency (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.330000	---	40.24	77.45	37.21	1000.0	9.000	Single Line	19.7
0.330000	48.10	---	90.45	42.35	1000.0	9.000	Single Line	19.7
0.495000	---	36.25	74.08	37.83	1000.0	9.000	Single Line	19.7
0.495000	43.62	---	87.08	43.46	1000.0	9.000	Single Line	19.7
4.015000	---	42.41	74.00	31.59	1000.0	9.000	Single Line	19.7
4.015000	47.76	---	87.00	39.24	1000.0	9.000	Single Line	19.7
23.130000	---	56.15	74.00	17.85	1000.0	9.000	Single Line	20.1
23.130000	59.66	---	87.00	27.34	1000.0	9.000	Single Line	20.1

■ PoE Mode

[100 Mbps]

Common Information

Test Description:	Telecommunication Emission
Model No.:	TNO-4051T
Mode :	PoE
Speed :	100
Operator Name:	KES



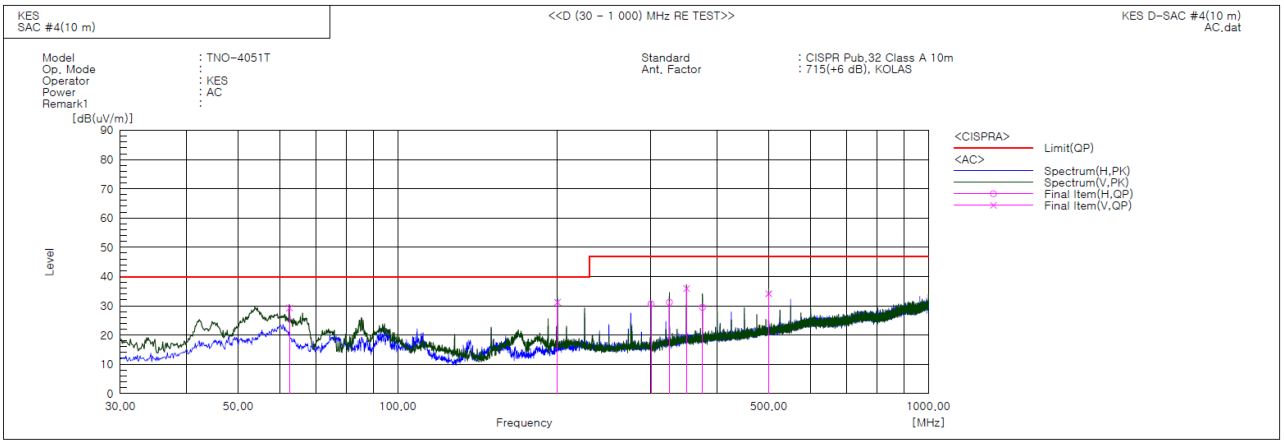
Final_Result

Frequency (MHz)	QuasiPeak (dB¥i V)	CAverage (dB¥i V)	Limit (dB¥i V)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.435000	---	40.75	75.16	34.41	1000.0	9.000	Single Line	19.7
0.435000	46.49	---	88.16	41.67	1000.0	9.000	Single Line	19.7
0.550000	---	30.66	74.00	43.34	1000.0	9.000	Single Line	19.8
0.550000	44.15	---	87.00	42.85	1000.0	9.000	Single Line	19.8
3.895000	---	40.66	74.00	33.34	1000.0	9.000	Single Line	19.7
3.895000	45.29	---	87.00	41.71	1000.0	9.000	Single Line	19.7
3.955000	---	42.73	74.00	31.27	1000.0	9.000	Single Line	19.7
3.955000	46.57	---	87.00	40.43	1000.0	9.000	Single Line	19.7
17.695000	---	58.69	74.00	15.31	1000.0	9.000	Single Line	19.8
17.695000	61.52	---	87.00	25.48	1000.0	9.000	Single Line	19.8
18.245000	---	58.98	74.00	15.02	1000.0	9.000	Single Line	19.8
18.245000	61.81	---	87.00	25.19	1000.0	9.000	Single Line	19.8

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

Radiated Electric Field Emissions(Below 1 ㎓)

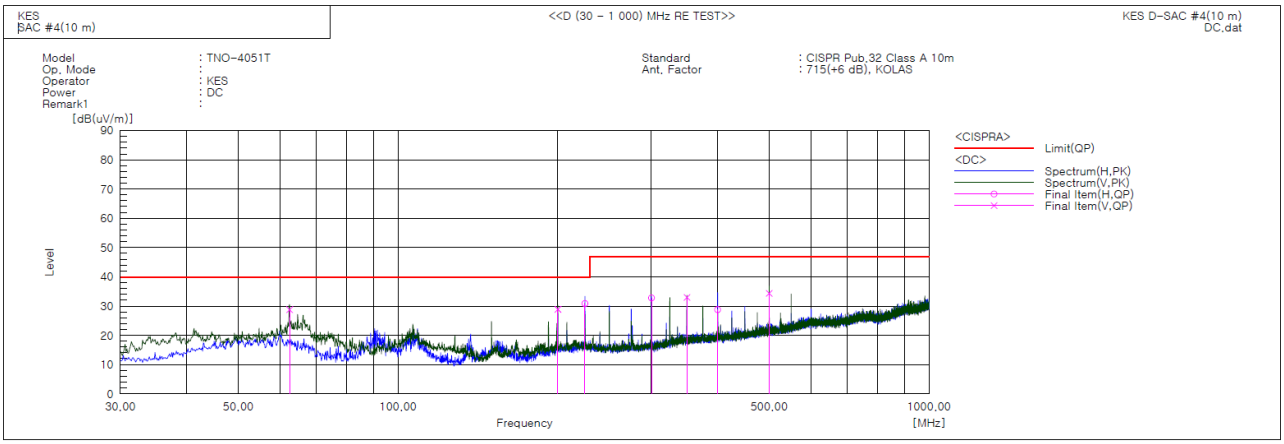
■ AC Mode



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	62.495	V	51.7	-22.5	29.2	40.0	10.8	111.0	265.2	
2	199.993	V	52.2	-21.0	31.2	40.0	8.8	101.0	216.6	
3	300.024	H	48.6	-18.0	30.6	47.0	16.4	396.0	327.7	
4	325.001	H	47.7	-16.5	31.2	47.0	15.8	366.0	271.3	
5	349.979	V	51.2	-15.3	35.9	47.0	11.1	108.0	309.8	
6	374.956	H	44.3	-14.8	29.5	47.0	17.5	327.0	181.0	
7	499.965	V	45.6	-11.5	34.1	47.0	12.9	100.0	90.6	

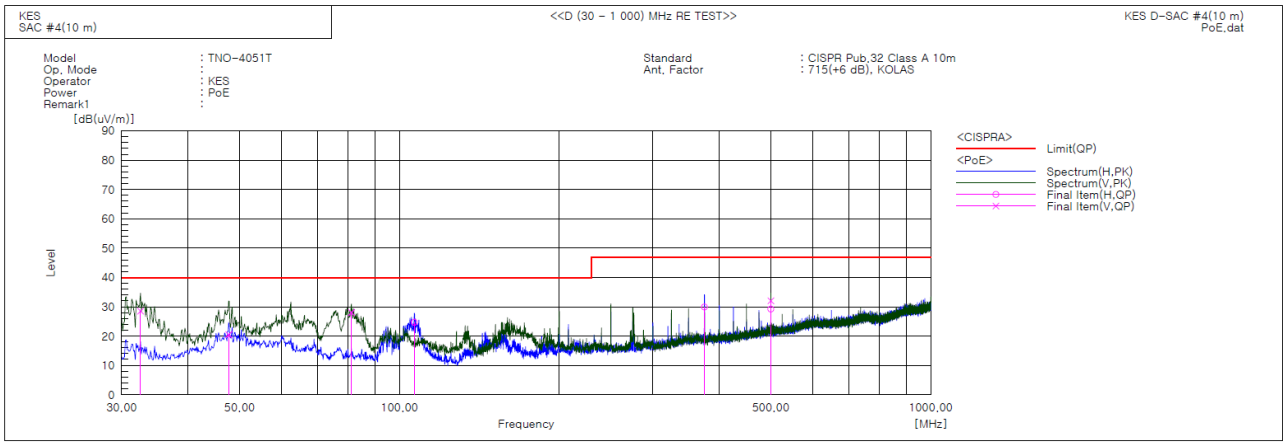
■ DC Mode



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	62.495	V	51.3	-22.5	28.8	40.0	11.2	114.0	101.1	
2	199.993	V	49.9	-21.0	28.9	40.0	11.1	102.0	347.0	
3	224.970	H	51.1	-20.2	30.9	40.0	9.1	374.0	217.2	
4	300.024	H	50.8	-18.0	32.8	47.0	14.2	322.0	236.4	
5	349.979	V	48.3	-15.3	33.0	47.0	14.0	100.0	219.6	
6	400.055	H	43.0	-14.2	28.8	47.0	18.2	382.0	35.4	
7	499.965	V	45.9	-11.5	34.4	47.0	12.6	109.0	329.2	

■ PoE Mode



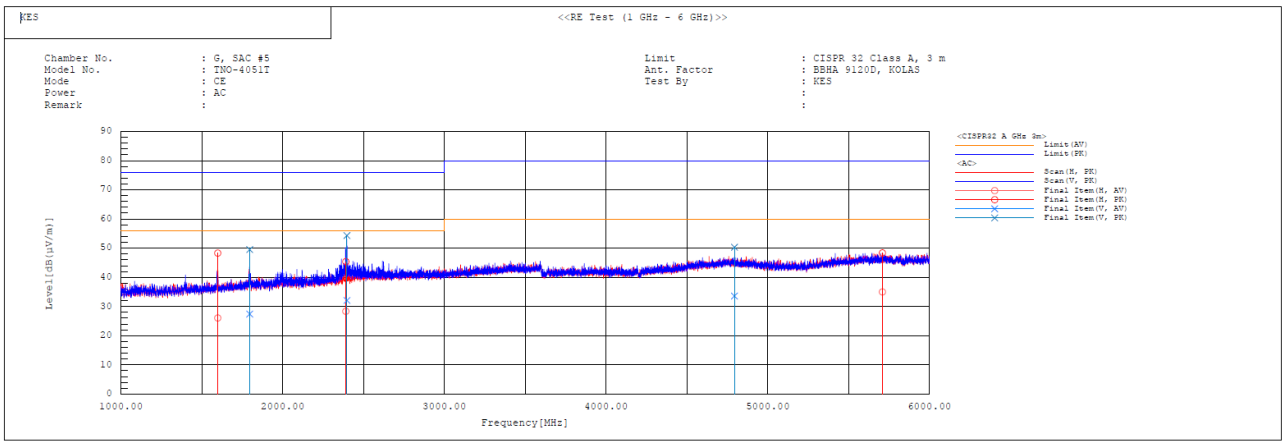
Final Result

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	32.546	V	53.5	-25.0	28.5	40.0	11.5	111.0	343.2	
2	47.703	V	41.7	-21.2	20.5	40.0	19.5	169.0	34.6	
3	81.168	V	55.6	-27.6	28.0	40.0	12.0	137.0	34.6	
4	106.630	H	47.1	-22.4	24.7	40.0	15.3	400.0	35.4	
5	374.956	H	44.7	-14.8	29.9	47.0	17.1	398.0	35.4	
6	499.965	V	43.5	-11.5	32.0	47.0	15.0	100.0	106.8	
7	499.989	H	40.7	-11.5	29.2	47.0	17.8	400.0	250.7	

♦ Calculation – SEMI ANECHOIC CHAMBER #4(10 m)
Result(QP) [dB(㎶/m)] = (Reading(QP)[dB(㎶)] + c.f[dB(1/m)]
Margin(QP)[dB] = Limit[dB(㎶/m)] - Result(QP) [dB(㎶/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)

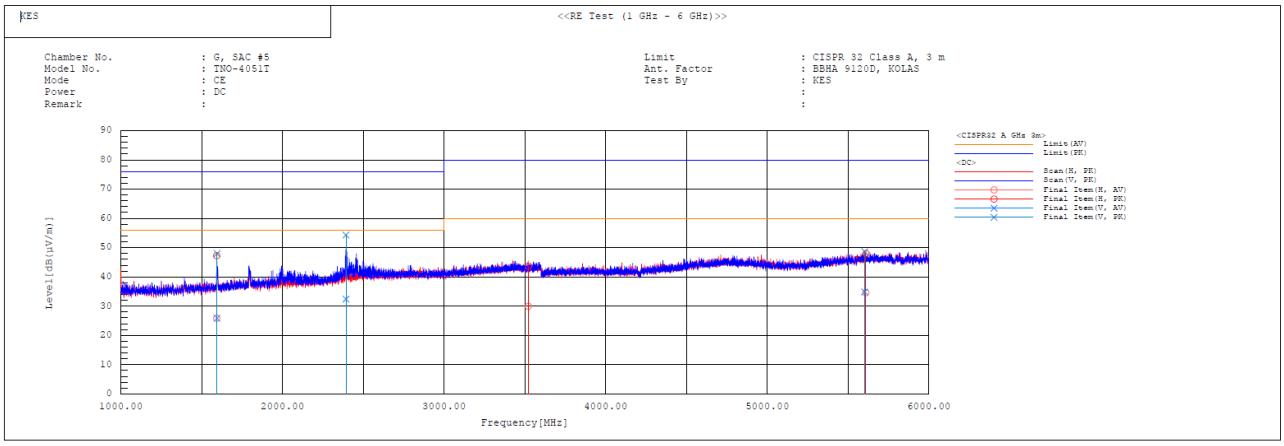
■ AC Mode



Final Result

No.	Frequency [MHz]	Pol	Reading AV [dB(μV)]	Reading PK [dB(μV)]	c.f [dB(1/m)]	Result AV [dB(μV/m)]	Result PK [dB(μV/m)]	Limit AV [dB(μV/m)]	Limit PK [dB(μV/m)]	Margin AV [dB]	Margin PK [dB]	Height [cm]	Angle [deg]
1	1598.250	H	30.8	53.0	-4.7	26.1	48.3	56.0	76.0	29.9	27.7	100.0	6.4
2	1795.564	V	31.1	53.2	-3.7	27.4	49.5	56.0	76.0	28.6	26.5	100.0	178.2
3	2390.645	H	29.9	46.9	-1.5	28.4	45.4	56.0	76.0	27.6	30.6	100.0	43.3
4	2396.619	V	33.6	55.8	-1.5	32.1	54.3	56.0	76.0	23.9	21.7	100.0	195.8
5	4793.864	V	27.2	43.9	6.4	33.6	50.3	60.0	80.0	26.4	29.7	100.0	23.3
6	5708.918	H	26.8	40.2	8.2	35.0	48.4	60.0	80.0	25.0	31.6	100.0	350.1

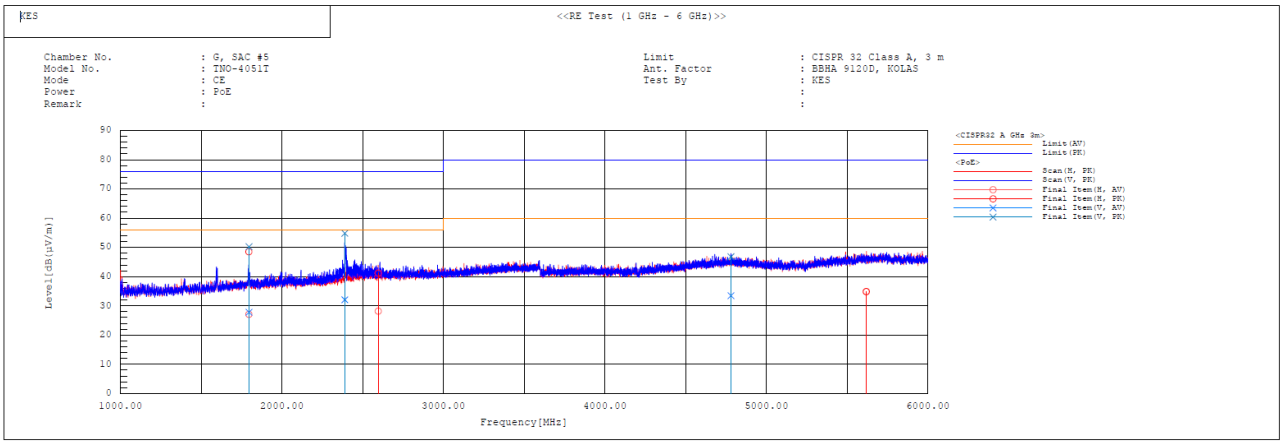
■ DC Mode



Final Result

No.	Frequency [MHz]	Pol	Reading AV [dB(μV)]	Reading PK [dB(μV)]	c.f [dB(1/m)]	Result AV [dB(μV/m)]	Result PK [dB(μV/m)]	Limit AV [dB(μV/m)]	Limit PK [dB(μV/m)]	Margin AV [dB]	Margin PK [dB]	Height [cm]	Angle [deg]
1	1592.892	H	30.6	51.9	-4.7	25.9	47.2	56.0	76.0	30.1	28.8	100.0	305.6
2	1594.352	V	30.5	52.6	-4.7	25.8	47.9	56.0	76.0	30.2	28.1	100.0	34.6
3	2392.728	V	33.9	55.8	-1.5	32.4	54.3	56.0	76.0	23.6	21.7	100.0	179.1
4	3520.727	H	28.1	41.7	1.9	30.0	43.6	60.0	80.0	30.0	36.4	100.0	0.8
5	5602.382	V	26.8	40.5	8.1	34.9	48.6	60.0	80.0	25.1	31.4	100.0	356.9
6	5609.746	H	26.5	39.9	8.1	34.6	48.0	60.0	80.0	25.4	32.0	100.0	220.3

■ PoE Mode



Final Result

No.	Frequency [MHz]	Pol	Reading AV [dB(μV)]	Reading PK [dB(μV)]	c.f [dB(1/m)]	Result AV [dB(μV/m)]	Result PK [dB(μV/m)]	Limit AV [dB(μV/m)]	Limit PK [dB(μV/m)]	Margin AV [dB]	Margin PK [dB]	Height [cm]	Angle [deg]
1	1794.915	H	30.8	52.2	-3.7	27.1	48.5	56.0	76.0	28.9	27.5	100.0	14.0
2	1795.744	V	31.5	53.9	-3.7	27.8	50.2	56.0	76.0	28.2	25.8	100.0	180.8
3	2389.419	V	33.6	56.3	-1.5	32.1	54.8	56.0	76.0	23.9	21.2	100.0	193.7
4	2596.215	H	28.9	41.9	-0.7	28.2	41.2	56.0	76.0	27.8	34.8	100.0	142.6
5	4780.041	V	27.1	40.4	6.4	33.5	46.8	60.0	80.0	26.5	33.2	100.0	156.8
6	5618.313	H	26.8	26.8	8.1	34.9	34.9	60.0	80.0	25.1	45.1	100.0	42.1

♦ Calculation
Result(PK/CAV) [dB(㎶/m)] = (Reading(PK/CAV)[dB(㎶)] + c.f[dB(1/m)]
Margin(PK/CAV)[dB] = Limit[dB(㎶/m)] - Result(PK/CAV) [dB(㎶/m)]
Reading(PK/CAV) : Reading value, Result(PK/CAV) : Reading value + Factor value
Limit(QP) : Limit value, c.f : (ANT Factor + Cable Loss - Preamp Factor), Margin: Margin value

Harmonic Current Emissions and Voltage Fluctuations and Flicker

■ AC Mode

Average harmonic current results

Hn	Ieff [A]	% of Limit	Limit [A]	Result
1	0.022			
2	0.001	0.057	1.080	n/a
3	0.002	0.096	2.300	n/a
4	0.001	0.199	0.430	n/a
5	0.002	0.160	1.140	n/a
6	0.001	0.329	0.300	n/a
7	0.001	0.181	0.770	n/a
8	0.001	0.321	0.230	n/a
9	0.002	0.562	0.400	n/a
10	0.001	0.451	0.184	n/a
11	0.002	0.709	0.330	n/a
12	0.001	0.490	0.153	n/a
13	0.002	0.804	0.210	n/a
14	0.001	0.567	0.131	n/a
15	0.001	0.890	0.150	n/a
16	0.001	0.674	0.115	n/a
17	0.001	0.945	0.132	n/a
18	0.001	0.682	0.102	n/a
19	0.001	1.141	0.118	n/a
20	0.001	0.728	0.092	n/a
21	0.001	0.857	0.161	n/a
22	0.001	0.771	0.084	n/a
23	0.001	0.890	0.147	n/a
24	0.001	0.861	0.077	n/a
25	0.001	0.867	0.135	n/a
26	0.001	0.899	0.071	n/a
27	0.001	0.873	0.125	n/a
28	0.001	0.913	0.066	n/a
29	0.001	0.935	0.116	n/a
30	0.001	0.954	0.061	n/a
31	0.001	0.944	0.109	n/a
32	0.001	0.970	0.058	n/a
33	0.001	0.968	0.102	n/a
34	0.001	1.039	0.054	n/a
35	0.001	0.988	0.096	n/a
36	0.001	1.042	0.051	n/a
37	0.001	0.962	0.091	n/a
38	0.001	1.050	0.048	n/a
39	0.001	0.993	0.087	n/a
40	0.000	1.077	0.046	n/a

Note: 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.
* Application of limits for average is 100% except for odd harmonics from 21 to 39, where 150% applies.

Test Data - Harmonics (continued)

Maximum harmonic current results

Hn	Ieff [A]	% of Limit	Limit [A]	Result
1	0.023			
2	0.001	0.050	1.620	n/a
3	0.002	0.066	3.450	n/a
4	0.001	0.164	0.645	n/a
5	0.002	0.112	1.710	n/a
6	0.002	0.403	0.450	n/a
7	0.002	0.137	1.155	n/a
8	0.001	0.260	0.345	n/a
9	0.002	0.391	0.600	n/a
10	0.001	0.438	0.276	n/a
11	0.002	0.489	0.495	n/a
12	0.001	0.377	0.230	n/a
13	0.002	0.563	0.315	n/a
14	0.001	0.452	0.197	n/a
15	0.001	0.660	0.225	n/a
16	0.001	0.562	0.173	n/a
17	0.001	0.711	0.199	n/a
18	0.001	0.553	0.153	n/a
19	0.001	0.807	0.178	n/a
20	0.001	0.607	0.138	n/a
21	0.001	0.897	0.161	n/a
22	0.001	0.599	0.125	n/a
23	0.001	0.931	0.147	n/a
24	0.001	0.709	0.115	n/a
25	0.001	0.930	0.135	n/a
26	0.001	0.691	0.106	n/a
27	0.001	0.932	0.125	n/a
28	0.001	0.709	0.099	n/a
29	0.001	1.036	0.116	n/a
30	0.001	0.757	0.092	n/a
31	0.001	1.024	0.109	n/a
32	0.001	0.819	0.086	n/a
33	0.001	1.047	0.102	n/a
34	0.001	0.851	0.081	n/a
35	0.001	1.109	0.096	n/a
36	0.001	0.884	0.077	n/a
37	0.001	1.029	0.091	n/a
38	0.001	0.802	0.073	n/a
39	0.001	1.088	0.087	n/a
40	0.001	0.907	0.069	n/a

Note: 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.
* Application of limits for average is 100% except for odd harmonics from 21 to 39, where 150% applies.

■ DC Mode

Average harmonic current results

Hn	Ieff [A]	% of Limit	Limit [A]	Result
1	0.022			
2	0.001	0.054	1.080	n/a
3	0.002	0.096	2.300	n/a
4	0.001	0.207	0.430	n/a
5	0.002	0.159	1.140	n/a
6	0.001	0.361	0.300	n/a
7	0.001	0.183	0.770	n/a
8	0.001	0.314	0.230	n/a
9	0.002	0.563	0.400	n/a
10	0.001	0.428	0.184	n/a
11	0.002	0.701	0.330	n/a
12	0.001	0.464	0.153	n/a
13	0.002	0.806	0.210	n/a
14	0.001	0.579	0.131	n/a
15	0.001	0.896	0.150	n/a
16	0.001	0.708	0.115	n/a
17	0.001	0.953	0.132	n/a
18	0.001	0.697	0.102	n/a
19	0.001	1.147	0.118	n/a
20	0.001	0.710	0.092	n/a
21	0.001	0.842	0.161	n/a
22	0.001	0.752	0.084	n/a
23	0.001	0.886	0.147	n/a
24	0.001	0.881	0.077	n/a
25	0.001	0.873	0.135	n/a
26	0.001	0.927	0.071	n/a
27	0.001	0.877	0.125	n/a
28	0.001	0.928	0.066	n/a
29	0.001	0.936	0.116	n/a
30	0.001	0.963	0.061	n/a
31	0.001	0.937	0.109	n/a
32	0.001	0.965	0.058	n/a
33	0.001	0.965	0.102	n/a
34	0.001	1.045	0.054	n/a
35	0.001	0.998	0.096	n/a
36	0.001	1.084	0.051	n/a
37	0.001	0.972	0.091	n/a
38	0.001	1.055	0.048	n/a
39	0.001	0.998	0.087	n/a
40	0.001	1.106	0.046	n/a

Note: 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.
* Application of limits for average is 100% except for odd harmonics from 21 to 39, where 150% applies.

Test Data - Harmonics (continued)

Maximum harmonic current results

Hn	Ieff [A]	% of Limit	Limit [A]	Result
1	0.023			
2	0.001	0.043	1.620	n/a
3	0.002	0.066	3.450	n/a
4	0.001	0.174	0.645	n/a
5	0.002	0.111	1.710	n/a
6	0.002	0.382	0.450	n/a
7	0.002	0.139	1.155	n/a
8	0.001	0.248	0.345	n/a
9	0.002	0.388	0.600	n/a
10	0.001	0.426	0.276	n/a
11	0.002	0.491	0.495	n/a
12	0.001	0.403	0.230	n/a
13	0.002	0.563	0.315	n/a
14	0.001	0.460	0.197	n/a
15	0.002	0.675	0.225	n/a
16	0.001	0.565	0.173	n/a
17	0.001	0.720	0.199	n/a
18	0.001	0.564	0.153	n/a
19	0.001	0.811	0.178	n/a
20	0.001	0.572	0.138	n/a
21	0.001	0.880	0.161	n/a
22	0.001	0.605	0.125	n/a
23	0.001	0.926	0.147	n/a
24	0.001	0.731	0.115	n/a
25	0.001	0.963	0.135	n/a
26	0.001	0.694	0.106	n/a
27	0.001	0.937	0.125	n/a
28	0.001	0.719	0.099	n/a
29	0.001	1.035	0.116	n/a
30	0.001	0.796	0.092	n/a
31	0.001	0.990	0.109	n/a
32	0.001	0.738	0.086	n/a
33	0.001	1.035	0.102	n/a
34	0.001	0.814	0.081	n/a
35	0.001	1.084	0.096	n/a
36	0.001	0.839	0.077	n/a
37	0.001	1.084	0.091	n/a
38	0.001	0.843	0.073	n/a
39	0.001	1.082	0.087	n/a
40	0.001	0.885	0.069	n/a

Note: 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.
* Application of limits for average is 100% except for odd harmonics from 21 to 39, where 150% applies.

Test Data - Voltage Fluctuations

Maximum Flicker results

■ AC Mode

Flicker Measurements					
	Plt	**Max Pst**	**Max Dc**	**Max Dmax**	**Max Tmax**
Line 1:	0.028	0.028	0	< 0.2	0
Limits:	0.65	1	3.3	4	0.5
Results:	PASS	PASS	PASS	PASS	PASS

■ DC Mode

Flicker Measurements					
	Plt	**Max Pst**	**Max Dc**	**Max Dmax**	**Max Tmax**
Line 1:	0.028	0.028	0	< 0.2	0
Limits:	0.65	1	3.3	4	0.5
Results:	PASS	PASS	PASS	PASS	PASS

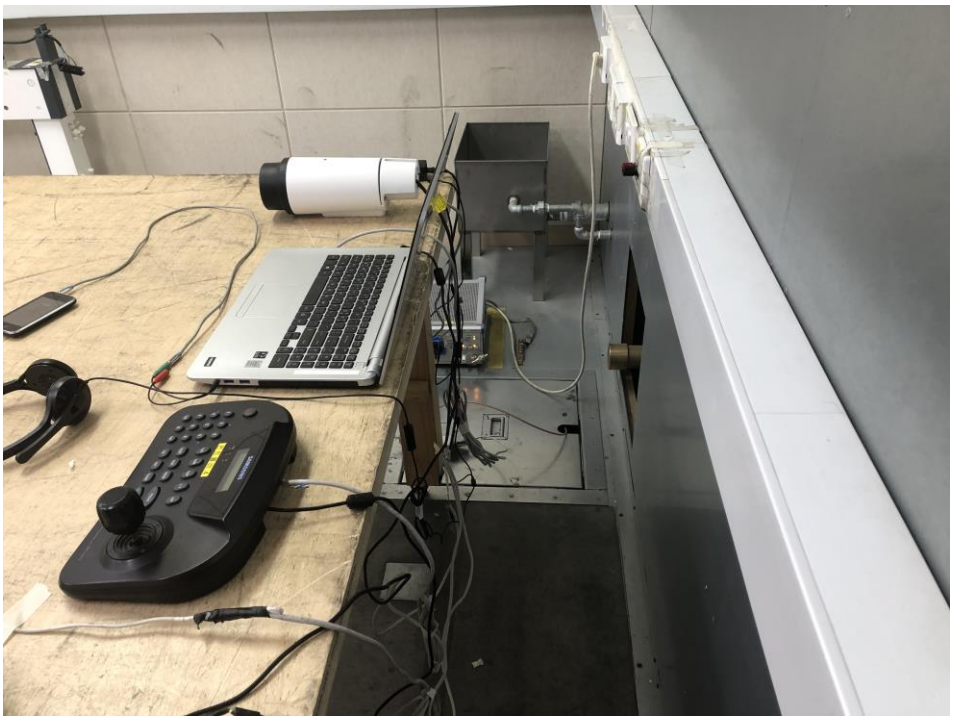
Test Setup Photos and Configuration

Conducted Emissions at Mains Power Ports

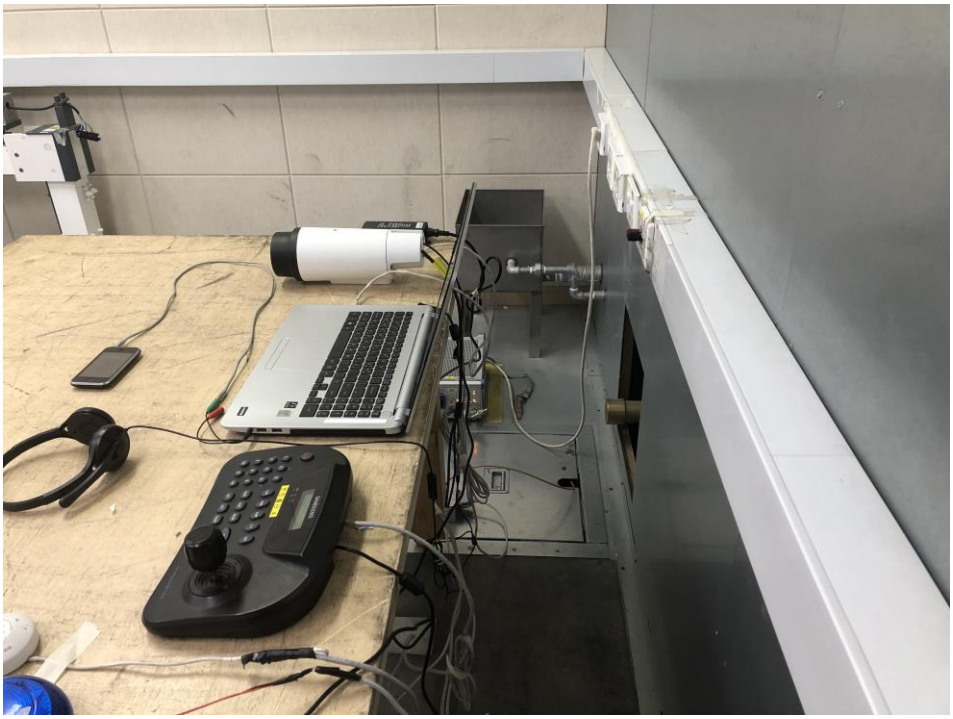
■ DC Mode

Conducted Emissions at Telecommunication Ports

■ DC Mode

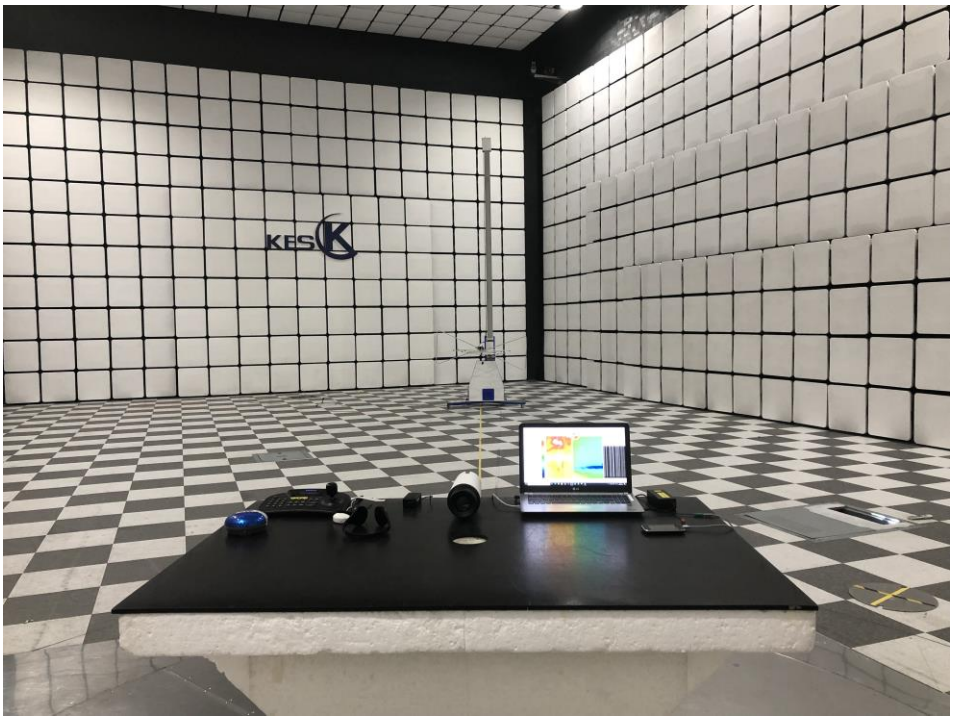


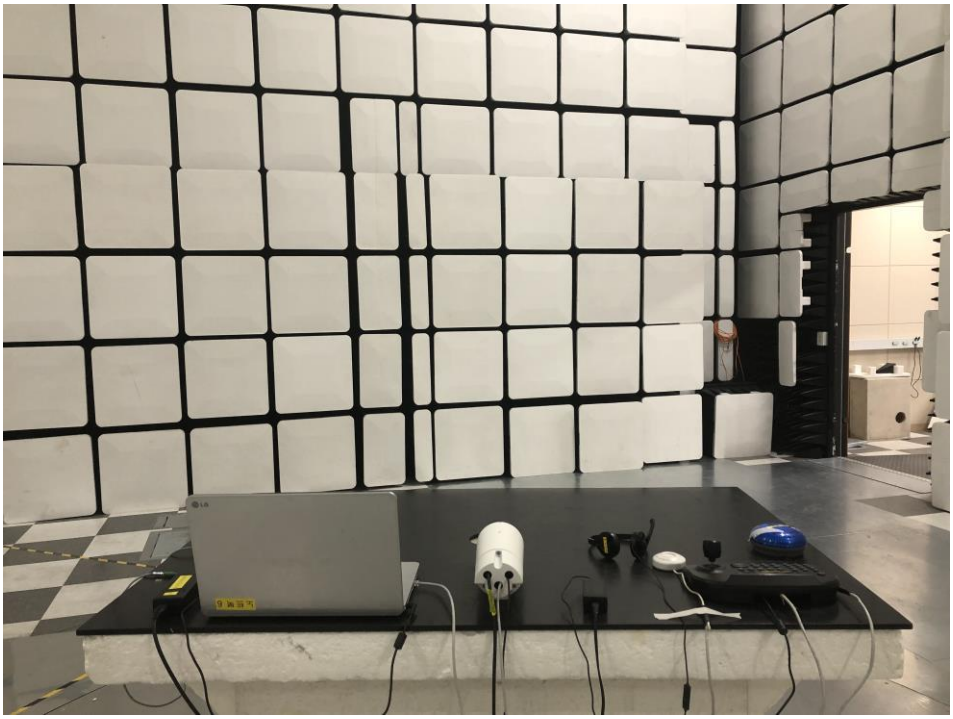
■ PoE Mode



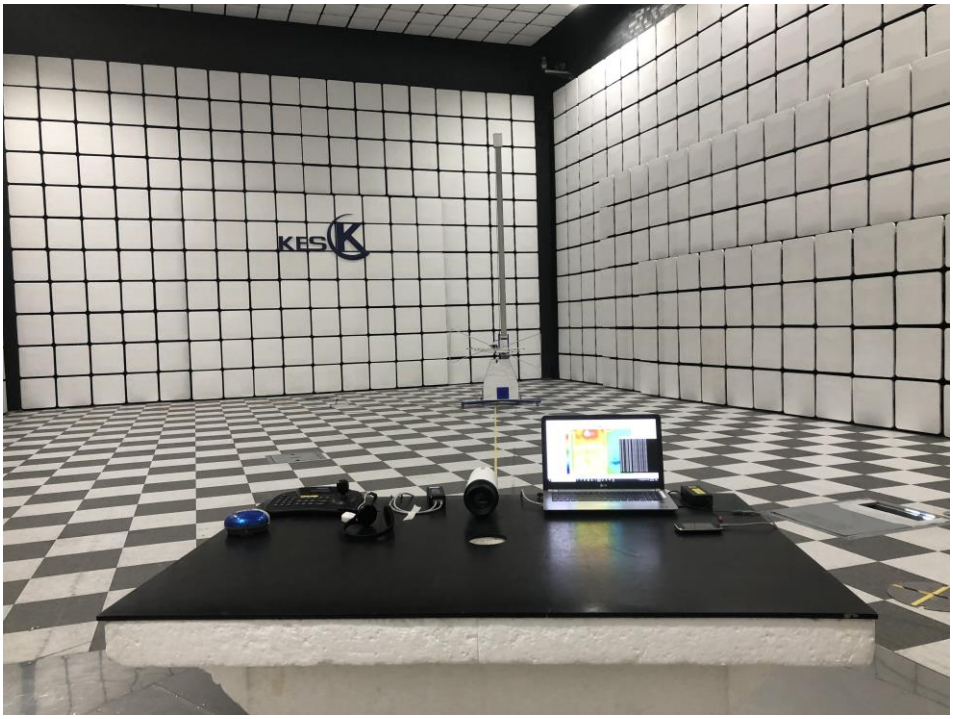
Radiated Electric Field Emissions(Below 1 ㎓)

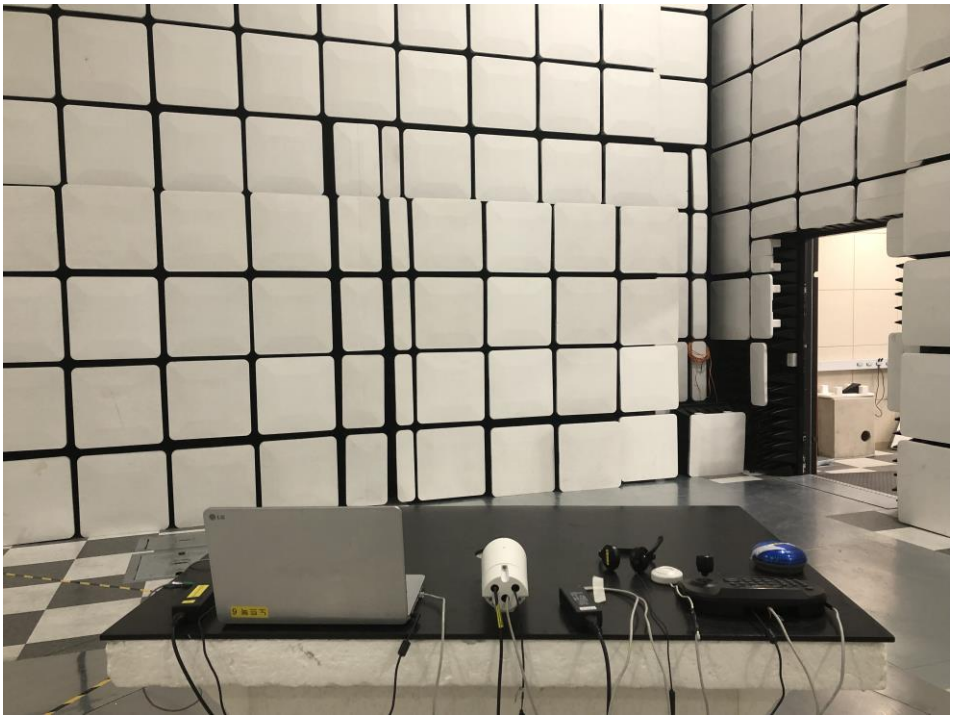
■ DC Mode





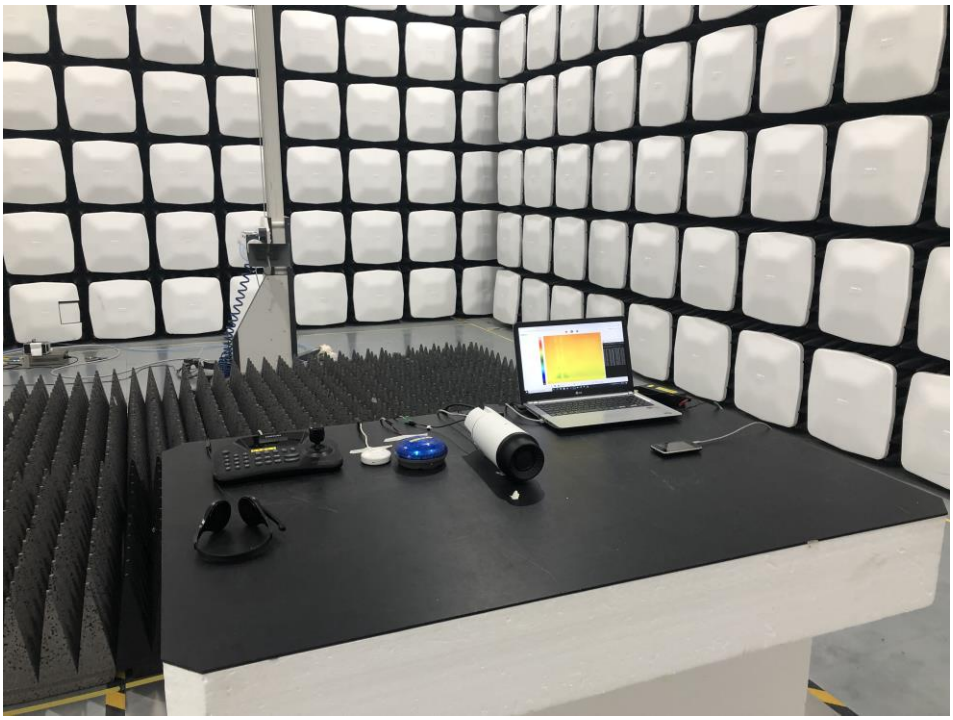
■ PoE Mode

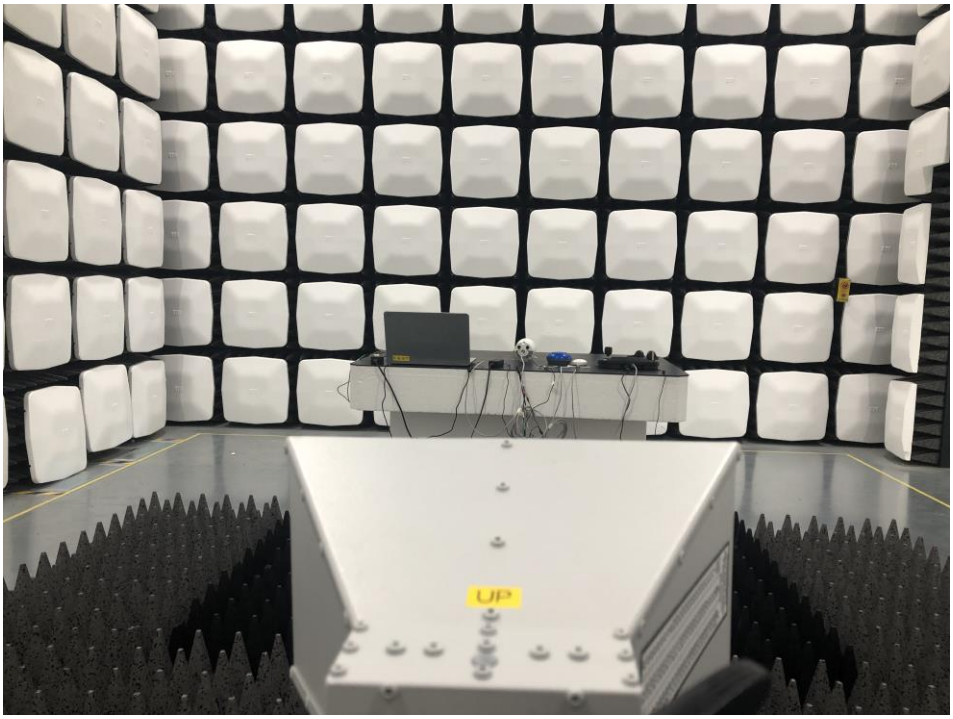




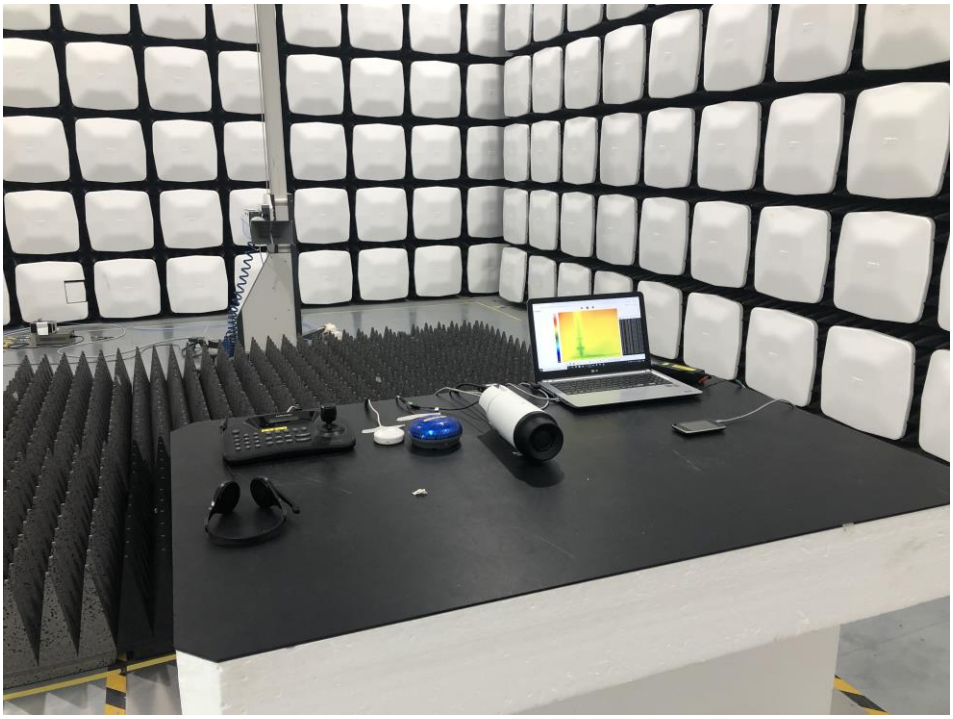
Radiated Electric Field Emissions(Above 1 ㎓)

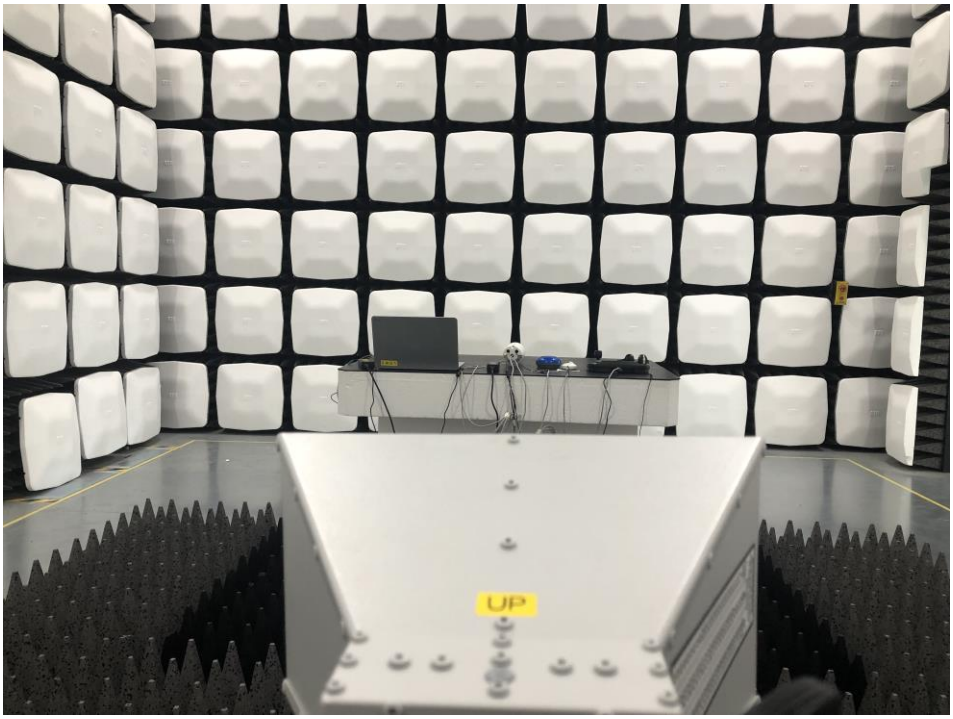
■ DC Mode





■ PoE Mode



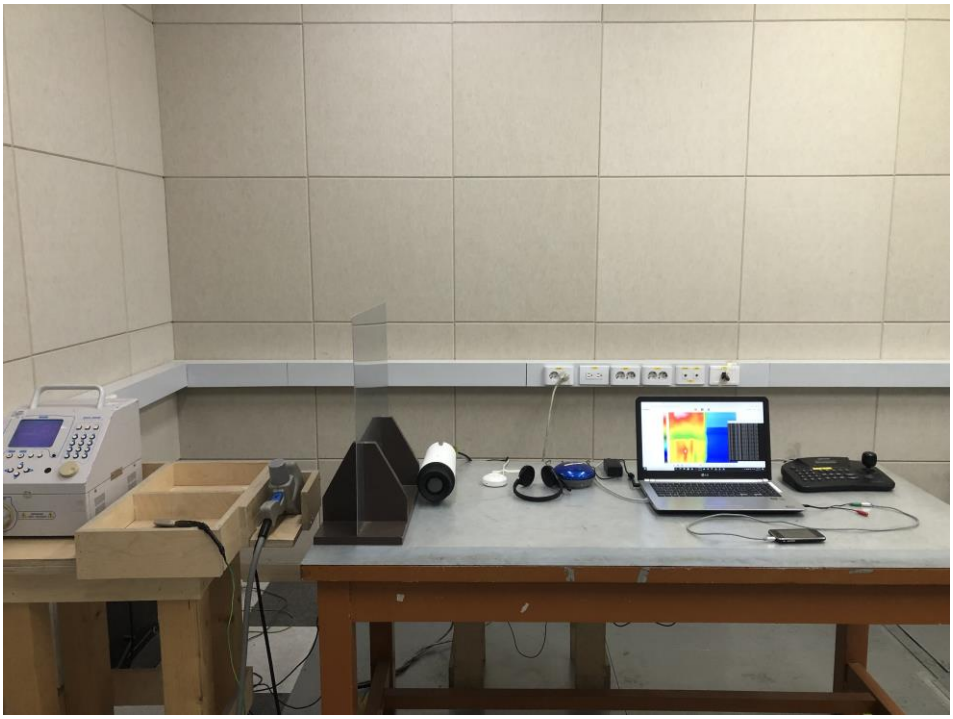


Harmonic Current Emissions and Voltage Fluctuations and Flicker

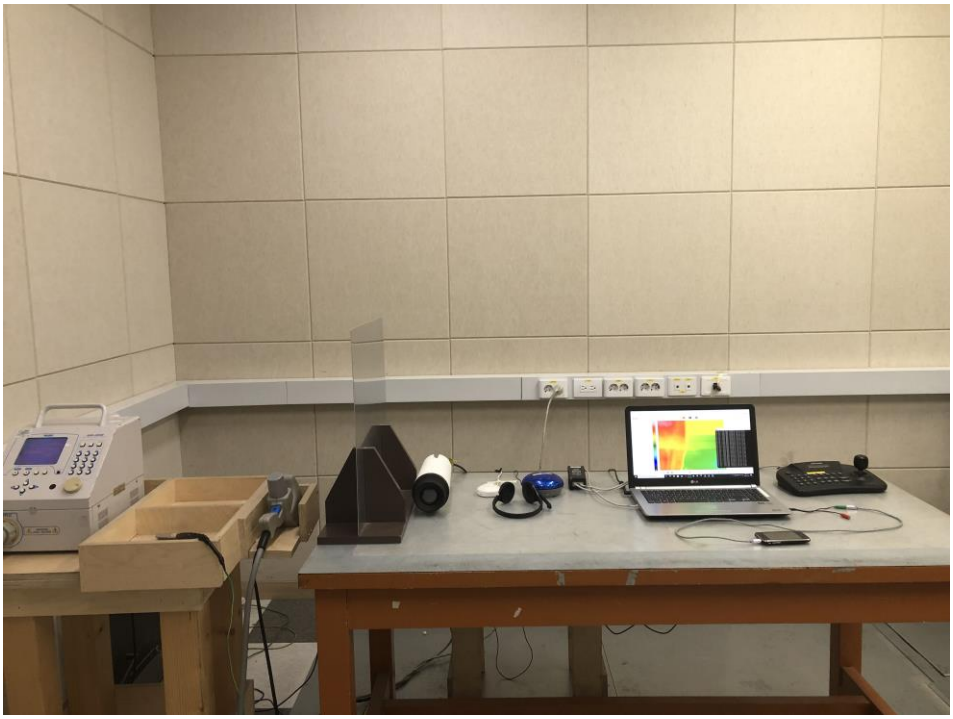
■ DC Mode

Electrostatic Discharge

■ DC Mode

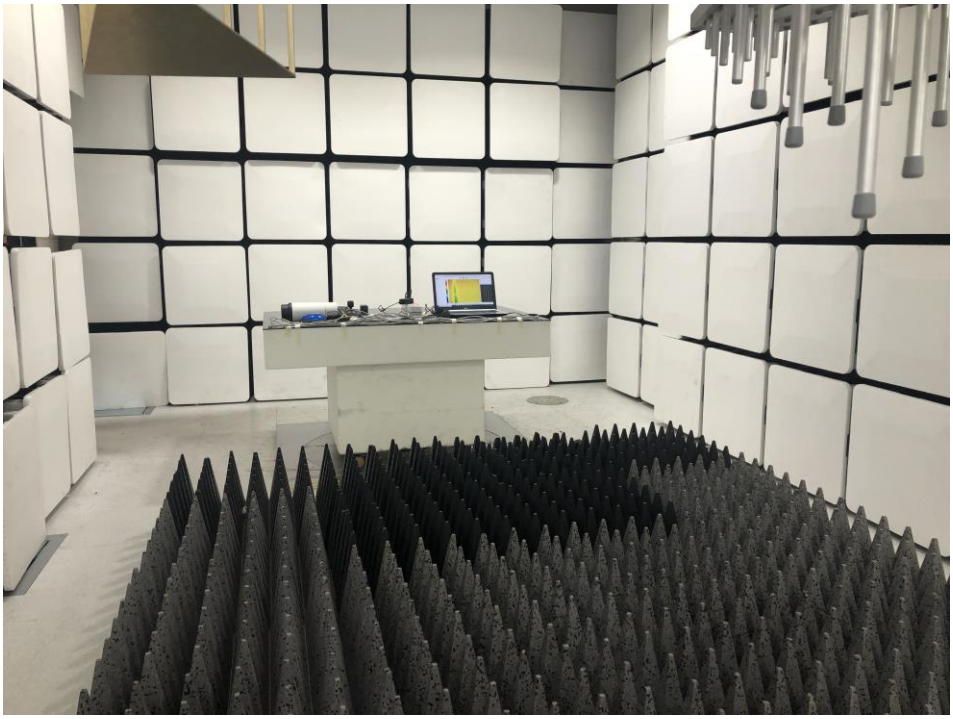


■ PoE Mode

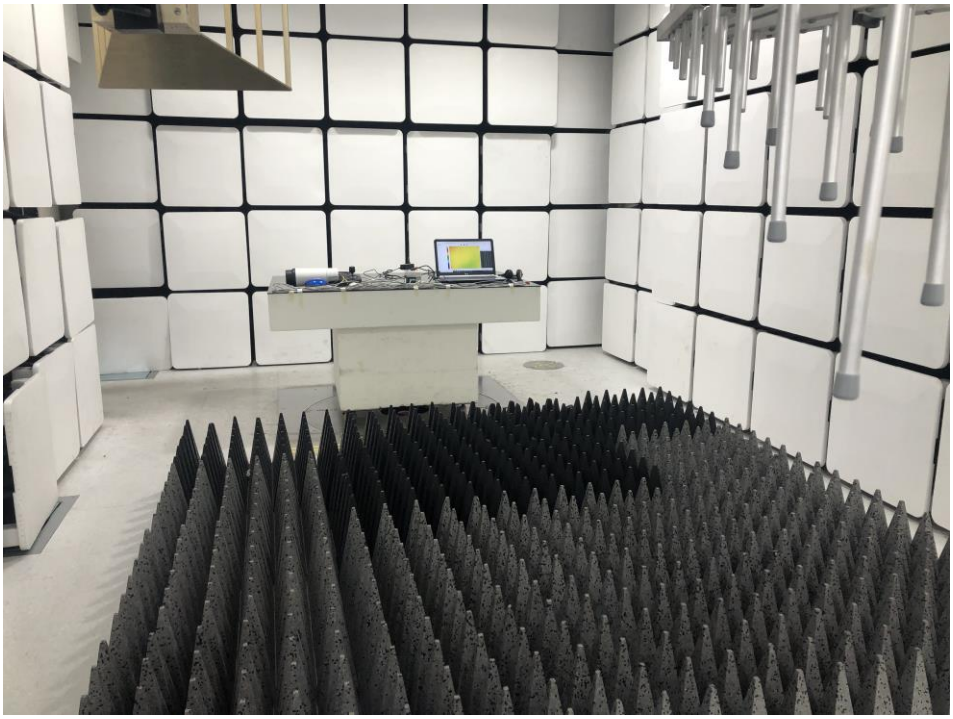


Radiated Electric Field Immunity

■ DC Mode



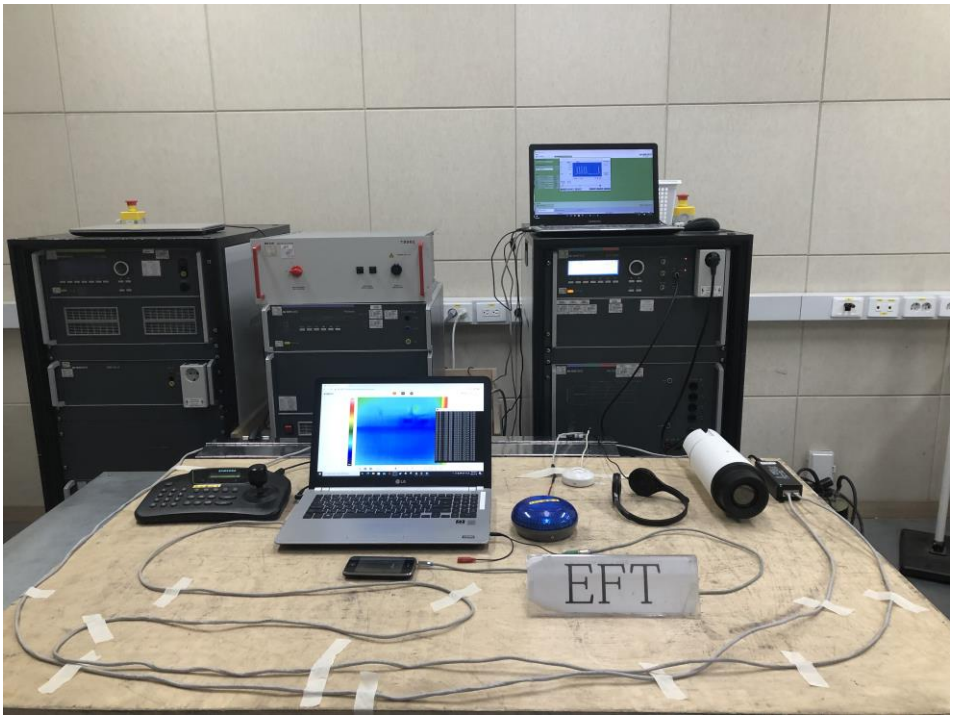
■ PoE Mode



Electrical Fast Transients/Bursts

■ DC Mode

■ PoE Mode



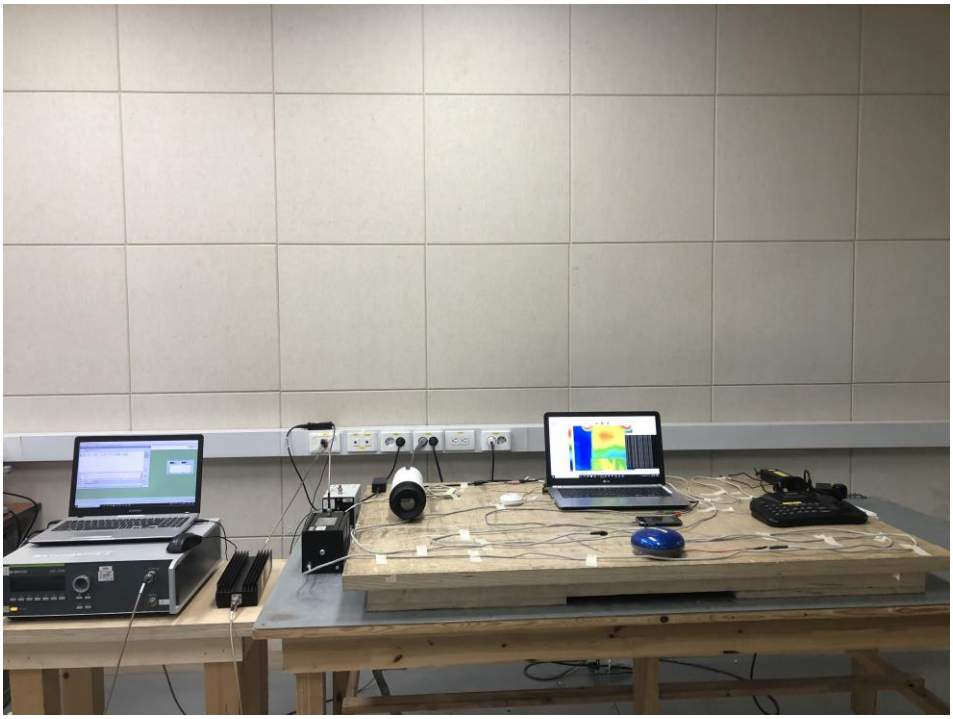
Surge Transients

■ DC Mode

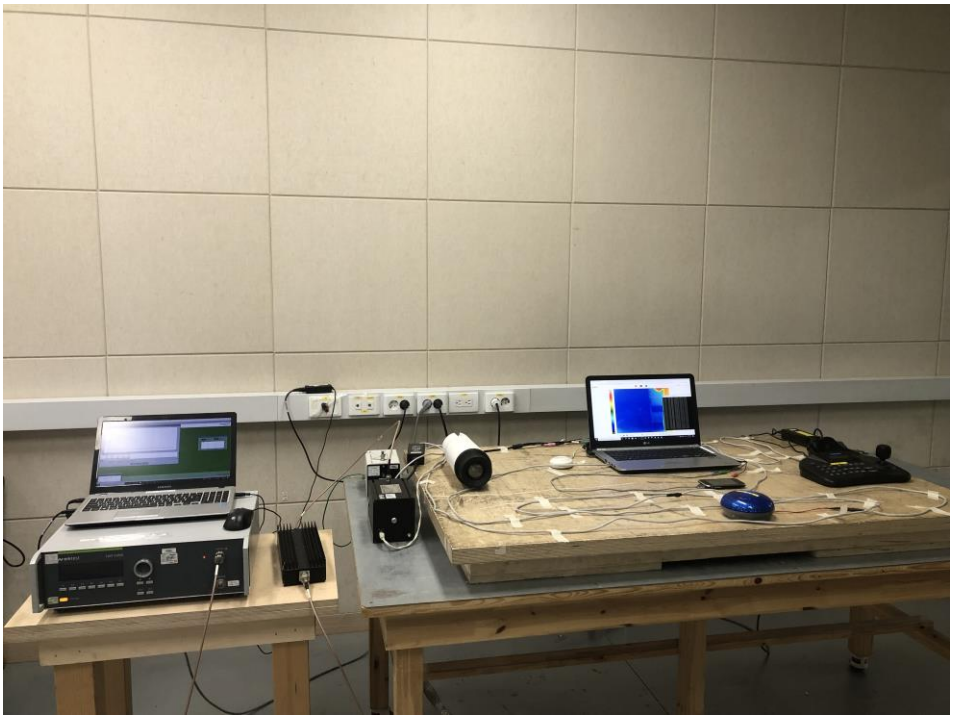
■ PoE Mode

Conducted Disturbance

■ DC Mode



■ PoE Mode



Voltage Dips and Short Interruptions

■ DC Mode

EUT External Photographs

(Top)

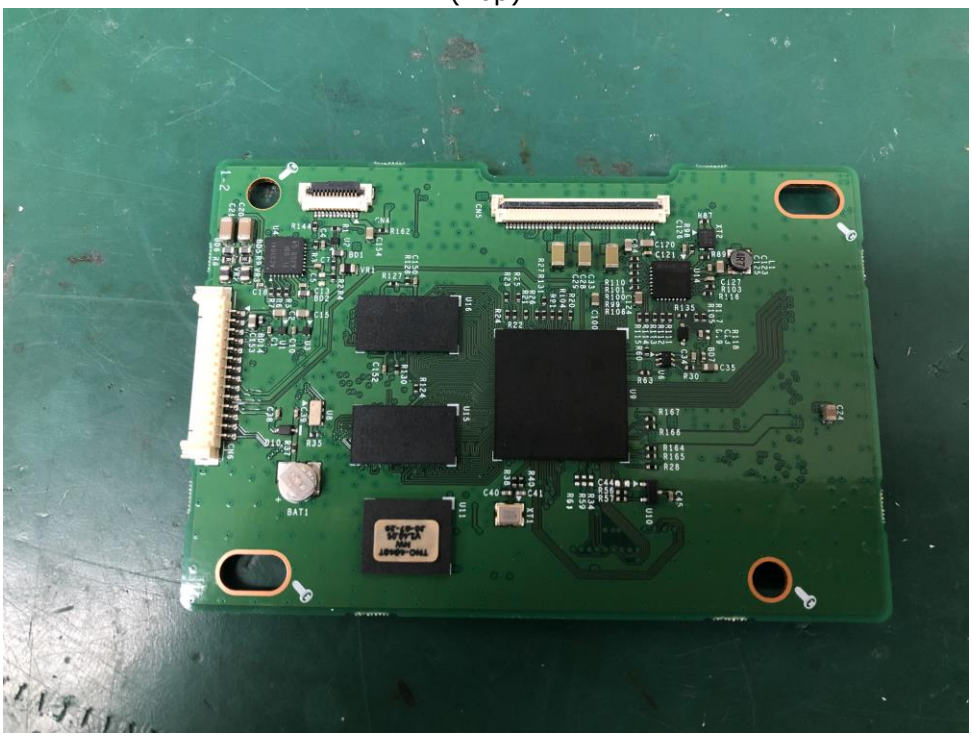
(Bottom)

EUT Internal Photographs

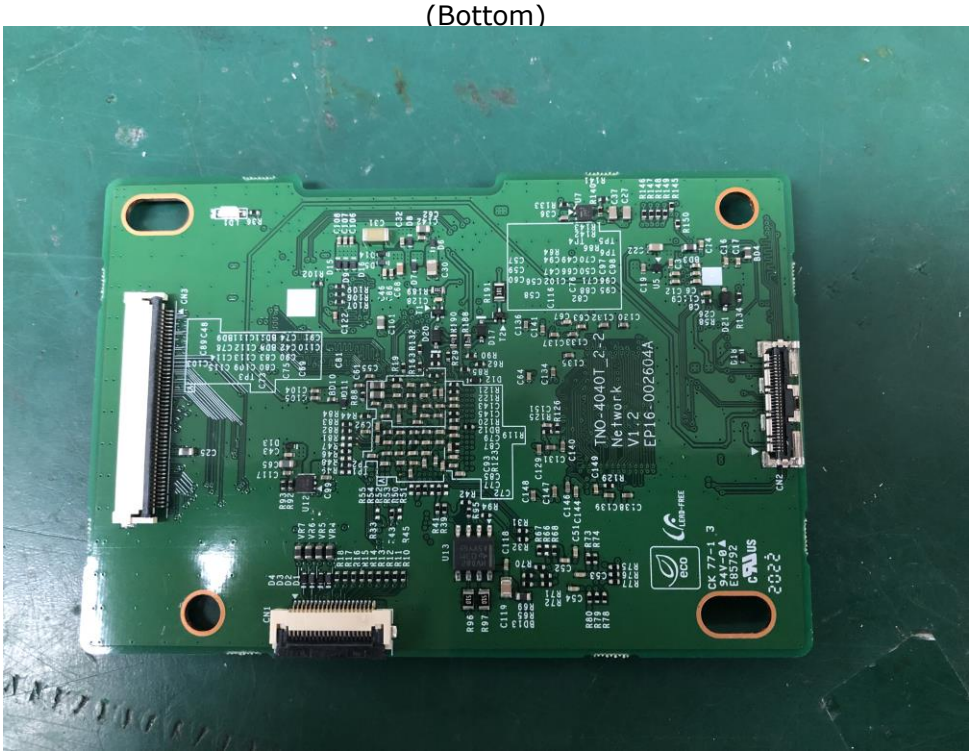
(Internal View)

EUT Internal View – Board 1

(Top)



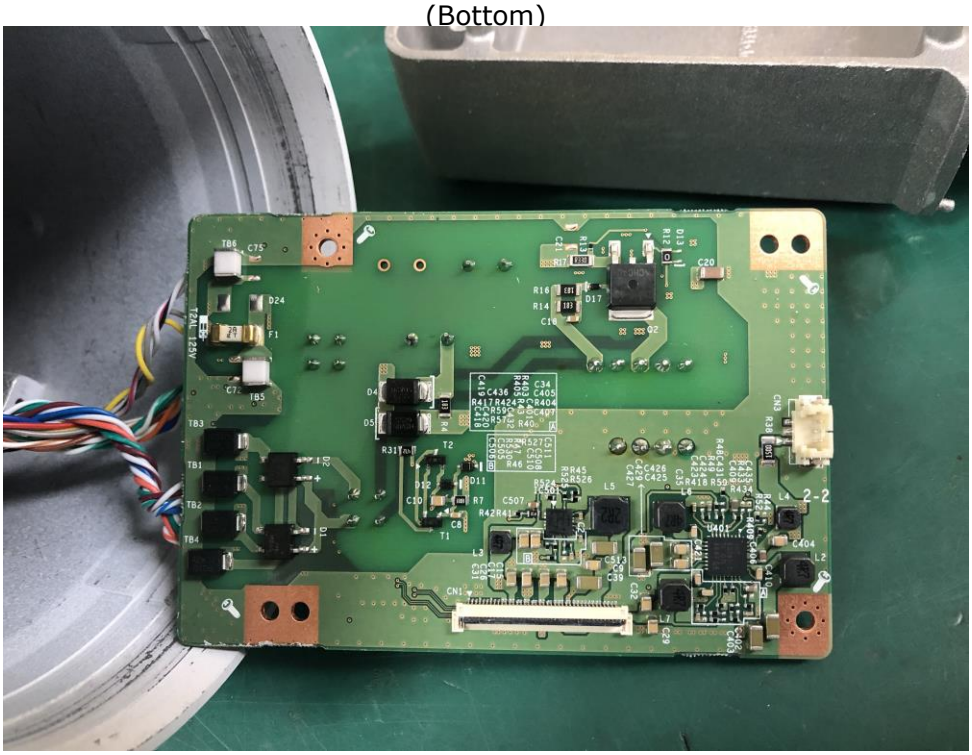
(Bottom)



EUT Internal View – Board 2

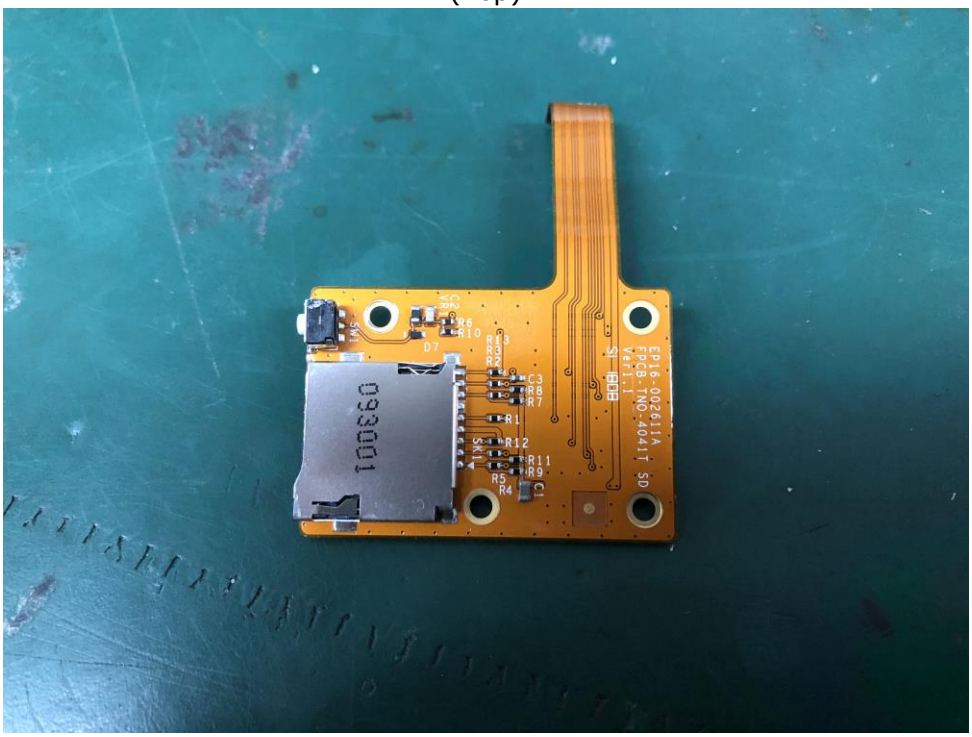
(Top)

(Bottom)

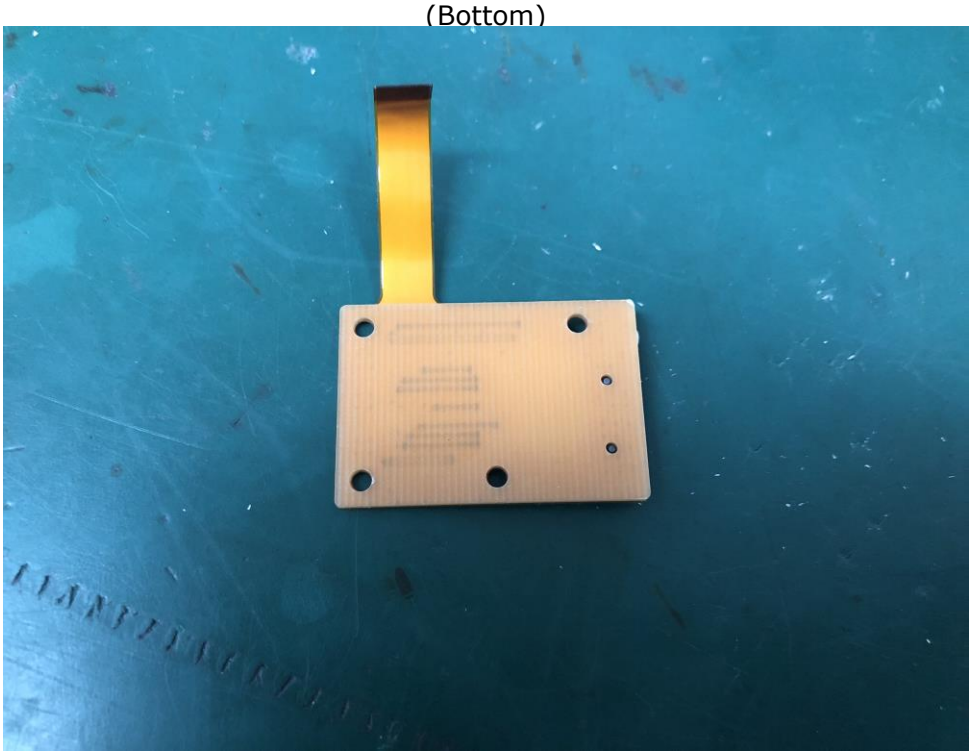


EUT Internal View – Board 3

(Top)

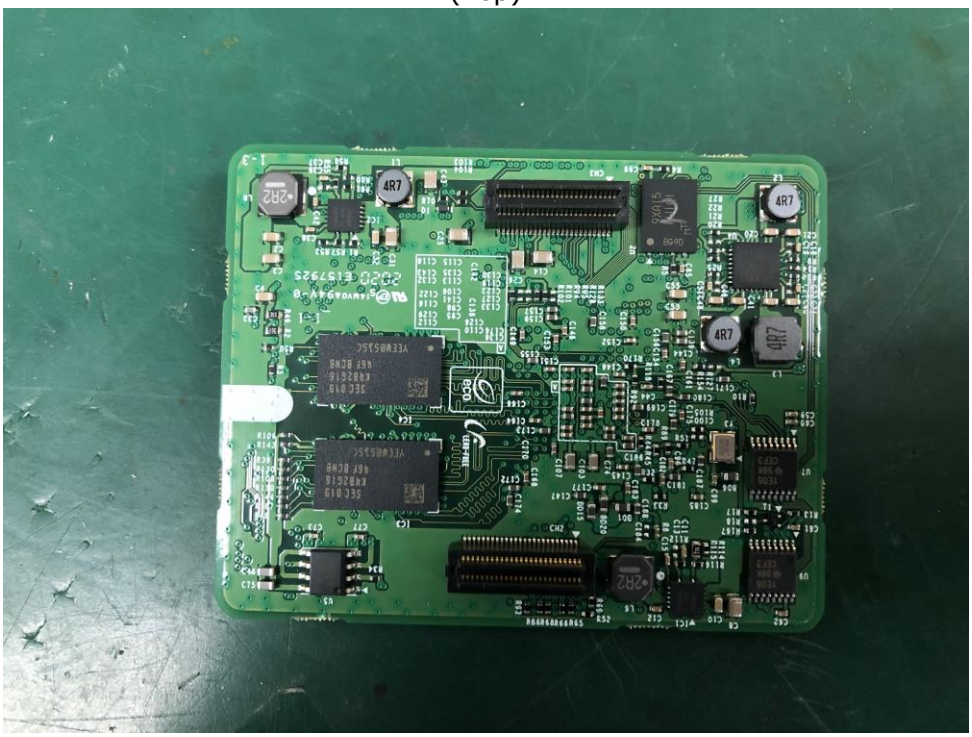


(Bottom)

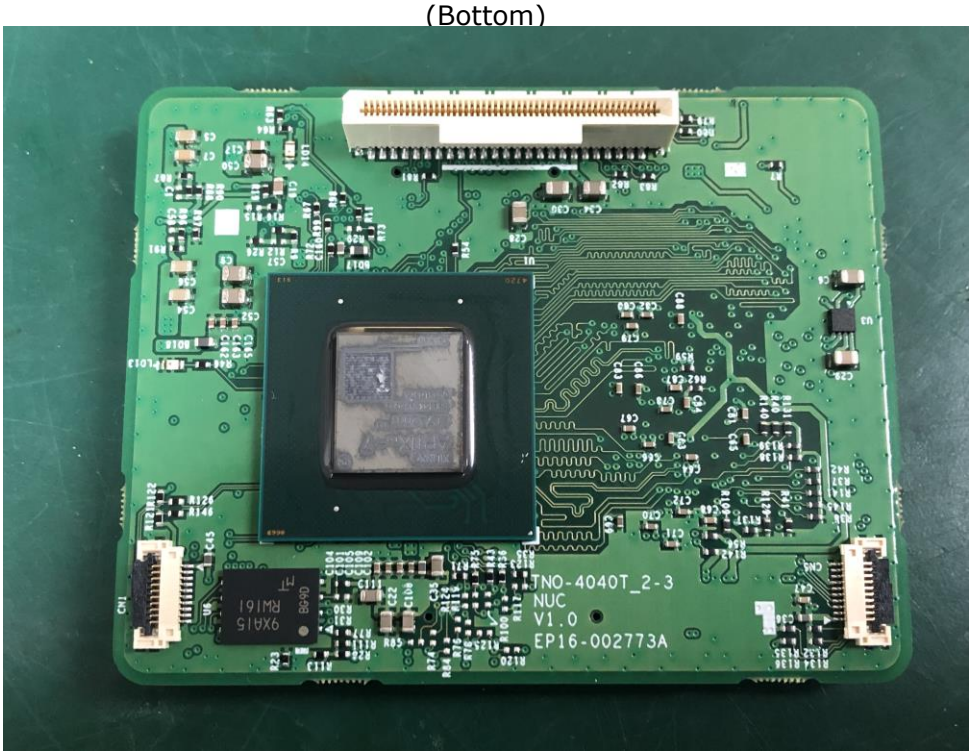


EUT Internal View –Board 4

(Top)



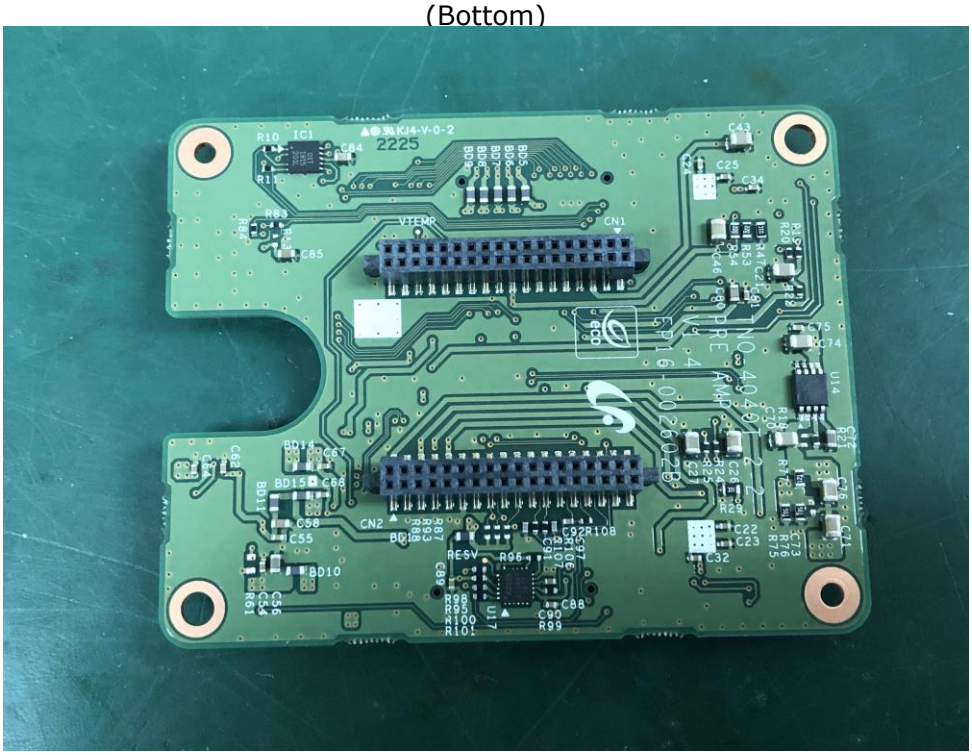
(Bottom)



EUT Internal View – Board 5

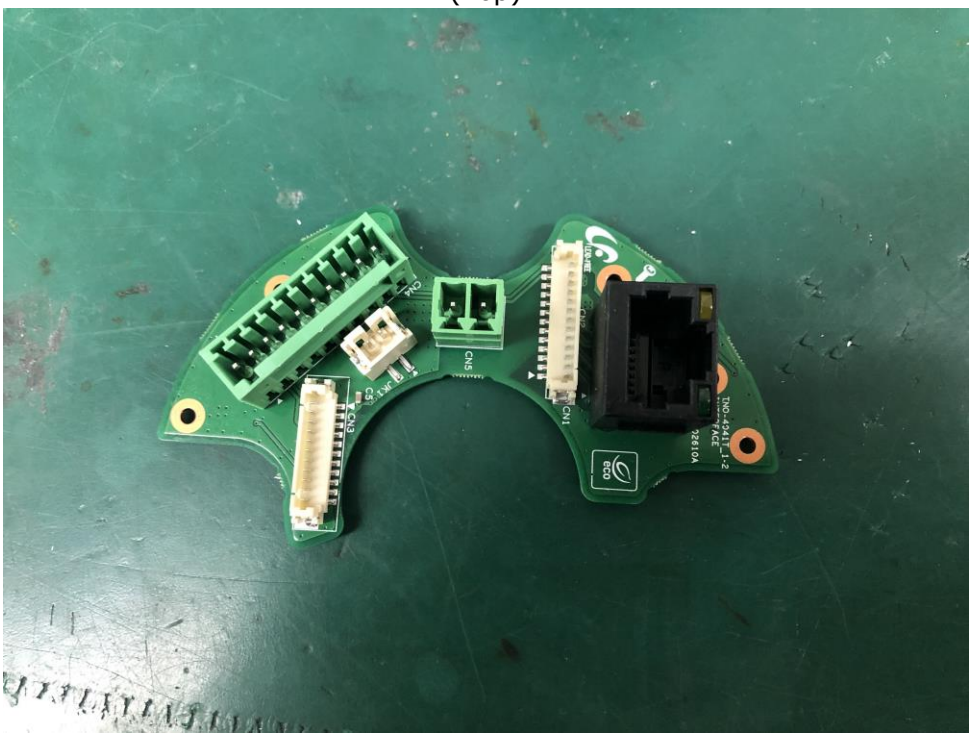
(Top)

(Bottom)



EUT Internal View – Board 6

(Top)



(Bottom)

EUT Internal View – Lens

(Top)

Label and Location

THERMAL CAMERA

Model No : TNO-4051T

Manufacturer : HANWHA VISION VIETNAM COMPANY LIMITED

Made in Vietnam