



EMC TEST REPORT

Test Report No. : KES-EM-22T0689-R1
Date of Issue : Feb. 24, 2023
Product name : Thermal Camera
Model/Type No. : TNO-4041TR
Variant Model : -
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. 26, 2022 ~ Aug. 01, 2022
Test Results : ☒ **In Compliance** ☐ **Not in Compliance**

Tested by

Eun Gu, Jeon
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.

**KES Co., Ltd.**

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REPORT REVISION HISTORY

Date	Test Report No.	Revision History
Aug. 09, 2022	KES-EM-22T0689	Issued
Feb. 24, 2023	KES-EM-22T0689-R1	Change the Applicant and manufacturer at the request of the customer.

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1.0 General Product Description

Main Specifications of EUT are:

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)	19mm fixed focal
Max. Aperture Ratio	F1.0
Angular Field of View	H: 32° / V: 24.3° / D: 39.2°
Min. Object Distance	11m(36.09ft)
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 detection, 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

Radiometry

Temperature Detect Range	-20°C~130°C(-4°F~266°F)
Temperature Accuracy	±5°C(≤100°C), ±20%(>100°C)
Temperature Detection	3ea rectangular
Additional	Hybrid palettes, Spot temperature reading

Network

Ethernet	RJ-45(10/100BASE-T)
Video Compression	H.265/H.264: Main/Baseline/High, MJPEG

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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(Sea 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

Webpage Language	English, Korean, Chinese, French, Italian, Spanish, German, Japanese, Russian, Swedish, Portuguese, Czech, Polish, Turkish, Dutch, Hungarian, Greek
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

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)

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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

Not applicable

1.3 Device Modifications

Not applicable

1.4 Equipment Under Test

Description	Model Number	Serial Number	Manufacturer	Remarks
Thermal Camera	TNO-4041TR	-	HANWHA VISION VIETNAM COMPANY LIMITED	EUT

1.5 Support Equipments

Description	Model Number	Serial Number	Manufacturer	Remarks
AC/DC Adapter	2ACB022F	-	ChAnnel Well Technology (Guangzhou) Co.,Ltd.	-
PoE Adapter	PT-PSE109GBRO-AH	-	Dongguan PROCET Network Technology Co.,Ltd	-
AC Adapter	AP-2410A	-	Safety officer	-
Notebook	Latitude 5300	8C47BE45C060	Wistron Infocom (Chengdu) Company Limited	-
Notebook Adapter	HA65NM130	-	Chicony Power Technology(Suzhou)Co., Ltd.	-
Controller	SPC-1010	C50E67WG10100 F	SamSung Techwin Co.,Ltd.	-
Controller Adapter	AP-12005A	-	A Power Co., Ltd.	-
Alarm	-	-	-	-
Button Alarm	-	-	-	-
Headset	K550	-	Britz®	-
SmartPhone	SHV-E330S	-	Samsung Electronics Co., Ltd.	-
Micro SD Card	-	-	SanDisk	16 GB

1.6 External I/O Cabling

■ AC Mode

Start		END		Cable Spec.	
Description	I/O Port	Description	I/O Port	Length	Shield
THERMAL CAMERA (EUT)	2 Pin	AC Adapter	Line	1.6	U
	RJ-45	Notebook	RJ-45	3.0	U
	Alarm OUT	Alarm	Alarm IN	3.0	U
	Alarm IN	Button Alarm	Alarm OUT	3.0	U
	RS-485	Controller	2 Pin	3.0	U
	3.5 mm (SPK)	Headset	3.5 mm	1.8	U
	3.5 mm (MIC)		3.5 mm	1.8	U
	Micro SD Slot	Micro SD Card	Micro SD Slot	-	-
Notebook	3.5 mm	SmartPhone	3.5 mm	1.1	U
	DC Jack	Notebook Adapter	DC Jack	1.6	U
Controller	DC Jack	Controller Adapter	DC Jack	1.2	U

* Unshielded=U, Shielded=S

■ DC Mode

Start		END		Cable Spec.	
Description	I/O Port	Description	I/O Port	Length	Shield
THERMAL CAMERA (EUT)	2 Pin	AC/DC Adapter	Line	1.6	U
	RJ-45	Notebook	RJ-45	3.0	U
	Alarm OUT	Alarm	Alarm IN	3.0	U
	Alarm IN	Button Alarm	Alarm OUT	3.0	U
	RS-485	Controller	2 Pin	3.0	U
	3.5 mm (SPK)	Headset	3.5 mm	1.8	U
	3.5 mm (MIC)		3.5 mm	1.8	U
	Micro SD Slot	Micro SD Card	Micro SD Slot	-	-
Notebook	3.5 mm	SmartPhone	3.5 mm	1.1	U
	DC Jack	Notebook Adapter	DC Jack	1.6	U
Controller	DC Jack	Controller Adapter	DC Jack	1.2	U

* Unshielded=U, Shielded=S

■ PoE Mode

Start		END		Cable Spec.	
Description	I/O Port	Description	I/O Port	Length	Shield
THERMAL CAMERA (EUT)	RJ-45	PoE Adapter	RJ-45	3.0	U
	Alarm OUT	Alarm	Alarm IN	3.0	U
	Alarm IN	Button Alarm	Alarm OUT	3.0	U
	RS-485	Controller	2 Pin	3.0	U
	3.5 mm (SPK)	Headset	3.5 mm	1.8	U
	3.5 mm (MIC)		3.5 mm	1.8	U
	Micro SD Slot	Micro SD Card	Micro SD Slot	-	-
PoE Adapter	RJ-45	Notebook	RJ-45	1.0	U
Notebook	3.5 mm	SmartPhone	3.5 mm	1.1	U
	DC Jack	Notebook Adapter	DC Jack	1.6	U
Controller	DC Jack	Controller Adapter	DC Jack	1.2	U

* Unshielded=U, Shielded=S

1.7 EUT Operating Mode(s)

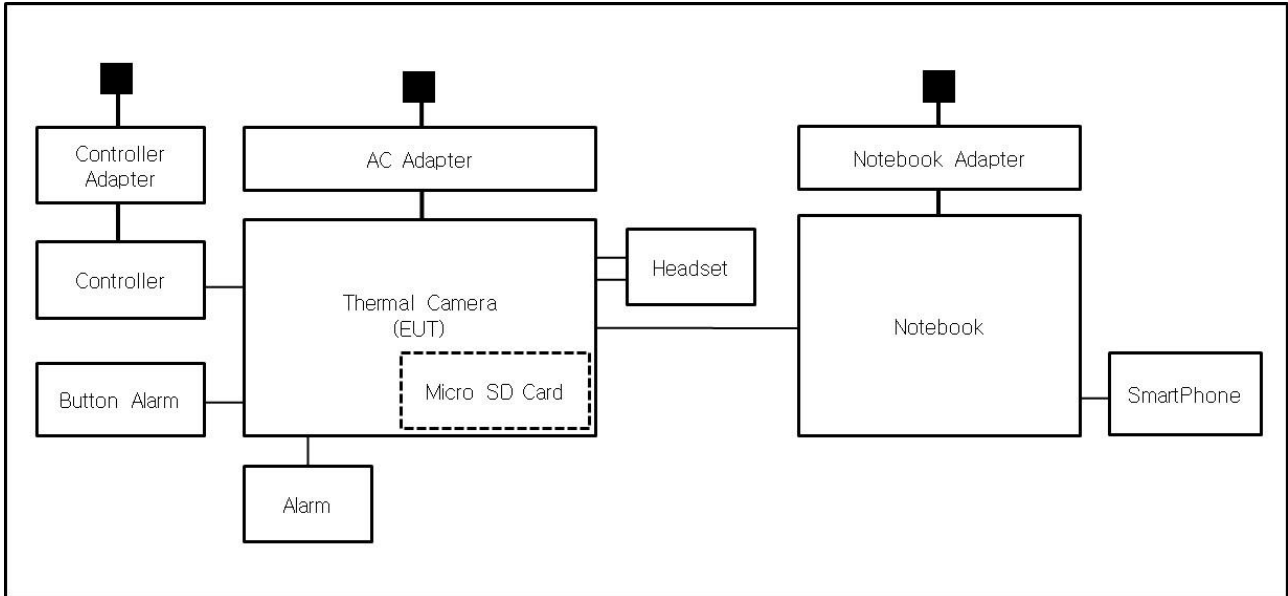
Test Mode	operating
AC, DC, PoE Mode	Check the Normal Operation status. after testing, check if the recording is normally done on the Micro SD Card

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

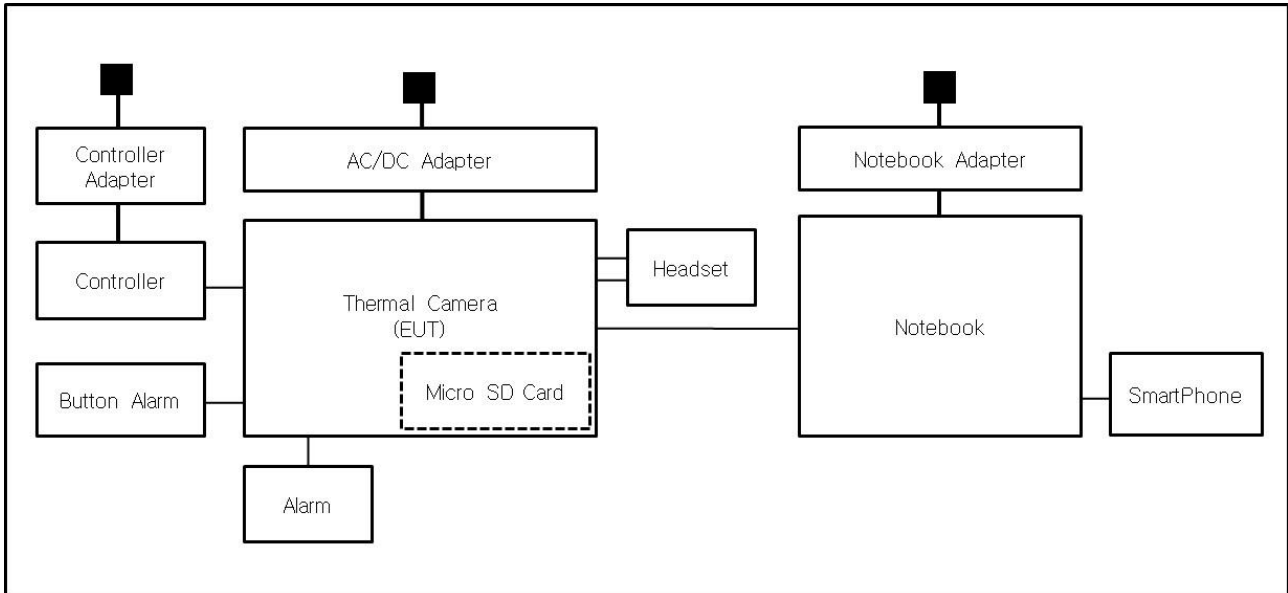
1.8 Configuration

■ AC Main
□ DC Main

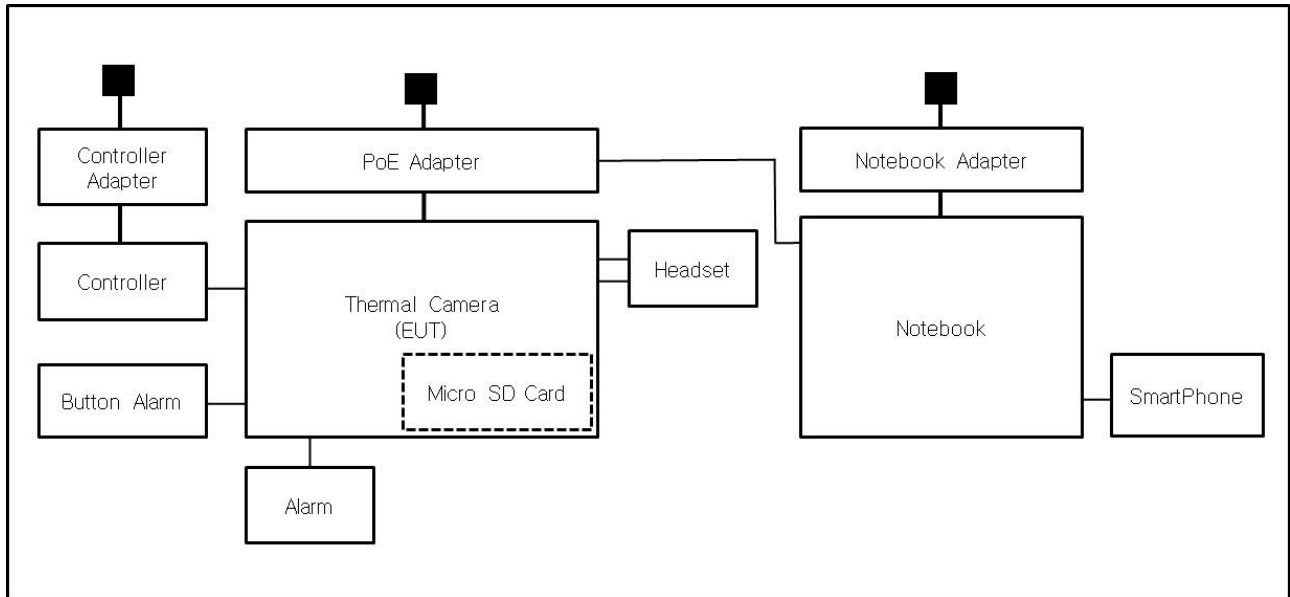
■ AC Mode



■ DC Mode



■ PoE Mode



1.9 Remarks when standards applied

The VIDEO ports were excluded from the test as administrator ports.







1.10 Calibration Details of Equipment Used for Measurement

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

1.11 Test Facility

The measurement facility is located at 473-21, Gayeo-ro, Yeosu-si, Gyeonggi-do, 12658, Korea, 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. 27, 2022

Test Location

Electro wave Shieldroom #6

Test Equipment

Used	Description	Model Number	Manufacturer	Serial Number	Cal. Due
<input checked="" type="checkbox"/>	EMI Test S/W	EMC32	R & S	9.12.00	-
<input checked="" type="checkbox"/>	EMI TEST RECEIVER	ESR3	R & S	101783	12, 28, 2022
<input checked="" type="checkbox"/>	LISN	ENV216	R & S	101787	12, 27, 2022
<input checked="" type="checkbox"/>	LISN	ESH2-Z5	R & S	100450	12, 27, 2022
<input checked="" type="checkbox"/>	PULSE LIMITER	ESH3-Z2	R & S	101915	12, 27, 2022

Test Conditions

Temperature: (24,5 ± 0,1) °C

Relative Humidity: (45,0 ± 0,1) % R.H.

Frequency Range of Measurement

150 kHz to 30 MHz

Instrument Settings

IF Band Width: 9 kHz

Test Results

The requirements are:

- ☒ PASS
☐ NOT PASS
☐ NOT APPLICABLE

RemarksSee Appendix A for test data.

2.2 Conducted Emissions at Telecommunication Ports

Test Date

Jul. 27, 2022

Test Location

Electro wave Shieldroom #6

Test Equipment

Used	Description	Model Number	Manufacturer	Serial Number	Cal. Due
<input checked="" type="checkbox"/>	EMI Test S/W	EMC32	R & S	9.12.00	-
<input checked="" type="checkbox"/>	EMI TEST RECEIVER	ESR3	R & S	101783	12, 28, 2022
<input checked="" type="checkbox"/>	LISN	ENV216	R & S	101787	12, 27, 2022
<input checked="" type="checkbox"/>	LISN	ESH2-Z5	R & S	100450	12, 27, 2022
<input checked="" type="checkbox"/>	PULSE LIMITER	ESH3-Z2	R & S	101915	12, 27, 2022
<input checked="" type="checkbox"/>	8-WIRE ISN CAT3,5	ENY81	R & S	100174	12, 28, 2022
<input type="checkbox"/>	ISN	ISN S8	SCHWARZBECK	ISN-S8-0019	03, 07, 2023

Test Conditions

Temperature: (24,5 ± 0,1) °C
Relative Humidity: (45,0 ± 0,1) % R.H.

Frequency Range of Measurement

150 kHz to 30 MHz

Instrument Settings

IF Band Width: 9 kHz

Test Results

The requirements are:

- ☒ PASS
☐ NOT PASS
☐ NOT APPLICABLE

Remarks

- See Appendix A for test data.
- For Ethernet interfaces, measurements are required at the highest data rate supported by the interface.

2.3 Radiated Electric Field Emissions(Below 1 GHz)

Test Date

Jul. 28, 2022

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

Used	Description	Model Number	Manufacturer	Serial Number	Cal. Due
<input checked="" type="checkbox"/>	EMI Test S/W	EP5/RE	TOYO Corporation	6.0.0	-
<input checked="" type="checkbox"/>	EMI TEST RECEIVER	ESU26	R & S	100551	03, 31, 2023
<input checked="" type="checkbox"/>	AMPLIFIER	SCU 01	R & S	100603	11, 24, 2022
<input checked="" type="checkbox"/>	TRILOG-BROADBAND ANTENNA	VULB9163	Schwarzbeck	715	12, 08, 2022
<input checked="" type="checkbox"/>	ATTENUATOR	8491A	HP	32173	03, 08, 2023

Test Conditions

Temperature: (24,4 ± 0,1) °C

Relative Humidity: (44,9 ± 0,2) % R.H.

Frequency Range of Measurement

30 MHz to 1 GHz

Instrument Settings

IF Band Width: 120 kHz

Test Results

The requirements are:

☒ PASS☐ NOT PASS☐ NOT APPLICABLE**Remarks**See Appendix A for test data.

2.4 Radiated Electric Field Emissions(Above 1 GHz)

Test Date

Aug. 01, 2022

Test Location

SEMI ANECHOIC CHAMBER #5

Test Equipment

Used	Description	Model Number	Manufacturer	Serial Number	Cal. Due
<input checked="" type="checkbox"/>	EMI Test S/W	ES10/RE	TOYO Corporation	2022.01.000	-
<input checked="" type="checkbox"/>	EMI TEST RECEIVER	ESU26	Rohde & Schwarz	100552	03, 31, 2023
<input checked="" type="checkbox"/>	HORN ANTENNA	BBHA 9120D	SCHWARZBECK	9120D-1802	12, 16, 2022
<input checked="" type="checkbox"/>	PREAMPLIFIER	8449B	HP	3008A00538	06, 02, 2023

Test Conditions

Temperature: (24,1 ± 0,2) °C

Relative Humidity: (45,7 ± 0,2) % R.H.

Frequency Range of Measurement

1 GHz to 6 GHz

Instrument Settings

IF Band Width: 1 MHz

Test Results

The requirements are:

- ☒ PASS
☐ NOT PASS
☐ NOT APPLICABLE

RemarksSee Appendix A for test data.

2.5 Harmonic Current Emissions

Test Date

Jul. 27, 2022

Test Location

Electro wave Shieldroom #3

Test Equipment

Used	Description	Model Number	Manufacturer	Serial Number	Cal. Due
<input checked="" type="checkbox"/>	EMI Test S/W	net.control	EM TEST	2.1.4	-
<input checked="" type="checkbox"/>	DIGITAL POWER ANALYZER	DPA 500N	EM TEST	V1024106759	04, 06, 2023
<input checked="" type="checkbox"/>	POWER SOURCE	ACS 500N6	EM TEST	V1024106760	-

Test Conditions

Temperature: (24,8 ± 0,2) °C

Relative Humidity: (47,0 ± 0,2) % 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. 27, 2022

Test Location

Electro wave Shieldroom #3

Test Equipment

Used	Description	Model Number	Manufacturer	Serial Number	Cal. Due
<input checked="" type="checkbox"/>	EMI Test S/W	net.control	EM TEST	2.1.4	-
<input checked="" type="checkbox"/>	DIGITAL POWER ANALYZER	DPA 500N	EM TEST	V1024106759	04, 06, 2023
<input checked="" type="checkbox"/>	POWER SOURCE	ACS 500N6	EM TEST	V1024106760	-

Test Conditions

Temperature: (24,8 ± 0,2) °C
Relative Humidity: (47,0 ± 0,2) % 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 $U = 130 \text{ dB}\mu\text{V}$.
For component of CCTV systems, where the status is monitored by observing the TV picture,
then deterioration of the picture is allowed at $U = 140 \text{ dB}\mu\text{V}$, providing:
(a) there is no permanent damage or change to the EUT
(e.g. no corruption of memory or changes to programmable settings etc.)
(b) at $U = 130 \text{ dB}\mu\text{V}$, any deterioration of the picture is so minor that the system could
still be used; and
(c) there in no observable deterioration of the picture at $U = 120 \text{ dB}\mu\text{V}$.

Voltage dip/interruption / Voltage variation

There shall be no damage, malfunction or change of status due to the conditioning.
Flickering of an indicator during the conditioning is permissible, providing that there is no
residual
change in the EUT or any change in outputs, which could be interpreted by associated
equipment
as a change. The EUT shall meet the acceptance criteria for the functional test, after the
conditioning.

3.1 Electrostatic Discharge

Reference Standard

EN 61000-4-2:2009

Test Date

Aug. 01, 2022

Test Location

EMS-ESD: Electro wave Shieldroom #7

Test Equipment

Used	Description	Model Number	Manufacturer	Serial Number	Cal. Due
<input checked="" type="checkbox"/>	ESD SIMULATOR	ESS-2000	Noise Ken	ESS01Z0454	02, 24, 2023
<input checked="" type="checkbox"/>	HCP	-	KES	-	-
<input checked="" type="checkbox"/>	VCP	-	Noise Ken	-	-

Test Conditions

Temperature: (23,9 ± 0,1) °C
Relative Humidity: (45,2 ± 0,1) % R.H.
Atmospheric Pressure: (99,9 ± 0,1) 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 <input type="checkbox"/> 2 kV <input type="checkbox"/> 4 kV <input checked="" type="checkbox"/> 6 kV <input type="checkbox"/> 8 kV <input type="checkbox"/> 15 kV	Air <input checked="" type="checkbox"/> 2 kV <input checked="" type="checkbox"/> 4 kV <input type="checkbox"/> 6 kV <input checked="" type="checkbox"/> 8 kV <input type="checkbox"/> 15 kV	HCP <input type="checkbox"/> 2 kV <input type="checkbox"/> 4 kV <input checked="" type="checkbox"/> 6 kV <input type="checkbox"/> 8 kV <input type="checkbox"/> 15 kV	VCP <input type="checkbox"/> 2 kV <input type="checkbox"/> 4 kV <input checked="" type="checkbox"/> 6 kV <input type="checkbox"/> 8 kV <input type="checkbox"/> 15 kV
--------------------	-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

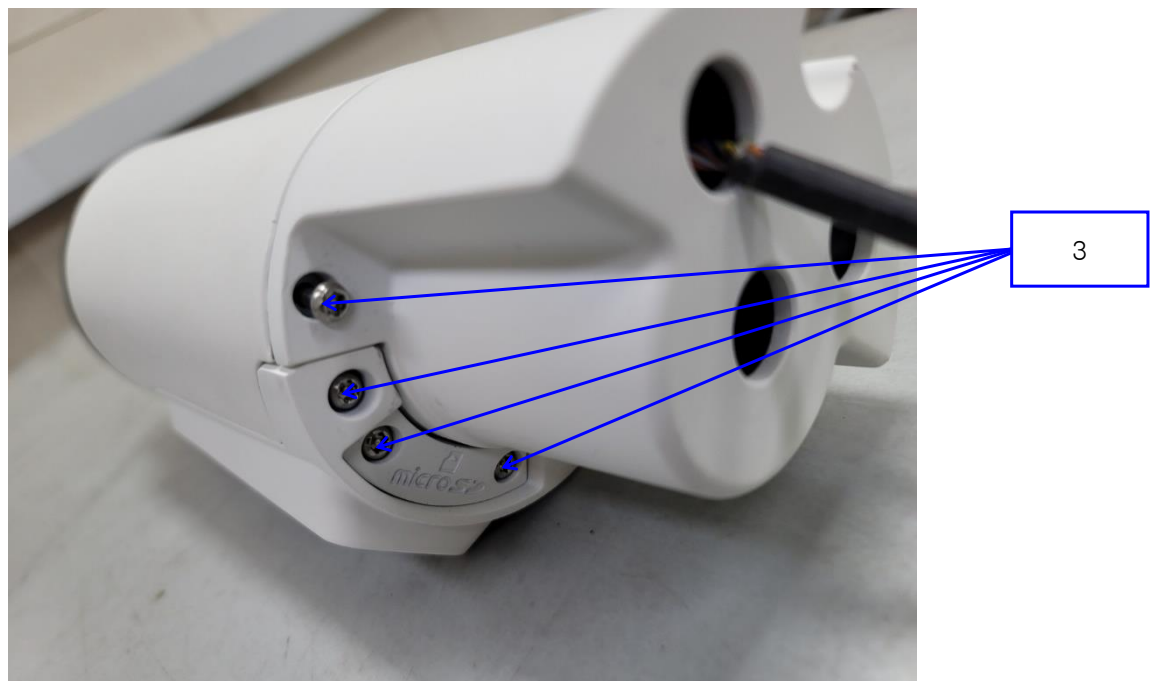
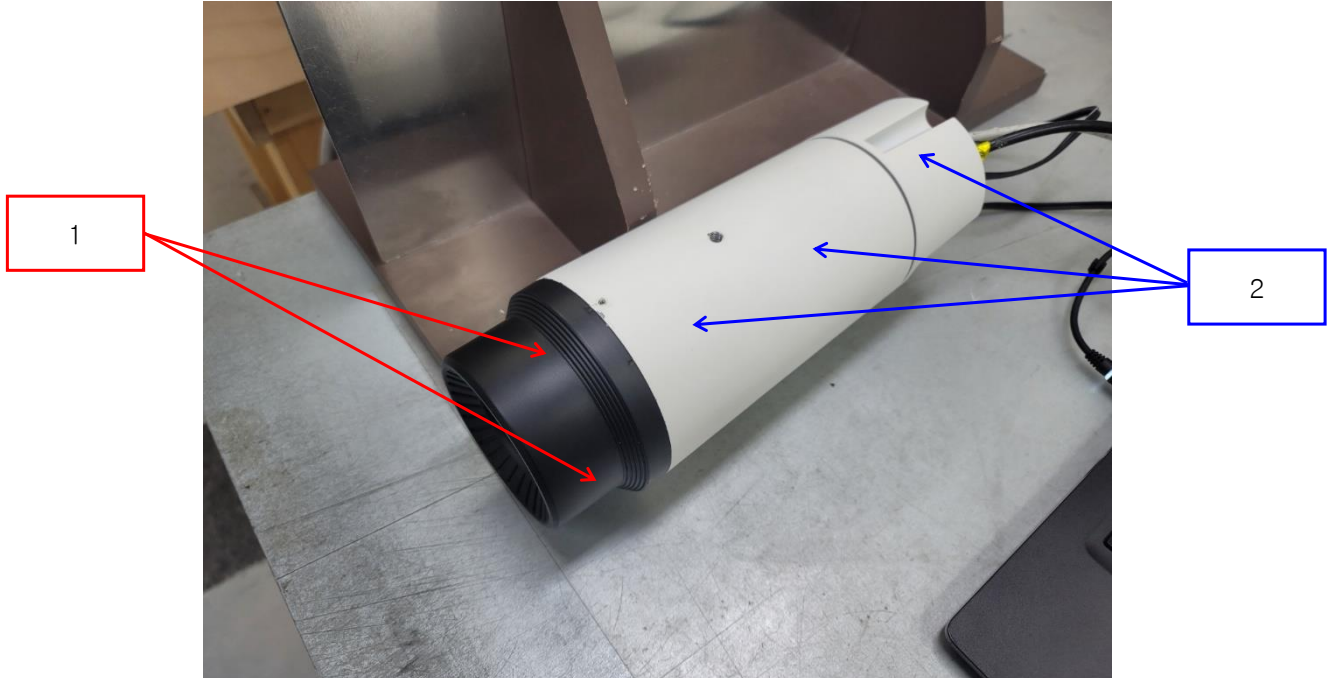
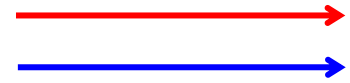
Notes: HCP: Horizontal coupling plane
VCP: Vertical coupling plane

Required Performance Criteria: ☒ Complied

Location of Discharge:

■ AC / DC / PoE Mode

Air
Contact



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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	Enclosure 1	Air Discharge	Complied	-
2	Enclosure 2	Contact Discharge	Complied	-
3	Screw	Contact Discharge	Complied	-

■ DC 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	Enclosure 1	Air Discharge	Complied	-
2	Enclosure 2	Contact Discharge	Complied	-
3	Screw	Contact Discharge	Complied	-

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■ 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	Enclosure 1	Air Discharge	Complied	-
2	Enclosure 2	Contact Discharge	Complied	-
3	Screw	Contact Discharge	Complied	-

Note: "Blank" = Not performed

Observations:

Complied – No degradation of function

Test Results

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

RemarksPASS Required Performance Criteria

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3.2 Radiated Electric Field Immunity

Reference Standard

EN IEC 61000-4-3:2020

Test Date

Jul. 26, 2022

Test Location

EMS-RS: ☐ SEMI ANECHOIC CHAMBER #2 ☒ SEMI ANECHOIC CHAMBER #3

Test Equipment

Used	Description	Model Number	Manufacturer	Serial Number	Cal. Due
<input checked="" type="checkbox"/>	EMS Test S/W	EMC32	R & S	10.10.02	-
<input checked="" type="checkbox"/>	SIGNAL GENERATOR	SMB 100A	Rohde & Schwarz	108252	08, 01, 2023
<input checked="" type="checkbox"/>	HIGH POWER DUAL AMP	SSA532	SUNGSAN	SSA532-001	-
<input checked="" type="checkbox"/>	POWER METER	E4419B	Agilent	GB40203000	03, 31, 2023
<input checked="" type="checkbox"/>	AVERAGE POWER SENSOR	E9301A	Agilent	MY52170007	04, 04, 2023
<input checked="" type="checkbox"/>	AVERAGE POWER SENSOR	E9301A	Agilent	MY41498669	04, 04, 2023
<input checked="" type="checkbox"/>	STACKED DOUBLE LOG-PER- ANTENNA	STPL9128 E	Schwarzbeck	9128ES-121	-
<input checked="" type="checkbox"/>	DOUBLE RIDGED HORN ANTENNA	SAS-571	A.H.SYSTEM,INC	781	03, 03, 2023

Test Conditions

Temperature: (24,3 ± 0,2) °C
Relative Humidity: (44,7 ± 0,2) % R.H.
Atmospheric Pressure: (100,2 ± 0,1) kPa



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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

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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. 29, 2022

Test Location

EMS-EFT: Electro wave Shieldroom #7

Test Equipment

Used	Description	Model Number	Manufacturer	Serial Number	Cal. Due
<input checked="" type="checkbox"/>	EMS Test S/W	iec.control	EM TEST	5.4.8	-
<input checked="" type="checkbox"/>	ULTRA COMPACT SIMULATOR	UCS 500N7	EM TEST	P1608172950	12, 03, 2022
<input checked="" type="checkbox"/>	MOTOR VARIAC	MV2616	EM TEST	P1552169719	03, 31, 2023
<input checked="" type="checkbox"/>	CAPACITIVE COUPLING CLAMP	HFK	EM TEST	P1633183115	12, 03, 2022

Test Conditions

Temperature: (24,4 ± 0,1) °C
Relative Humidity: (45,6 ± 0,1) % R.H.
Atmospheric Pressure: (99,6 ± 0,2) kPa

Test Specifications

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

Pulse Amplitude & Polarity:
(Other supply / Signal Lines) ☐ ± 0.5 kV ☒ ± 1.0 kV
☐ ± 2.0 kV

Burst Period: ☒ 300 ms ☐ 2 s

Repetition Rate: ☐ 5 kHz ☒ 100 kHz

Duration of Test Voltage: ☒ ≥ 1 min

Required Performance Criteria: ☒ Complied

Test Data

■ AC Mode

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

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

☒ Signal ports and telecommunication ports – Coupling Clamp used

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

■ DC Mode

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

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

☒ Signal ports and telecommunication ports – Coupling Clamp used

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

☒ PoE Mode

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

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

☒ Signal ports and telecommunication ports – Coupling Clamp used

Mode of Application	Observations	
	(+) Burst (kV)	(-) Burst (kV)
RJ-45	Complied	Complied
Alarm OUT	Complied	Complied
Alarm IN	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. 29, 2022

Test Location

EMS-Surge: Electro wave Shieldroom #7

Test Equipment

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

Test Conditions

Temperature: (24,4 ± 0,2) °C
Relative Humidity: (45,6 ± 0,2) % R.H.
Atmospheric Pressure: (99,6 ± 0,3) kPa



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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 (kV)	(-) Surge (kV)
L – N	Complied	Complied

☐ Line to Earth – Common Mode

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

Signal Lines
☒ Line to Earth – Common Mode

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

☒ DC Mode

☒ Line to Line – Differential Mode

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

☐ Line to Earth – Common Mode

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

Signal Lines
☒ Line to Earth – Common Mode

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

☒ PoE Mode

☐ Line to Line – Differential Mode

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

☐ Line to Earth – Common Mode

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

Signal Lines

☒ Line to Earth – Common Mode

Mode of Application	Coupling Method	Observations	
		(+) Surge (kV)	(-) Surge (kV)
RJ-45	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. 28, 2022

Test Location

EMS-CS: Electro wave Shieldroom #6

Test Equipment

Used	Description	Model Number	Manufacturer	Serial Number	Cal. Due
<input checked="" type="checkbox"/>	EMS Test S/W	icd.control	EM TEST	5.3.12	-
<input checked="" type="checkbox"/>	CONTINUOUS WAVE SIMULATOR	CWS 500N1.4	EM TEST	P1602169880	11, 24, 2022
<input checked="" type="checkbox"/>	ATTENUATOR	ATT 6/80	EM TEST	P1614178148	11, 24, 2022
<input checked="" type="checkbox"/>	CDN	CDN M016	TESEQ	43694	11, 24, 2022
<input checked="" type="checkbox"/>	CDN	CDN M016	TESEQ	43697	11, 24, 2022
<input checked="" type="checkbox"/>	CDN	CDN T8RJ45	EM TEST	0909-09	08, 03, 2022
<input type="checkbox"/>	CDN	CDN ST08A	TESEQ	43886	11, 24, 2022
<input checked="" type="checkbox"/>	EM CLAMP	KEMZ 801A	TESEQ	44099	11, 25, 2022

Test Conditions

Temperature: (24,9 ± 0,2) °C

Relative Humidity: (44,8 ± 0,1) % R.H.

Atmospheric Pressure: (100,0 ± 0,2) kPa



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Test Specifications

Frequency range:

☒ 150 kHz to 100 MHz

☐ 150 kHz to 80 MHz

Voltage Level:

☐ 1 Vrms

☐ 3 Vrms

☒ 10 Vrms

Modulation:

☒ AM, 80 %, 1 kHz sine wave

☒ PM, 1 Hz (0,5 s ON : 0,5 s OFF)

Frequency step:

☒ 1 % step

Dwell Time:

☐ 1 s

☒ 3 s

Required Performance Criteria: ☒ Complied

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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	CDN	Complied
Alarm OUT	Clamp	Complied
Alarm IN	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	CDN	Complied
Alarm OUT	Clamp	Complied
Alarm IN	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	CDN	Complied
Alarm OUT	Clamp	Complied
Alarm IN	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. 29, 2022

Test Location

EMS-Voltage dip: Electro wave Shieldroom #7

Test Equipment

Used	Description	Model Number	Manufacturer	Serial Number	Cal. Due
<input checked="" type="checkbox"/>	EMS Test S/W	iec.control	EM TEST	5.4.8	-
<input checked="" type="checkbox"/>	ULTRA COMPACT SIMULATOR	UCS 500N7	EM TEST	P1608172950	03, 31, 2023
<input checked="" type="checkbox"/>	MOTOR VARIAC	MV2616	EM TEST	P1552169719	03, 31, 2023

Test Conditions

Temperature: (24,4 ± 0,1) °C
Relative Humidity: (45,6 ± 0,1) % R.H.
Atmospheric Pressure: (99,6 ± 0,1) kPa



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Test Specifications & Observations/Remarks

■ AC Mode

- Voltage Dips and Short Interruptions

<u>Test Level</u>	<u>Duration [in period/ms (50 Hz)]</u>	<u>Results</u>
<input checked="" type="checkbox"/> 20 % dip	<input checked="" type="checkbox"/> 250 / 5 000	<u>Complied</u>
<input checked="" type="checkbox"/> 30 % dip	<input checked="" type="checkbox"/> 25 / 500	<u>Complied</u>
<input checked="" type="checkbox"/> 60 % dip	<input checked="" type="checkbox"/> 10 / 200	<u>Complied</u>
<input checked="" type="checkbox"/> 100 % dip	<input checked="" type="checkbox"/> 250 / 5 000	<u>Degradation</u>

- Voltage variations

<input checked="" type="checkbox"/> Unom + 10 %	<input checked="" type="checkbox"/> 253.0 V (ac)	<u>Complied</u>
<input checked="" type="checkbox"/> Unom - 15 %	<input checked="" type="checkbox"/> 195.5 V (ac)	<u>Complied</u>

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■ DC Mode**- Voltage Dips and Short Interruptions**

<u>Test Level</u>	<u>Duration [in period/ms (50 Hz)]</u>	<u>Results</u>
<input checked="" type="checkbox"/> 20 % dip	<input checked="" type="checkbox"/> 250 / 5 000	<u>Complied</u>
<input checked="" type="checkbox"/> 30 % dip	<input checked="" type="checkbox"/> 25 / 500	<u>Complied</u>
<input checked="" type="checkbox"/> 60 % dip	<input checked="" type="checkbox"/> 10 / 200	<u>Complied</u>
<input checked="" type="checkbox"/> 100 % dip	<input checked="" type="checkbox"/> 250 / 5 000	<u>Degradation</u>

- Voltage variations

<input checked="" type="checkbox"/> Unom + 10 %	<input checked="" type="checkbox"/> 253.0 V (ac)	<u>Complied</u>
<input checked="" type="checkbox"/> Unom - 15 %	<input checked="" type="checkbox"/> 195.5 V (ac)	<u>Complied</u>

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 by no operator's intervention.

APPENDIX A – TEST DATA

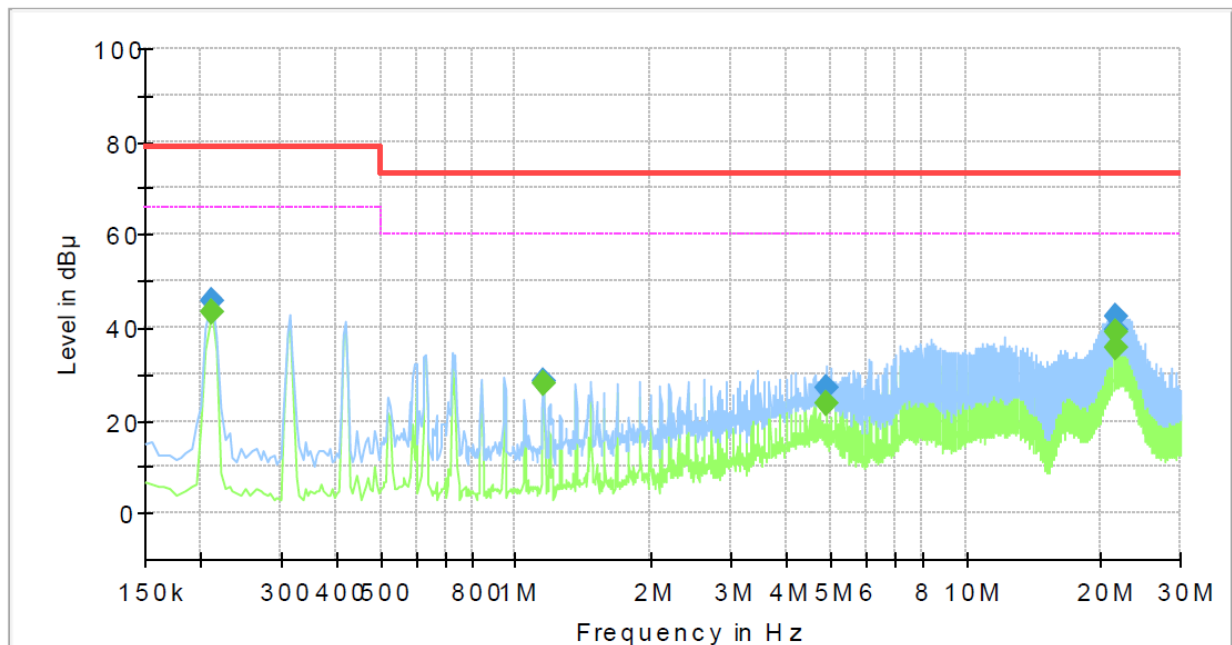
Conducted Emissions at Mains Power Ports

■ AC Mode

[HOT]

Common Information

Test Description:	Conducted Emission
Model No.:	TNO-4041R
Phase:	L1
Mode:	AC
Operator Name:	KES



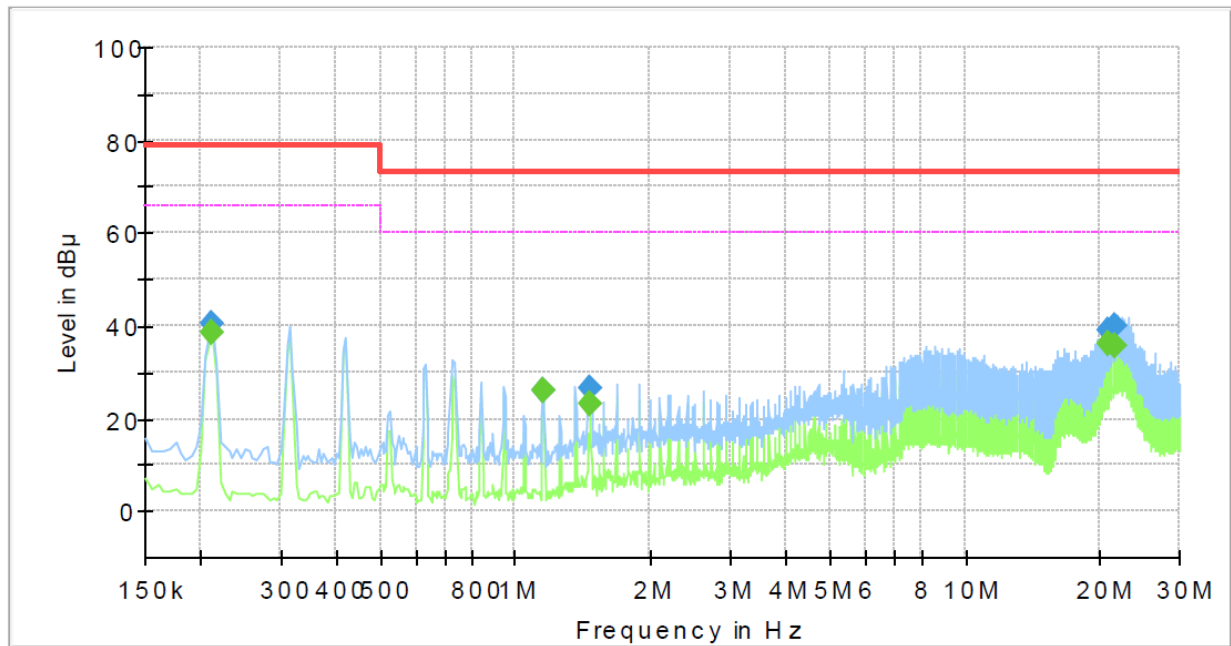
Final Result

Frequency (MHz)	QuasiPeak (dBμV)	CAverage (dBμV)	Limit (dBμV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.210000	---	43.14	66.00	22.86	1000.0	9.000	L1	19.4
0.210000	45.88	---	79.00	33.12	1000.0	9.000	L1	19.4
1.150000	---	28.13	60.00	31.87	1000.0	9.000	L1	20.1
1.150000	28.24	---	73.00	44.76	1000.0	9.000	L1	20.1
4.915000	---	23.41	60.00	36.59	1000.0	9.000	L1	19.6
4.915000	26.98	---	73.00	46.02	1000.0	9.000	L1	19.6
21.450000	---	35.64	60.00	24.36	1000.0	9.000	L1	20.1
21.450000	39.64	---	73.00	33.36	1000.0	9.000	L1	20.1
21.655000	---	39.08	60.00	20.92	1000.0	9.000	L1	20.1
21.655000	42.28	---	73.00	30.72	1000.0	9.000	L1	20.1

[NEUTRAL]

Common Information

Test Description:	Conducted Emission
Model No.:	TNO-4041R
Phase:	N
Mode:	AC
Operator Name:	KES



Final Result

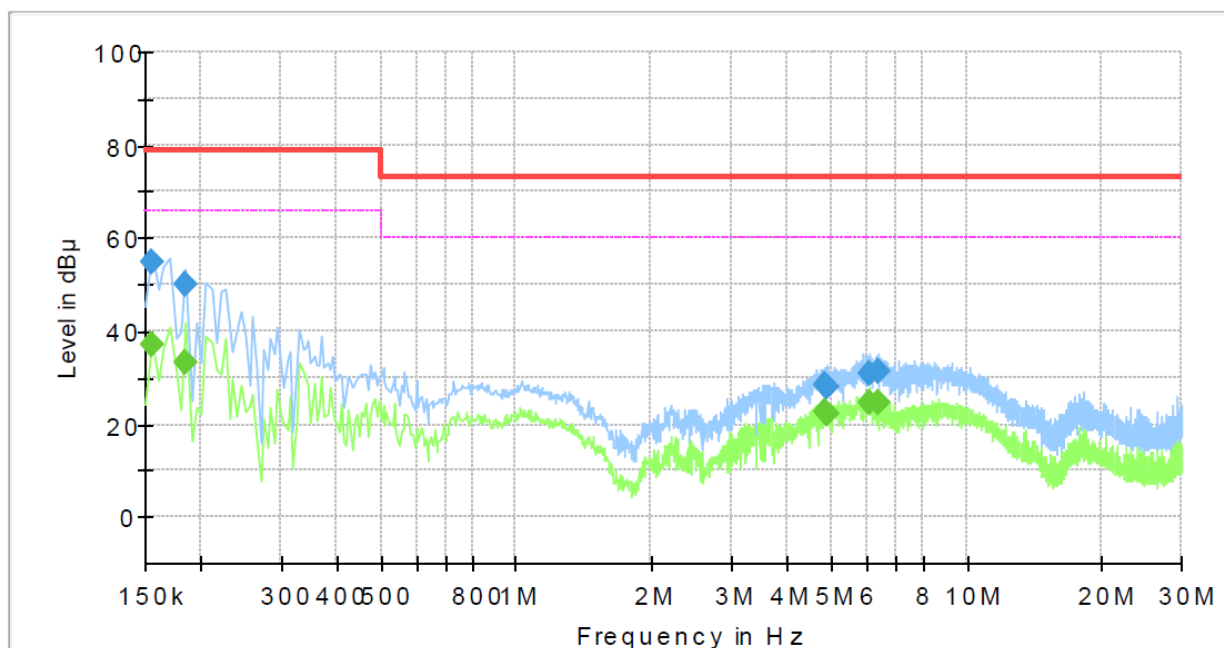
Frequency (MHz)	QuasiPeak (dBμV)	CAverage (dBμV)	Limit (dBμV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.210000	---	38.44	66.00	27.56	1000.0	9.000	N	19.4
0.210000	40.60	---	79.00	38.40	1000.0	9.000	N	19.4
1.150000	---	25.84	60.00	34.16	1000.0	9.000	N	20.1
1.150000	25.91	---	73.00	47.09	1000.0	9.000	N	20.1
1.465000	---	23.10	60.00	36.90	1000.0	9.000	N	20.2
1.465000	26.59	---	73.00	46.41	1000.0	9.000	N	20.2
20.925000	---	36.11	60.00	23.89	1000.0	9.000	N	20.2
20.925000	39.04	---	73.00	33.96	1000.0	9.000	N	20.2
21.660000	---	35.62	60.00	24.38	1000.0	9.000	N	20.2
21.660000	40.05	---	73.00	32.95	1000.0	9.000	N	20.2

■ DC Mode

[HOT]

Common Information

Test Description: Conducted Emission
 Model No.: TNO-4041R
 Phase: L1
 Mode: DC
 Operator Name: KES



Final Result

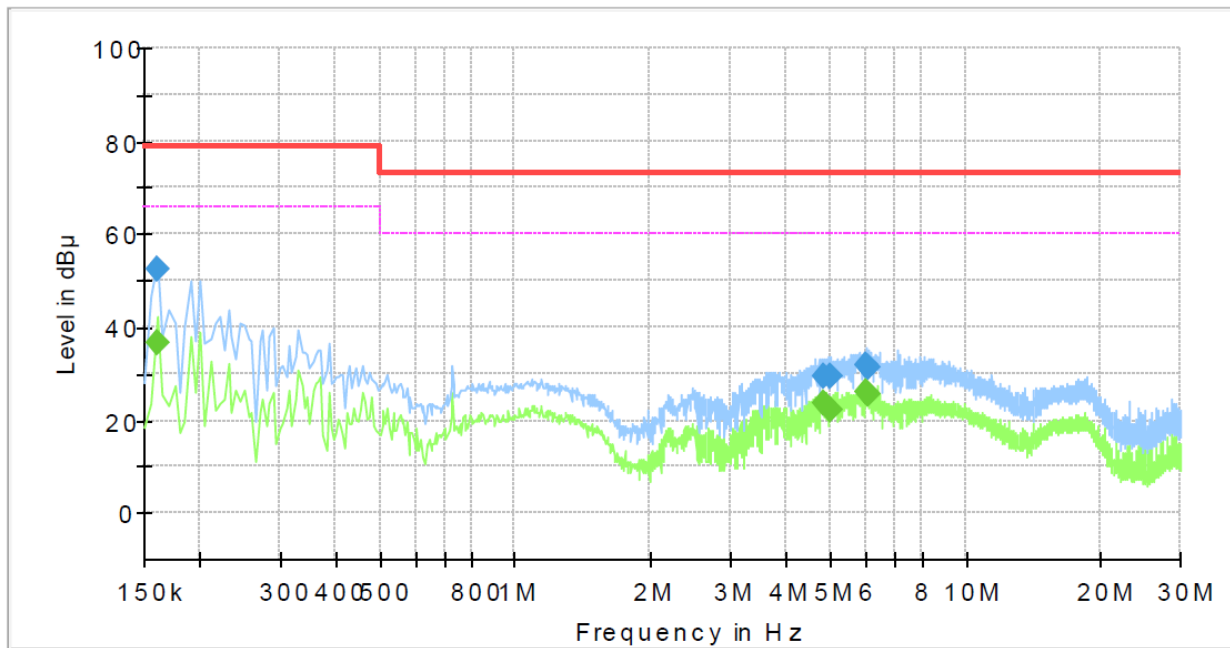
Frequency (MHz)	QuasiPeak (dBμV)	CAverage (dBμV)	Limit (dBμV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.155000	---	37.03	66.00	28.97	1000.0	9.000	L1	19.4
0.155000	55.04	---	79.00	23.96	1000.0	9.000	L1	19.4
0.185000	---	33.09	66.00	32.91	1000.0	9.000	L1	19.4
0.185000	50.11	---	79.00	28.89	1000.0	9.000	L1	19.4
4.870000	---	22.78	60.00	37.22	1000.0	9.000	L1	19.7
4.870000	28.27	---	73.00	44.73	1000.0	9.000	L1	19.7
4.925000	---	22.05	60.00	37.95	1000.0	9.000	L1	19.6
4.925000	27.84	---	73.00	45.16	1000.0	9.000	L1	19.6
6.105000	---	24.67	60.00	35.33	1000.0	9.000	L1	19.5
6.105000	30.88	---	73.00	42.12	1000.0	9.000	L1	19.5
6.335000	---	24.57	60.00	35.43	1000.0	9.000	L1	19.5
6.335000	31.08	---	73.00	41.92	1000.0	9.000	L1	19.5

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[NEUTRAL]

Common Information

Test Description:	Conducted Emission
Model No.:	TNO-4041R
Phase:	N
Mode:	DC
Operator Name:	KES



Final Result

Frequency (MHz)	QuasiPeak (dBμV)	CAverage (dBμV)	Limit (dBμV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.160000	---	36.48	66.00	29.52	1000.0	9.000	N	19.4
0.160000	52.24	---	79.00	26.76	1000.0	9.000	N	19.4
4.855000	---	23.86	60.00	36.14	1000.0	9.000	N	19.7
4.855000	29.60	---	73.00	43.40	1000.0	9.000	N	19.7
4.990000	---	22.30	60.00	37.70	1000.0	9.000	N	19.6
4.990000	29.27	---	73.00	43.73	1000.0	9.000	N	19.6
6.035000	---	25.95	60.00	34.05	1000.0	9.000	N	19.5
6.035000	31.56	---	73.00	41.44	1000.0	9.000	N	19.5
6.090000	---	25.48	60.00	34.52	1000.0	9.000	N	19.5
6.090000	31.34	---	73.00	41.66	1000.0	9.000	N	19.5

◆ Calculation

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

QuasiPeak / CAverage : The Final Value

Reading Value : Not shown in the table.

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

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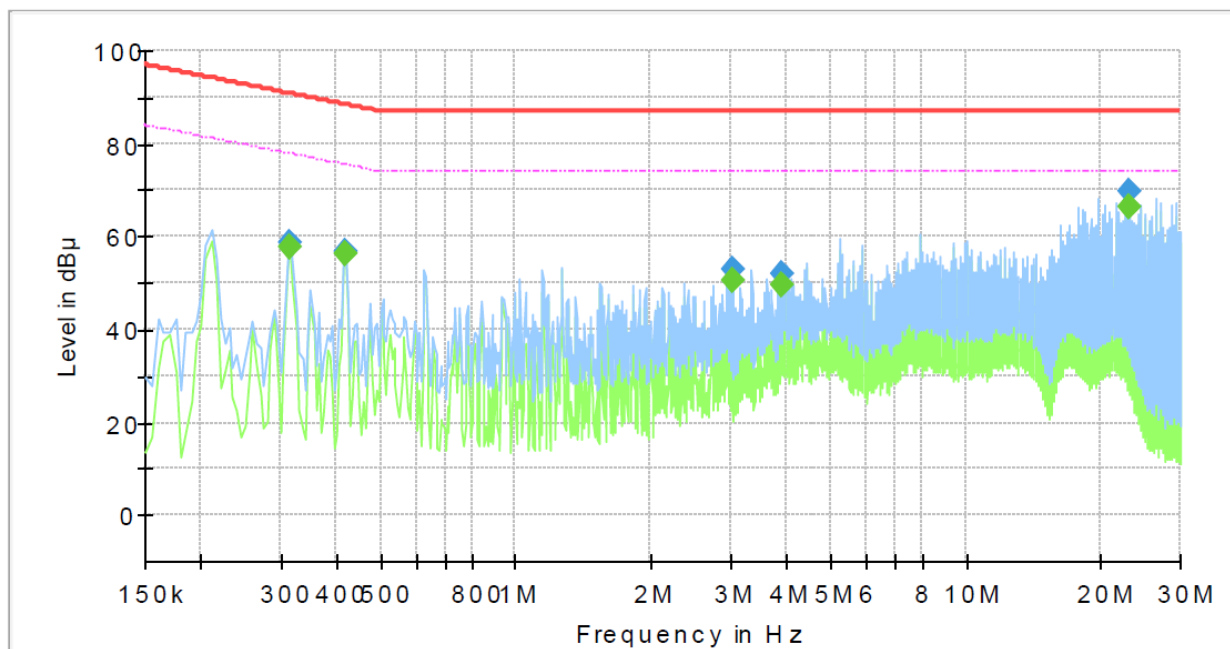
Conducted Emissions at Telecommunication Ports

■ AC Mode

[100 Mbps]

Common Information

Test Description:	Telecommunication Emission
Model No.:	TNO-4041R
Mode :	AC
Speed :	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)
0.315000	---	57.76	77.84	20.08	1000.0	9.000	Single Line	19.7
0.315000	58.86	---	90.84	31.98	1000.0	9.000	Single Line	19.7
0.420000	---	56.48	75.45	18.97	1000.0	9.000	Single Line	19.7
0.420000	56.73	---	88.45	31.72	1000.0	9.000	Single Line	19.7
3.040000	---	50.40	74.00	23.60	1000.0	9.000	Single Line	20.0
3.040000	53.02	---	87.00	33.98	1000.0	9.000	Single Line	20.0
3.895000	---	49.35	74.00	24.65	1000.0	9.000	Single Line	19.7
3.895000	52.09	---	87.00	34.91	1000.0	9.000	Single Line	19.7
23.130000	---	66.38	74.00	7.62	1000.0	9.000	Single Line	20.1
23.130000	69.95	---	87.00	17.05	1000.0	9.000	Single Line	20.1

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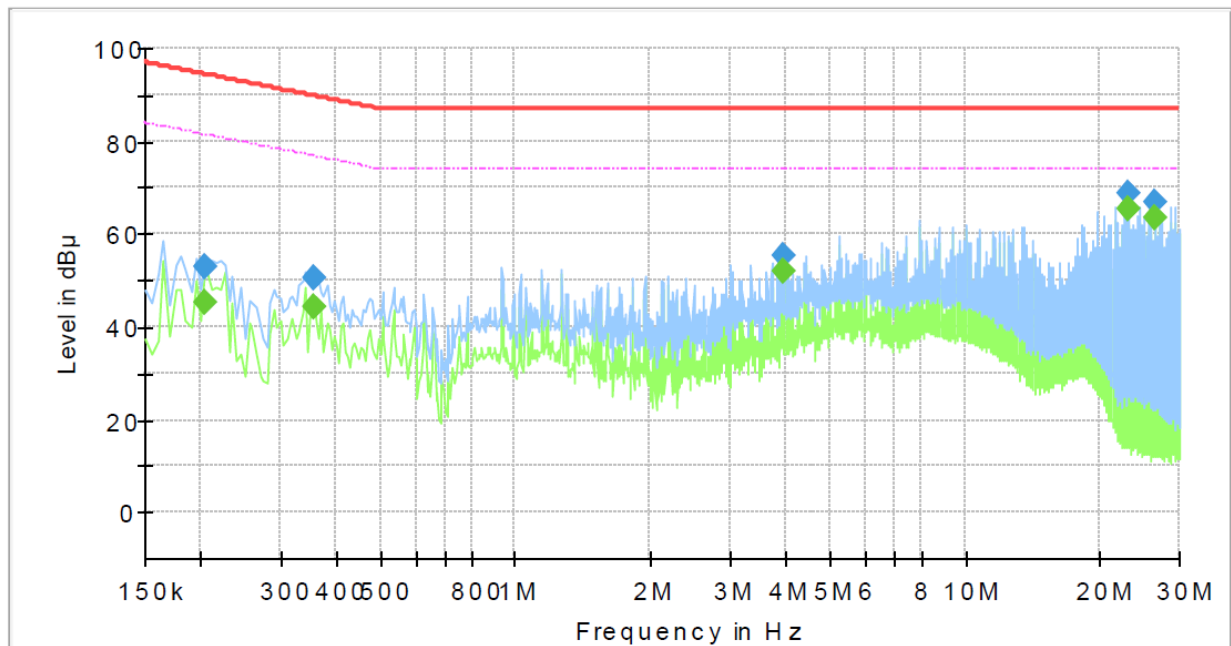
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DC Mode

[100 Mbps]

Common Information

Test Description:	Telecommunication Emission
Model No.:	TNO-4041R
Mode :	DC
Speed :	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)
0.205000	---	45.37	81.41	36.04	1000.0	9.000	Single Line	19.7
0.205000	53.07	---	94.41	41.34	1000.0	9.000	Single Line	19.7
0.355000	---	44.51	76.84	32.33	1000.0	9.000	Single Line	19.7
0.355000	50.38	---	89.84	39.46	1000.0	9.000	Single Line	19.7
3.955000	---	52.07	74.00	21.93	1000.0	9.000	Single Line	19.7
3.955000	55.43	---	87.00	31.57	1000.0	9.000	Single Line	19.7
23.130000	---	65.57	74.00	8.43	1000.0	9.000	Single Line	20.1
23.130000	68.98	---	87.00	18.02	1000.0	9.000	Single Line	20.1
26.610000	---	63.51	74.00	10.49	1000.0	9.000	Single Line	20.2
26.610000	66.80	---	87.00	20.20	1000.0	9.000	Single Line	20.2

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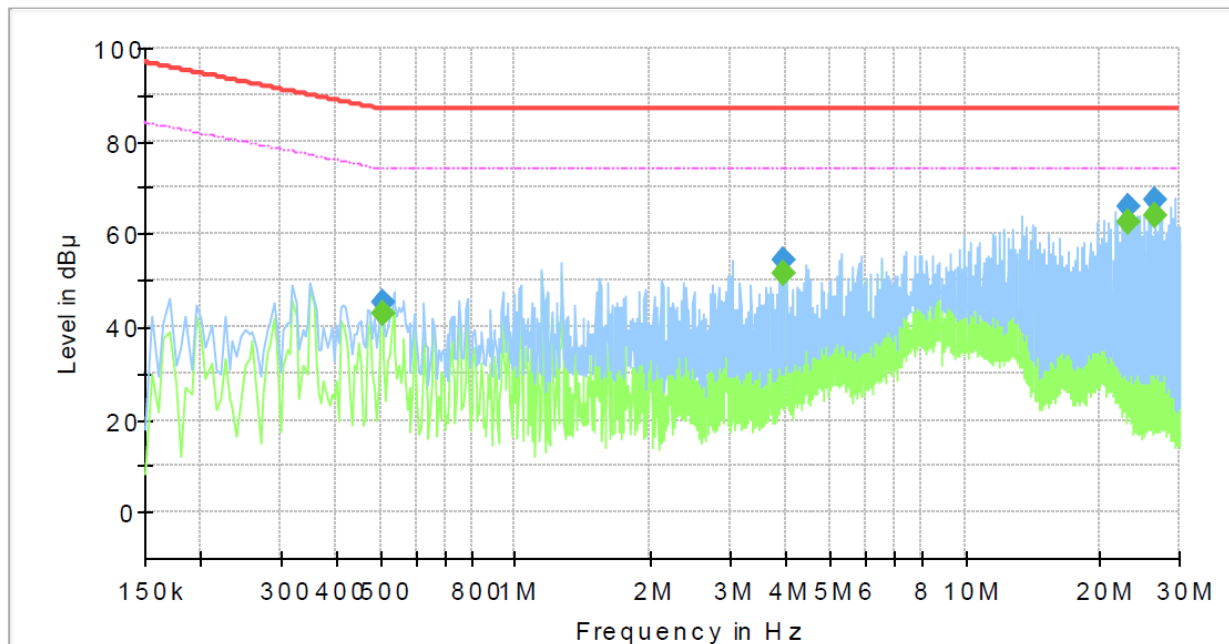
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■ PoE Mode

[100 Mbps]

Common Information

Test Description:	Telecommunication Emission
Model No.:	TNO-4041R
Mode :	PoE
Speed :	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)
0.505000	---	42.80	74.00	31.20	1000.0	9.000	Single Line	19.8
0.505000	45.27	---	87.00	41.73	1000.0	9.000	Single Line	19.8
3.955000	---	51.68	74.00	22.32	1000.0	9.000	Single Line	19.7
3.955000	54.54	---	87.00	32.46	1000.0	9.000	Single Line	19.7
23.125000	---	62.58	74.00	11.42	1000.0	9.000	Single Line	20.1
23.125000	66.06	---	87.00	20.94	1000.0	9.000	Single Line	20.1
26.610000	---	63.94	74.00	10.06	1000.0	9.000	Single Line	20.2
26.610000	67.45	---	87.00	19.55	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 + Pulse Limiter FACTOR))



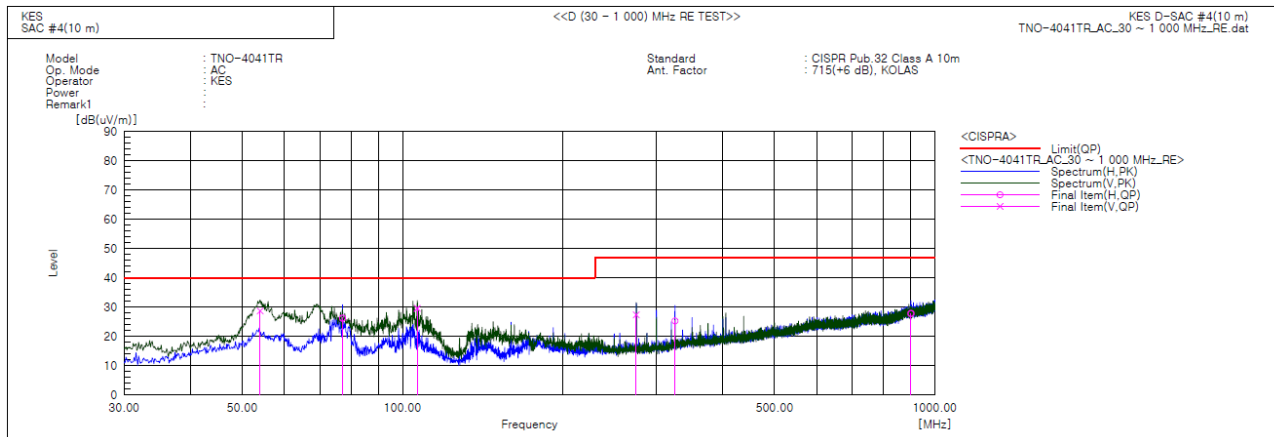
KES Co., Ltd.

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Radiated Electric Field Emissions(Below 1 GHz)

■ 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	54.038	V	50.0	-21.3	28.7	40.0	11.3	134.0	279.3	
2	77.166	H	53.6	-27.4	26.2	40.0	13.8	391.0	354.5	
3	106.634	V	52.0	-22.4	29.6	40.0	10.4	162.0	91.8	
4	274.928	V	46.1	-18.7	27.4	47.0	19.6	126.0	35.8	
5	325.039	H	41.7	-16.4	25.3	47.0	21.7	389.0	296.6	
6	902.158	H	31.8	-4.0	27.8	47.0	19.2	379.0	135.7	

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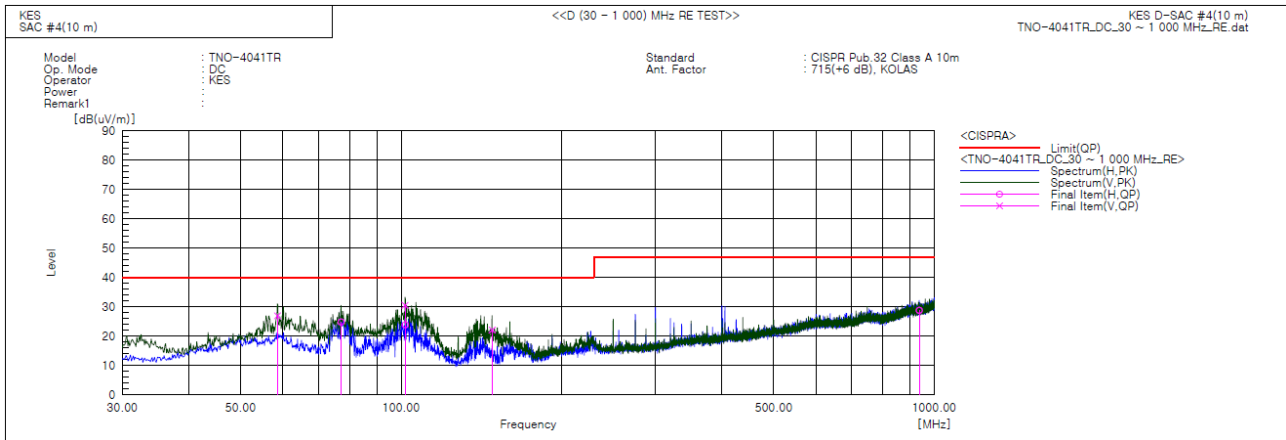
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Report No.:

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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	58.633	V	48.7	-21.8	26.9	40.0	13.1	144.0	200.6	
2	77.166	H	52.2	-27.4	24.8	40.0	15.2	392.0	345.9	
3	101.783	V	53.0	-22.5	30.5	40.0	9.5	144.0	219.2	
4	101.821	H	46.4	-22.5	23.9	40.0	16.1	378.0	328.1	
5	148.098	V	47.4	-25.3	22.1	40.0	17.9	107.0	255.2	
6	937.556	H	32.6	-3.8	28.8	47.0	18.2	348.0	216.7	

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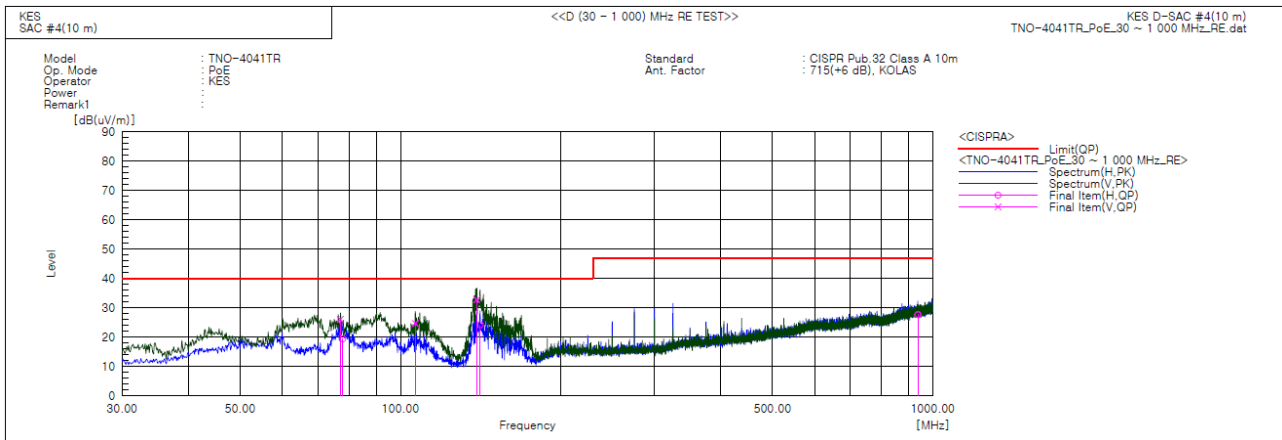
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■ PoE Mode



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	77.122	V	53.5	-27.4	26.1	40.0	13.9	142.0	101.7	
2	77.923	H	47.0	-27.6	19.4	40.0	20.6	361.0	355.6	
3	106.633	V	47.1	-22.4	24.7	40.0	15.3	161.0	288.4	
4	139.128	V	58.3	-25.5	32.8	40.0	7.2	147.0	211.5	
5	141.186	H	49.7	-25.5	24.2	40.0	15.8	338.0	290.4	
6	937.556	H	31.4	-3.8	27.6	47.0	19.4	368.0	5.8	

◆ Calculation – SEMI ANECHOIC CHAMBER #4(10 m)

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

Margin(QP)[dB] = Limit[dB(μ V/m)] - Result(QP) [dB(μ V/m)]

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

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

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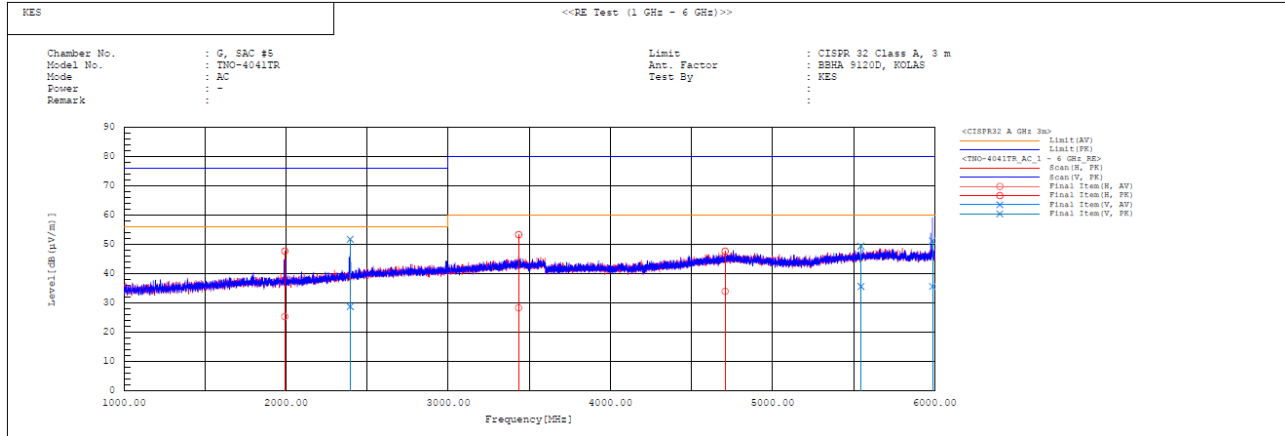
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Radiated Electric Field Emissions(Above 1 GHz)

■ AC Mode

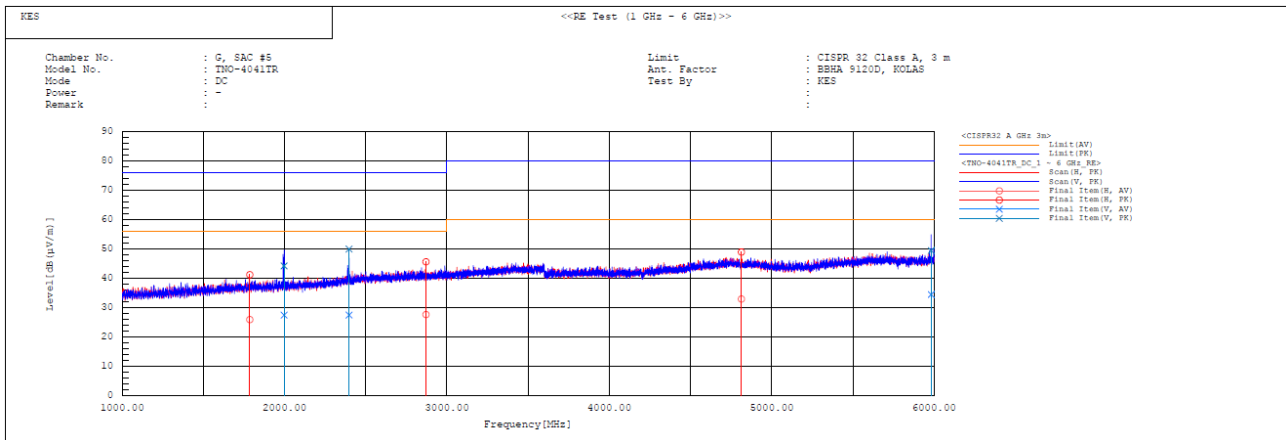


Final Result

No.	Frequency [MHz]	Pol	Reading AV [dB(μV)]	Reading PK [dB(μV)]	c.f [dB(l/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	1992.544	H	28.1	50.4	-2.8	25.3	47.6	56.0	76.0	30.7	28.4	100.0	178.0
2	2395.572	V	30.2	53.2	-1.5	28.7	51.7	56.0	76.0	27.3	24.3	100.0	96.7
3	3434.724	H	26.5	51.5	1.8	28.3	53.3	60.0	80.0	31.7	26.7	100.0	50.6
4	4709.541	H	27.8	41.5	6.1	33.9	47.6	60.0	80.0	26.1	32.4	100.0	186.9
5	5546.582	V	27.5	41.2	8.1	35.6	49.3	60.0	80.0	24.4	30.7	100.0	302.9
6	5987.584	V	26.8	42.3	8.8	35.6	51.1	60.0	80.0	24.4	28.9	100.0	143.8



DC Mode



Final Result

No.	Frequency	Pol	Reading AV	Reading PK	c.f	Result AV	Result PK	Limit AV	Limit PK	Margin AV	Margin PK	Height	Angle
	[MHz]		[dB (μV)]	[dB (μV)]	[dB (l/m)]	[dB (μV/m)]	[dB (μV/m)]	[dB (μV/m)]	[dB (μV/m)]	[dB]	[dB]	[cm]	[deg]
1	1786.421	H	29.6	44.9	-3.7	25.9	41.2	56.0	76.0	30.1	34.8	100.0	114.0
2	1998.544	V	30.1	46.9	-2.7	27.4	44.2	56.0	76.0	28.6	31.8	100.0	39.8
3	2398.542	V	28.8	51.3	-1.4	27.4	49.9	56.0	76.0	28.6	26.1	100.0	96.1
4	2872.341	H	27.1	45.1	0.5	27.6	45.6	56.0	76.0	28.4	30.4	100.0	343.8
5	4814.551	H	26.4	42.4	6.5	32.9	48.9	60.0	80.0	27.1	31.1	100.0	312.9
6	5983.124	V	25.6	40.6	8.8	34.4	49.4	60.0	80.0	25.6	30.6	100.0	190.5



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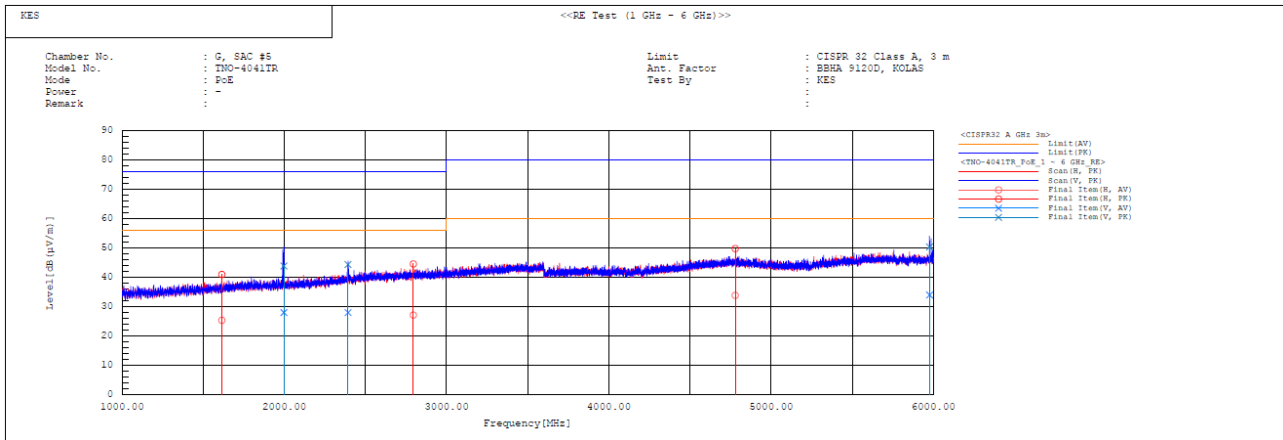
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PoE Mode



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	1615.421	H	29.9	45.5	-4.6	25.3	40.9	56.0	76.0	30.7	35.1	100.0	272.5
2	1998.541	V	30.6	46.5	-2.7	27.9	43.8	56.0	76.0	28.1	32.2	100.0	50.7
3	2394.125	V	29.4	45.8	-1.5	27.9	44.3	56.0	76.0	28.1	31.7	100.0	111.4
4	2795.619	H	26.8	44.2	0.3	27.1	44.5	56.0	76.0	28.9	31.5	100.0	253.2
5	4780.349	H	27.4	43.3	6.4	33.8	49.7	60.0	80.0	26.2	30.3	100.0	352.1
6	5977.125	V	25.2	41.6	8.7	33.9	50.3	60.0	80.0	26.1	29.7	100.0	50.7

◆ Calculation

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

Margin(PK/CAV) [dB] = Limit [dB (μV/m)] - Result(PK/CAV) [dB (μV/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

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Harmonic Current Emissions and Voltage Fluctuations and Flicker

■ AC Mode

Average harmonic current results

Hn	I _{eff} [A]	% of Limit	Limit [A]	Result
1	0.084			
2	0.000	0.045	1.080	n/a
3	0.030	1.316	2.300	PASS
4	0.001	0.146	0.430	n/a
5	0.030	2.625	1.140	PASS
6	0.001	0.189	0.300	n/a
7	0.006	0.747	0.770	PASS
8	0.001	0.243	0.230	n/a
9	0.006	1.510	0.400	PASS
10	0.001	0.336	0.184	n/a
11	0.003	1.053	0.330	n/a
12	0.001	0.396	0.153	n/a
13	0.002	1.162	0.210	n/a
14	0.001	0.428	0.131	n/a
15	0.002	1.059	0.150	n/a
16	0.001	0.510	0.115	n/a
17	0.001	0.813	0.132	n/a
18	0.001	0.579	0.102	n/a
19	0.001	0.938	0.118	n/a
20	0.001	0.633	0.092	n/a
21	0.001	0.413	0.161	n/a
22	0.001	0.676	0.084	n/a
23	0.001	0.861	0.147	n/a
24	0.001	0.824	0.077	n/a
25	0.001	0.650	0.135	n/a
26	0.001	0.776	0.071	n/a
27	0.001	0.553	0.125	n/a
28	0.001	0.872	0.066	n/a
29	0.002	1.360	0.116	n/a
30	0.001	0.918	0.061	n/a
31	0.001	0.604	0.109	n/a
32	0.001	1.010	0.058	n/a
33	0.001	1.225	0.102	n/a
34	0.001	1.091	0.054	n/a
35	0.001	0.866	0.096	n/a
36	0.001	1.429	0.051	n/a
37	0.001	0.733	0.091	n/a
38	0.001	1.198	0.048	n/a
39	0.001	0.751	0.087	n/a
40	0.001	1.282	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	I _{eff} [A]	% of Limit	Limit [A]	Result
1	0.084			
2	0.001	0.037	1.620	n/a
3	0.030	0.881	3.450	PASS
4	0.001	0.110	0.645	n/a
5	0.030	1.756	1.710	PASS
6	0.001	0.140	0.450	n/a
7	0.006	0.507	1.155	PASS
8	0.001	0.180	0.345	n/a
9	0.006	1.023	0.600	PASS
10	0.001	0.246	0.276	n/a
11	0.004	0.719	0.495	n/a
12	0.001	0.354	0.230	n/a
13	0.003	0.803	0.315	n/a
14	0.001	0.319	0.197	n/a
15	0.002	0.744	0.225	n/a
16	0.001	0.453	0.173	n/a
17	0.001	0.588	0.199	n/a
18	0.001	0.539	0.153	n/a
19	0.001	0.693	0.178	n/a
20	0.001	0.478	0.138	n/a
21	0.001	0.471	0.161	n/a
22	0.001	0.508	0.125	n/a
23	0.001	0.918	0.147	n/a
24	0.001	0.727	0.115	n/a
25	0.001	0.704	0.135	n/a
26	0.001	0.582	0.106	n/a
27	0.001	0.602	0.125	n/a
28	0.001	0.728	0.099	n/a
29	0.002	1.454	0.116	n/a
30	0.001	0.759	0.092	n/a
31	0.001	0.668	0.109	n/a
32	0.001	0.789	0.086	n/a
33	0.001	1.304	0.102	n/a
34	0.001	0.850	0.081	n/a
35	0.001	0.968	0.096	n/a
36	0.001	1.549	0.077	n/a
37	0.001	0.836	0.091	n/a
38	0.001	0.923	0.073	n/a
39	0.001	0.845	0.087	n/a
40	0.001	1.198	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.

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■ DC Mode

Average harmonic current results

Hn	I _{eff} [A]	% of Limit	Limit [A]	Result
1	0.043			
2	0.001	0.126	1.080	n/a
3	0.036	1.557	2.300	PASS
4	0.002	0.425	0.430	n/a
5	0.036	3.124	1.140	PASS
6	0.001	0.486	0.300	n/a
7	0.035	4.577	0.770	PASS
8	0.001	0.615	0.230	n/a
9	0.033	8.322	0.400	PASS
10	0.001	0.661	0.184	n/a
11	0.031	9.543	0.330	PASS
12	0.001	0.735	0.153	n/a
13	0.030	14.130	0.210	PASS
14	0.001	0.895	0.131	n/a
15	0.028	18.398	0.150	PASS
16	0.001	0.938	0.115	n/a
17	0.026	19.274	0.132	PASS
18	0.001	1.002	0.102	n/a
19	0.023	19.675	0.118	PASS
20	0.001	1.089	0.092	n/a
21	0.021	13.090	0.161	PASS
22	0.001	1.183	0.084	n/a
23	0.019	12.705	0.147	PASS
24	0.001	1.300	0.077	n/a
25	0.016	12.209	0.135	PASS
26	0.001	1.339	0.071	n/a
27	0.014	11.543	0.125	PASS
28	0.001	1.527	0.066	n/a
29	0.012	10.483	0.116	PASS
30	0.001	1.528	0.061	n/a
31	0.010	9.602	0.109	PASS
32	0.001	1.682	0.058	n/a
33	0.009	8.583	0.102	PASS
34	0.001	1.767	0.054	n/a
35	0.007	7.642	0.096	PASS
36	0.001	1.853	0.051	n/a
37	0.006	6.918	0.091	PASS
38	0.001	1.973	0.048	n/a
39	0.005	6.284	0.087	PASS
40	0.001	1.922	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.

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Test Data - Harmonics (continued)

Maximum harmonic current results

Hn	I _{eff} [A]	% of Limit	Limit [A]	Result
1	0.043			
2	0.002	0.109	1.620	n/a
3	0.038	1.089	3.450	PASS
4	0.003	0.404	0.645	n/a
5	0.036	2.098	1.710	PASS
6	0.002	0.511	0.450	n/a
7	0.036	3.117	1.155	PASS
8	0.002	0.494	0.345	n/a
9	0.034	5.596	0.600	PASS
10	0.001	0.510	0.276	n/a
11	0.032	6.460	0.495	PASS
12	0.001	0.589	0.230	n/a
13	0.030	9.587	0.315	PASS
14	0.001	0.734	0.197	n/a
15	0.028	12.484	0.225	PASS
16	0.001	0.762	0.173	n/a
17	0.026	12.945	0.199	PASS
18	0.001	0.791	0.153	n/a
19	0.024	13.232	0.178	PASS
20	0.001	0.858	0.138	n/a
21	0.021	13.218	0.161	PASS
22	0.001	0.923	0.125	n/a
23	0.019	12.860	0.147	PASS
24	0.001	1.040	0.115	n/a
25	0.017	12.418	0.135	PASS
26	0.001	1.051	0.106	n/a
27	0.015	11.766	0.125	PASS
28	0.001	1.233	0.099	n/a
29	0.012	10.724	0.116	PASS
30	0.001	1.193	0.092	n/a
31	0.011	9.817	0.109	PASS
32	0.001	1.262	0.086	n/a
33	0.009	8.715	0.102	PASS
34	0.001	1.370	0.081	n/a
35	0.008	7.814	0.096	PASS
36	0.001	1.502	0.077	n/a
37	0.007	7.229	0.091	PASS
38	0.001	1.578	0.073	n/a
39	0.006	6.667	0.087	PASS
40	0.001	1.508	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.

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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

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Test Setup Photos and Configuration

Conducted Emissions at Mains Power Ports

■ DC Mode



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Conducted Emissions at Telecommunication Ports

■ DC Mode



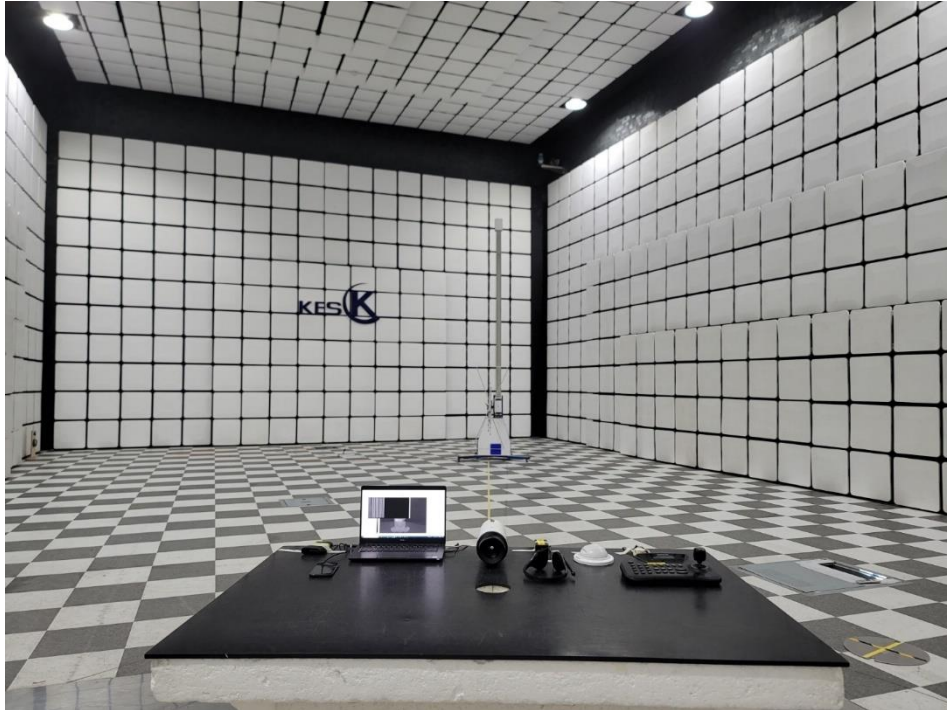
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■ PoE Mode



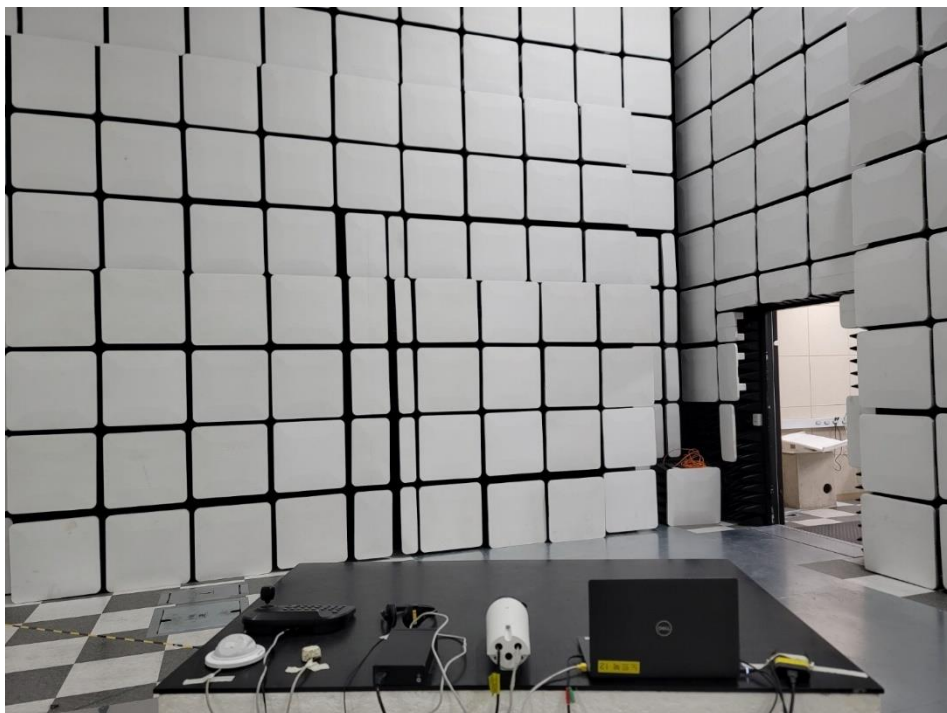
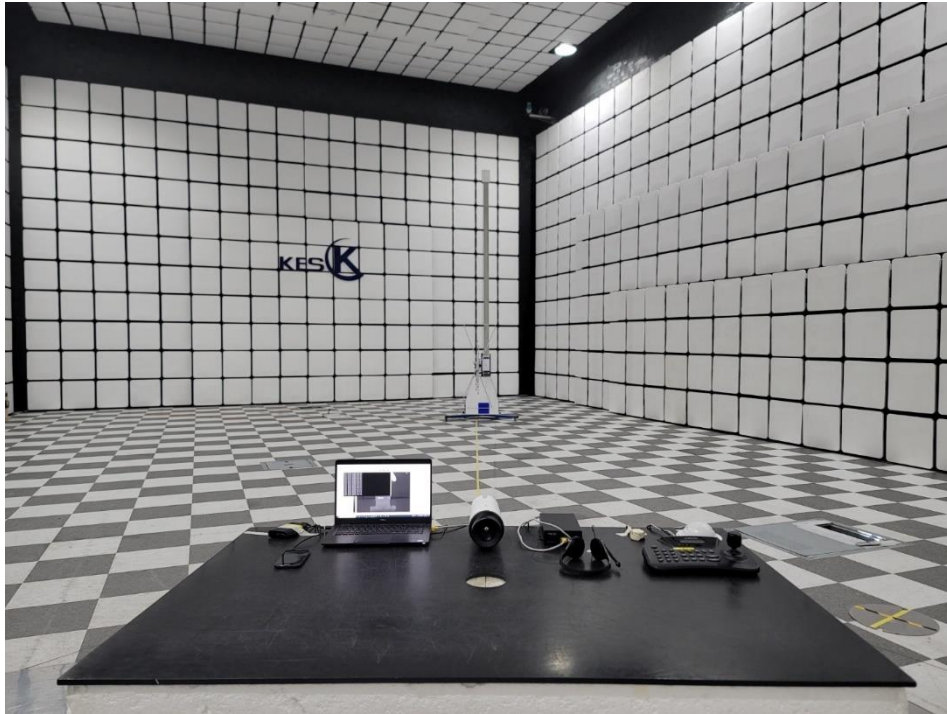
Radiated Electric Field Emissions(Below 1 GHz)

■ DC Mode



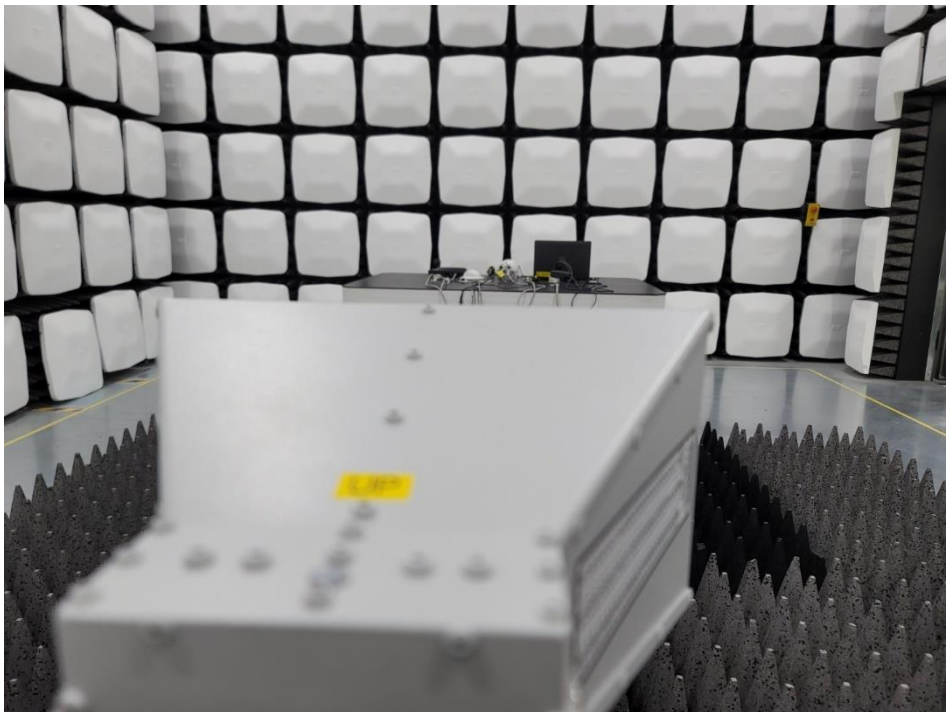
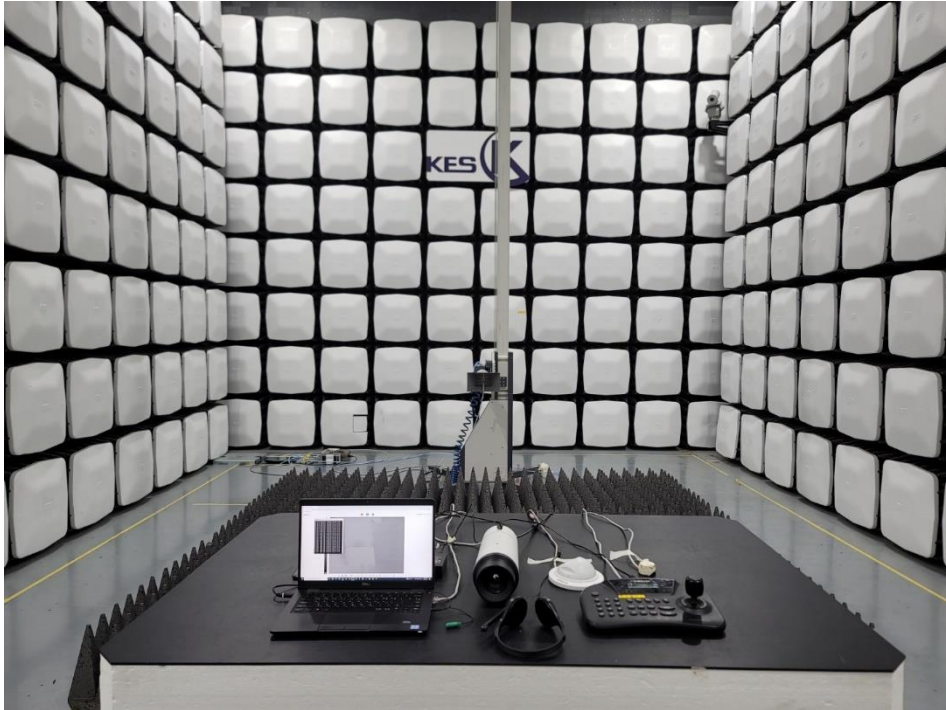
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■ PoE Mode



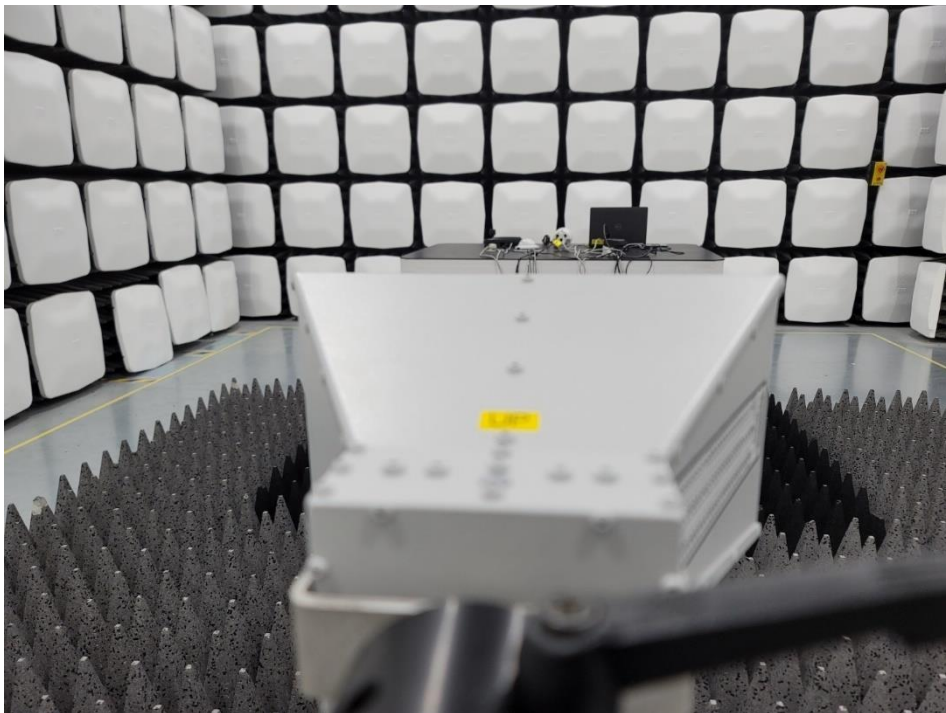
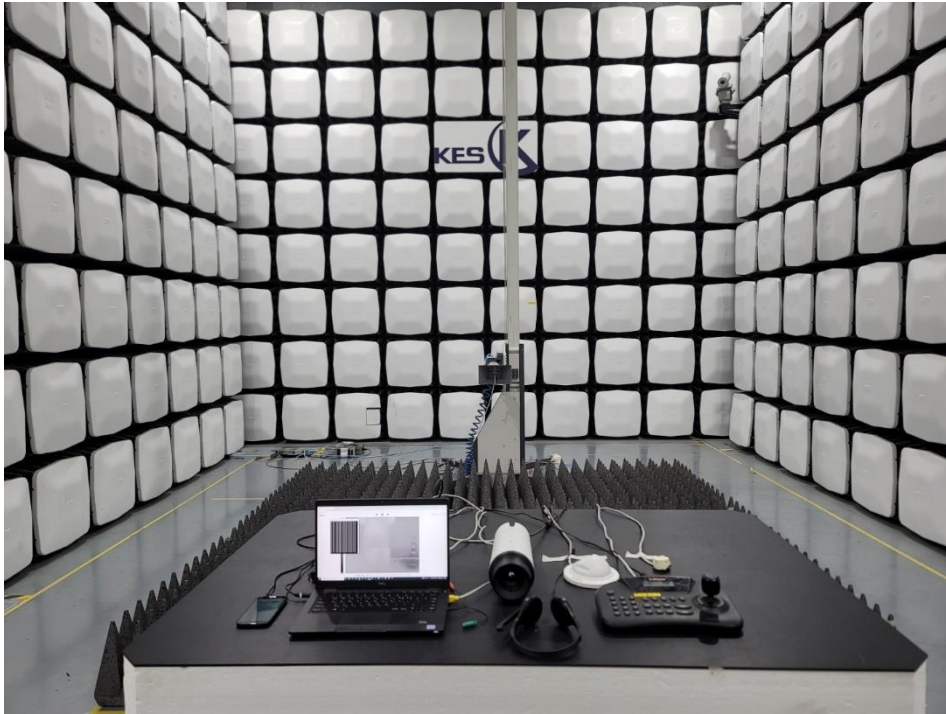
Radiated Electric Field Emissions(Above 1 GHz)

■ DC Mode



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■ PoE Mode



Harmonic Current Emissions and Voltage Fluctuations and Flicker

■ DC Mode



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Electrostatic Discharge

■ DC Mode



■ PoE Mode



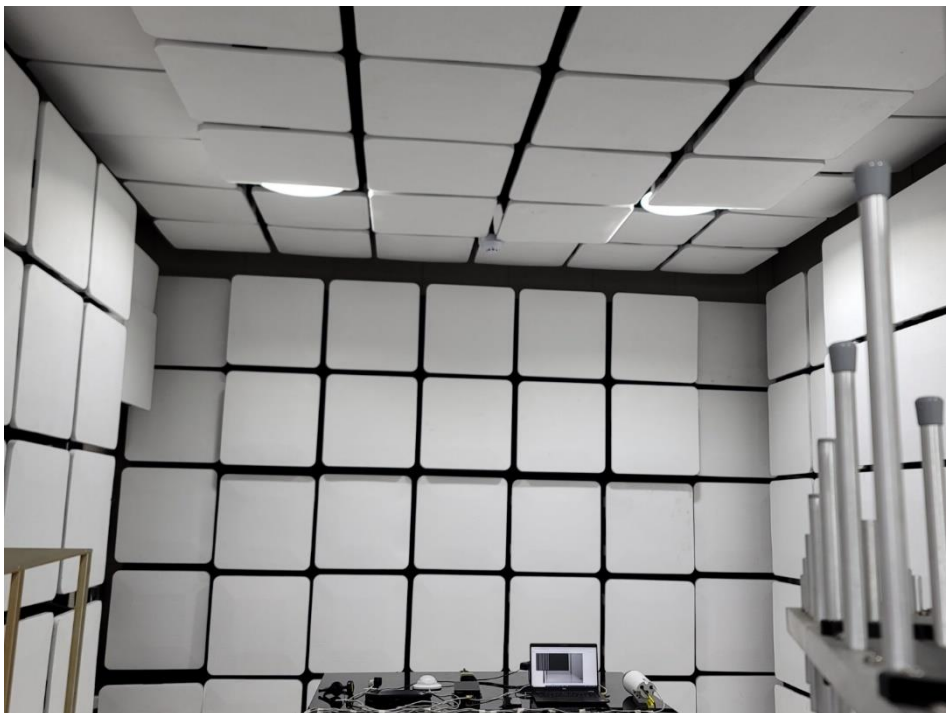
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Radiated Electric Field Immunity

■ DC Mode



■ PoE Mode



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Electrical Fast Transients/Bursts

■ DC Mode



■ PoE Mode



Surge Transients

■ DC Mode



■ PoE Mode



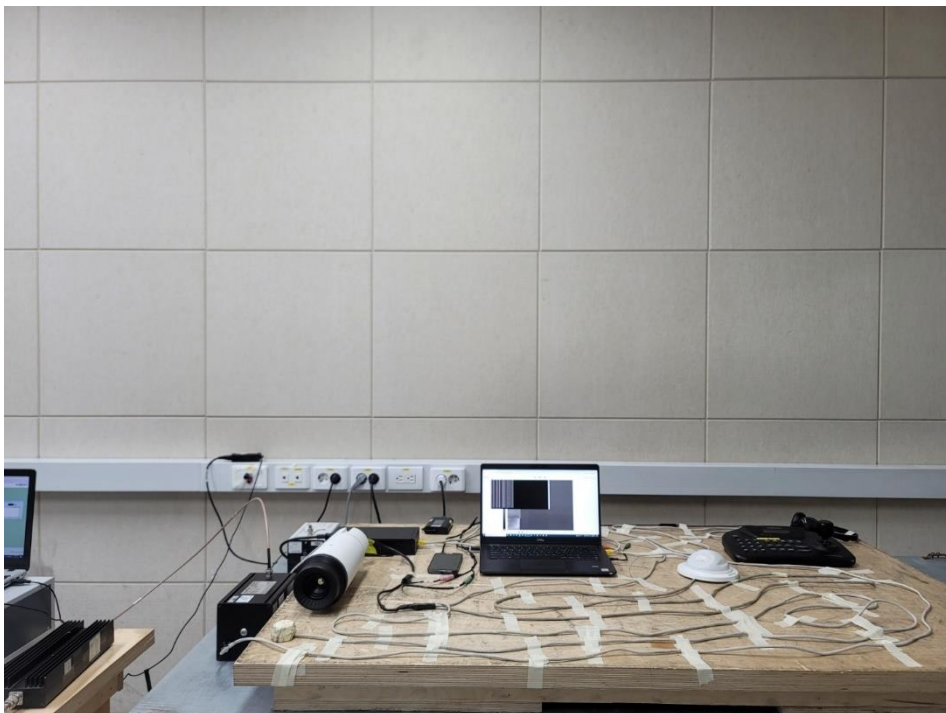
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Conducted Disturbance

■ DC Mode



■ PoE Mode



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Voltage Dips and Short Interruptions

■ DC Mode



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EUT External Photographs

(Top)



(Bottom)



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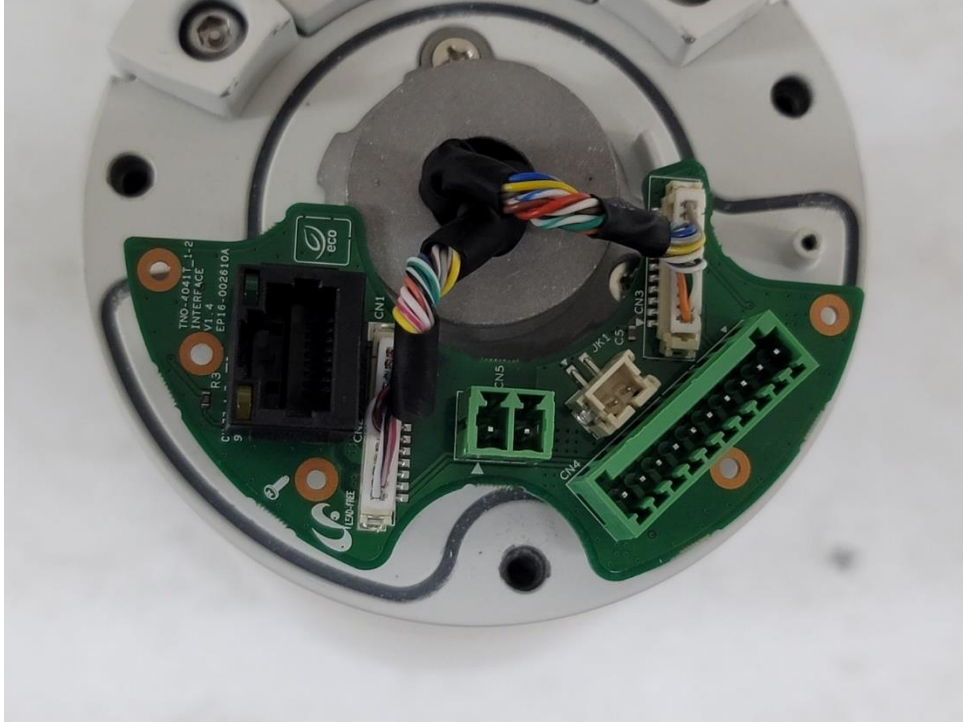
EUT Internal Photographs

(Internal View)



EUT Internal View – Board 1

(Top)

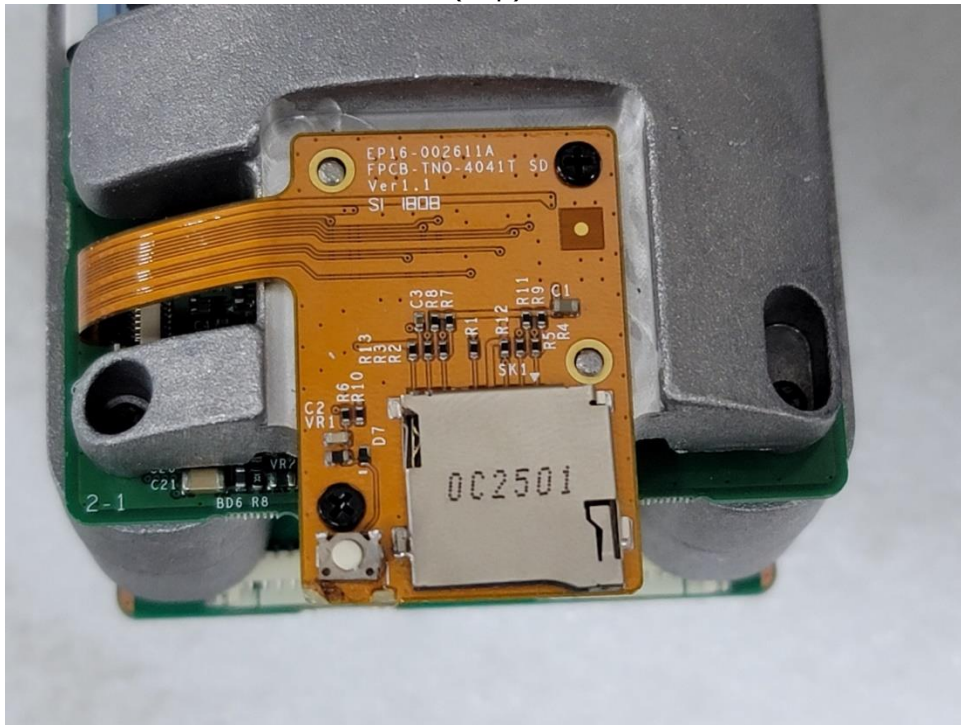


(Bottom)



EUT Internal View – Board 2

(Top)



(Bottom)



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EUT Internal View – Board 3

(Top)



(Bottom)



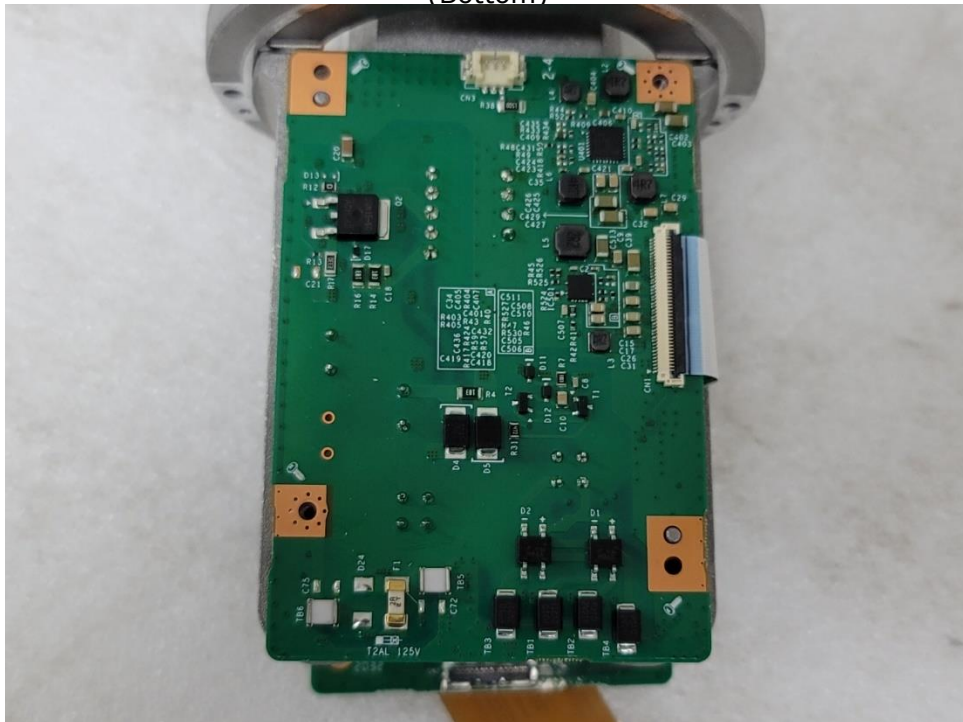
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EUT Internal View – Board 4

(Top)



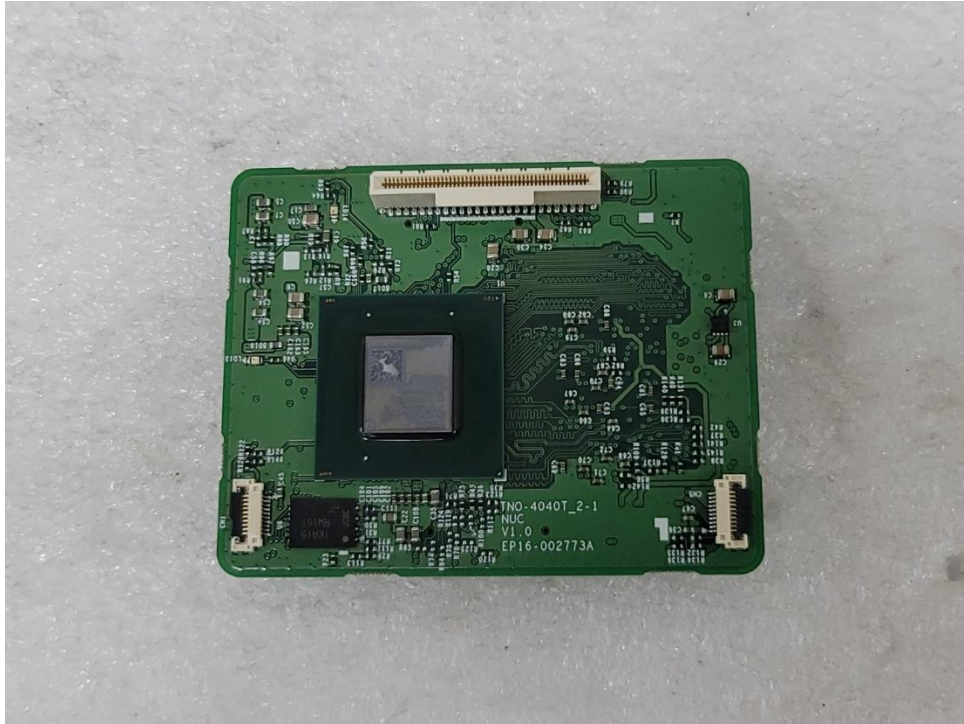
(Bottom)



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EUT Internal View – Board 5

(Top)



(Bottom)



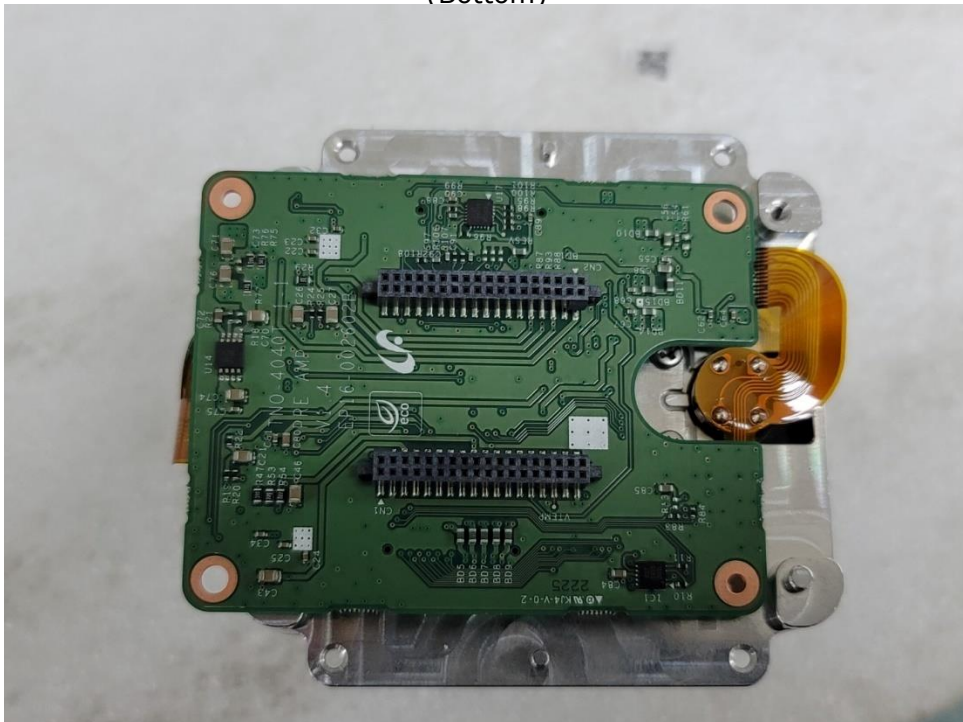
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EUT Internal View – Board 6

(Top)



(Bottom)



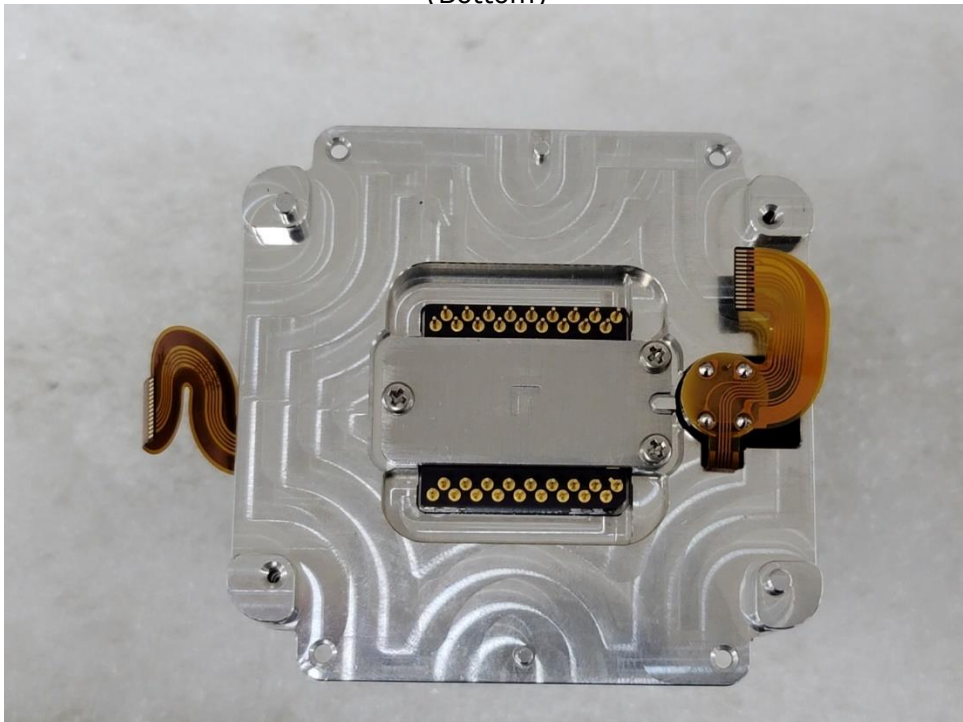
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EUT Internal View – Lens

(Top)



(Bottom)



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Label and Location



Thermal Camera

Model No : TNO-4041TR

Manufacturer : HANWHA VISION VIETNAM COMPANY LIMITED

Made in Vietnam

