



# TEST REPORT



Report No. : KES-EM-22T0674-R3  
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**KES Co., Ltd.**  
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## 1. Client

Applicant : Hanwha Vision Co., Ltd  
Applicant Address : 6, Pangyo-ro 319Beon-gil, Bundang-gu, Seongnam-si,  
Gyeonggi-do, Republic of Korea

## 2. Sample Description

Product name : NETWORK THERMAL CAMERA  
Model/Type No. : TNO-4050T  
Variant Model : TNO-4030T, TNO-4040T, TNO-L4030T, TNO-L4040T, TNO-L4050T  
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)

3. Date of Receipt : Mar. 26, 2024

4. Test date : Jul. 21, 2022 ~ Jul. 25, 2022

5. Date of Issue : Mar. 26, 2024

6. Test Results : In Compliance

Tested by

[최선희]2024/03/26

Reviewed by

[장동훈]2024/03/26

Seon Ho, Choi  
EMC Test Engineer

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-22T0674    | Issued                                                                |
| Feb. 24, 2023 | KES-EM-22T0674-R1 | Change the Applicant and manufacturer at the request of the customer. |
| Feb. 21, 2024 | KES-EM-22T0674-R2 | Change the manufacturer at the request of the customer.               |
| Mar. 26, 2024 | KES-EM-22T0674-R3 | Product name change and reissue due to addition of derivative model   |
|               |                   |                                                                       |
|               |                   |                                                                       |
|               |                   |                                                                       |
|               |                   |                                                                       |
|               |                   |                                                                       |
|               |                   |                                                                       |

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## 1.0 General Product Description

Main Specifications of EUT are:

| Video                             |                                                                                                                                                                                                                                  |
|-----------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Imaging Device                    | Uncooled Micro volometer                                                                                                                                                                                                         |
| Pixel size                        | 17µm                                                                                                                                                                                                                             |
| Effective Pixels                  | 640x480(Scale up 800x600)                                                                                                                                                                                                        |
| Sensitivity                       | NETD < 50mK                                                                                                                                                                                                                      |
| Video Out                         | CVBS : 1.0 Vp-p / 75Ω composite, 720x480(N), 720x576(P), for installation<br>USB : Micro USB type B, 1280x720, for installation                                                                                                  |
| Lens                              |                                                                                                                                                                                                                                  |
| Focal Length (Zoom Ratio)         | 35mm fixed                                                                                                                                                                                                                       |
| Max. Aperture Ratio               | 1.0                                                                                                                                                                                                                              |
| Angular Field of View             | H: 17°                                                                                                                                                                                                                           |
| Min. Object Distance              | TBD                                                                                                                                                                                                                              |
| Focus Control                     | Fixed                                                                                                                                                                                                                            |
| Lens Type                         | TBD                                                                                                                                                                                                                              |
| Mount Type                        | Board-in type                                                                                                                                                                                                                    |
| Operational                       |                                                                                                                                                                                                                                  |
| Camera Title                      | Off / On<br>- W/W : English/Numeric/Special Characters<br>- China : English/Numeric/Special/Chinese Characters<br>- Common : Multi-line (Max 5), Color (Grey/Green/Red/Blue/Black/White), Transparency, Auto Scale by Resolution |
| Digital Image Stabilization       | Off / On(with Gyro)                                                                                                                                                                                                              |
| Motion Detection                  | Off/ On(8ea, 8point Polygonal zones), Handover                                                                                                                                                                                   |
| Privacy Masking                   | Off / On (32ea, polygonal zones)<br>- Color : Grey/Green/Red/Blue/Black/White<br>- Mosaic                                                                                                                                        |
| Gain Control                      | Off / Low / Middle / High                                                                                                                                                                                                        |
| Electronic Shutter Speed          | Minimum / Maximum / Anti flicker (2 ~ 1/12,000sec)                                                                                                                                                                               |
| Pan/Tilt                          | Pelco D/P, Samsung T/E, Honeywell, Bosch, Panasonic, Sungin, AD, Vicon, GE                                                                                                                                                       |
| Flip / Mirror                     | Flip : On/Off<br>Mirror : On/Off<br>Halfway view : 90°/270°                                                                                                                                                                      |
| Video & Audio Analytics           | Tampering, Loitering, Directional Detection, Virtual Line, Fence detection, Enter/Exit, Appear / Disappear, Audio Detection, Motion Detection, Sound Classification, Shock detection, drastic temperature swings                 |
| Alarm I/O                         | Input 2ea / Output 2ea                                                                                                                                                                                                           |
| Alarm Triggers                    | Alarm Input, Motion Detection, Video & Audio Analytics, Network Disconnect                                                                                                                                                       |
| Alarm events                      | File upload via FTP, E-Mail<br>Notification via E-Mail<br>local storage(SD/SDHC/SDXC) or NAS recording at Event Triggers<br>External output                                                                                      |
| Audio In                          | Selectable (Mic IN/Line IN),<br>Supply voltage: 2.5VDC(4mA), Input impedance: approx. 2K Ohm                                                                                                                                     |
| Audio out                         | Line out, Max output level: 1 Vrms                                                                                                                                                                                               |
| Pixel count                       | support                                                                                                                                                                                                                          |
| Digital zoom                      | -                                                                                                                                                                                                                                |
| Remote control                    | -                                                                                                                                                                                                                                |
| Network                           |                                                                                                                                                                                                                                  |
| Ethernet                          | RJ-45 (10/100BASE-T)                                                                                                                                                                                                             |
| Video Compression Format          | H.265/H.264 (MPEG-4 Part 10/AVC) : Main/Baseline/High , Motion JPEG                                                                                                                                                              |
| Resolution                        | 800x600, 640x480, 640x360, 320x240                                                                                                                                                                                               |
| Max. Framerate                    | H.265/H.264 : Max. 30fps at all resolutions<br>Motion JPEG : Max. 30fps                                                                                                                                                          |
| Smart Codec                       | Manual Mode (area-based : SEA)                                                                                                                                                                                                   |
| WiseStream II                     | Support                                                                                                                                                                                                                          |
| Video Quality Adjustment          | H.264/H.265 : Target Bitrate Level Control<br>MJPEG : Target Bitrate Level Control                                                                                                                                               |
| Bitrate Control Method            | H.264/H.265 : CBR or VBR<br>MJPEG : VBR                                                                                                                                                                                          |
| Streaming Capability              | Multiple Streaming (Up to 10 Profiles)                                                                                                                                                                                           |
| Audio Compression Format          | G.711 u-law /G.726 Selectable<br>G.726 (ADPCM) 8KHz, G.711 8KHz<br>G.726 : 16Kbps, 24Kbps, 32Kbps, 40Kbps<br>AAC-LC : 48Kbps at 8/16/32/48KHz                                                                                    |
| Audio Communication               | Bi-directional (2-Way)                                                                                                                                                                                                           |
| IP                                | IPv4, IPv6                                                                                                                                                                                                                       |
| Protocol                          | TCP/IP, UDP/IP, RTP(UDP), RTP(TCP), RTCP,RTSP, NTP, HTTP, HTTPS, SSL/TLS, DHCP, PPPoE, FTP, SMTP, ICMP, IGMP, SNMPv1/v2c/v3(MIB-2), ARP, DNS, DDNS, QoS, PIM-SM, UPnP, Bonjour                                                   |
| Security                          | HTTPS(SSL) Login Authentication<br>Digest Login Authentication<br>IP Address Filtering<br>User access Log<br>802.1X Authentication (EAP-TLS, EAP-LEAP)                                                                           |
| Streaming Method                  | Unicast / Multicast                                                                                                                                                                                                              |
| Max. User Access                  | 20 users at Unicast Mode                                                                                                                                                                                                         |
| Edge Storage                      | SD/SDHC/SDXC (up to 256 GB)<br>- Motion images recorded in the SD/SDHC/SDXC memory card can be downloaded.<br>NAS(Network Attached Storage)<br>Local PC for Instant Recording                                                    |
| Application Programming Interface | ONVIF Profile S/G<br>SUNAPI(HTTP API)<br>Open Platform                                                                                                                                                                           |
| Webpage Language                  | English, Korean, Chinese, French, Italian, Spanish, German, Japanese, Russian, Swedish., Portuguese, Czech, Polish, Turkish, Dutch, Hungarian, Greek                                                                             |
| Web Viewer                        | TBD                                                                                                                                                                                                                              |
| Central Management Software       | SmartViewer, SSM                                                                                                                                                                                                                 |
| Environmental                     |                                                                                                                                                                                                                                  |
| Operating Temperature / Humidity  | -40°C ~ +60°C (-40°F ~ +131°F) / Less than 90% RH                                                                                                                                                                                |
| Storage Temperature / Humidity    | -50°C ~ +60°C (-58°F ~ +140°F) / Less than 90% RH                                                                                                                                                                                |
| Ingress Protection                | IP66, NEMA 4X                                                                                                                                                                                                                    |
| Vandal Resistance                 | IK10                                                                                                                                                                                                                             |
| Electrical                        |                                                                                                                                                                                                                                  |
| Input Voltage / Current           | 24VAC ± 10%, 12VDC ± 10%, PoE(IEEE802.3af)                                                                                                                                                                                       |
| Power Consumption                 | TBD                                                                                                                                                                                                                              |
| Mechanical                        |                                                                                                                                                                                                                                  |
| Color / Material                  | TBD                                                                                                                                                                                                                              |
| Dimension (WxHxD)                 | TBD                                                                                                                                                                                                                              |
| Weight                            | TBD                                                                                                                                                                                                                              |
| 기타                                | Palette 7mode                                                                                                                                                                                                                    |



## 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

- TNO-4030T, TNO-4040T, TNO-L4030T : Added derivative model due to HW same FW difference.
- TNO-L4040T, TNO-L4050T : Add derivative model due to SW difference  
(Number of video frames: 30 → 8)

## 1.3 Device Modifications

Not applicable

## 1.4 Equipment Under Test

| Description            | Model Number | Serial Number | Manufacturer    | Remarks |
|------------------------|--------------|---------------|-----------------|---------|
| NETWORK THERMAL CAMERA | TNO-4050T    | -             | D-TECH CO.,LTD. | EUT     |

## 1.5 Support Equipments

| Description      | Model Number | Serial Number | Manufacturer                                 | Remarks |
|------------------|--------------|---------------|----------------------------------------------|---------|
| AC/DC Adapter    | 2ACB022F     | -             | ChAnnel Well Technology (Guangzhou) Co.,Ltd. | -       |
| PoE Adapter      | PSE156G      | -             | -                                            | -       |
| AC Adapter       | DRL-246000AC | -             | Dream Electronics Co., Ltd.                  | -       |
| Notebook         | LG15N54      | 410NZGK015231 | LG Electronics Inc.                          | -       |
| Notebook Adapter | ADP-90WH B   | 84ZW19F1663   | DELTA ELECTRONICS (JIANGSU) LTD.             | -       |
| Alarm            | PRO-SL       | -             | SENSOR PRO                                   | -       |
| Button Alarm     | -            | -             | -                                            | -       |
| Headset          | K550         | -             | Britz®                                       | -       |
| SmartPhone       | SM-N920S     | -             | Samsung                                      | -       |
| Micro SD Card    | -            | -             | SanDisk                                      | -       |



## 1.6 External I/O Cabling

### ■ AC Mode

| Start                        |                    | END              |                    | Cable Spec. |        |
|------------------------------|--------------------|------------------|--------------------|-------------|--------|
| Description                  | I/O Port           | Description      | I/O Port           | Length      | Shield |
| NETWORK THERMAL CAMERA (EUT) | 2 Pin              | AC Adapter       | 2 Pin              | 2.0         | U      |
|                              | RJ-45(LAN)         | Notebook         | RJ-45(LAN)         | 3.0         | U      |
|                              | Alarm OUT          | Alarm            | Alarm IN           | 4.0         | U      |
|                              | Alarm IN           | Button Alarm     | Alarm OUT          | 3.5         | U      |
|                              | 3.5 mm             | Headset          | 3.5 mm             | 1.8         | U      |
|                              | 3.5 mm             |                  | 3.5 mm             | 1.8         | U      |
|                              | Micro SD Card Slot | Micro SD Card    | Micro SD Card Slot | -           | -      |
| Notebook                     | 3.5 mm             | SmartPhone       | 3.5 mm             | 1.1         | U      |
|                              | DC Jack            | Notebook Adapter | DC Jack            | 1.9         | U      |

\* Unshielded=U, Shielded=S

### ■ DC Mode

| Start                        |                    | END              |                    | Cable Spec. |        |
|------------------------------|--------------------|------------------|--------------------|-------------|--------|
| Description                  | I/O Port           | Description      | I/O Port           | Length      | Shield |
| NETWORK THERMAL CAMERA (EUT) | 2 Pin              | AC/DC Adapter    | 2 Pin              | 1.6         | U      |
|                              | RJ-45(LAN)         | Notebook         | RJ-45(LAN)         | 3.0         | U      |
|                              | Alarm OUT          | Alarm            | Alarm IN           | 4.0         | U      |
|                              | Alarm IN           | Button Alarm     | Alarm OUT          | 3.5         | U      |
|                              | 3.5 mm             | Headset          | 3.5 mm             | 1.8         | U      |
|                              | 3.5 mm             |                  | 3.5 mm             | 1.8         | U      |
|                              | Micro SD Card Slot | Micro SD Card    | Micro SD Card Slot | -           | -      |
| Notebook                     | 3.5 mm             | SmartPhone       | 3.5 mm             | 1.1         | U      |
|                              | DC Jack            | Notebook Adapter | DC Jack            | 1.9         | U      |

\* Unshielded=U, Shielded=S



## ■ PoE Mode

| Start                        |                    | END              |                    | Cable Spec. |        |
|------------------------------|--------------------|------------------|--------------------|-------------|--------|
| Description                  | I/O Port           | Description      | I/O Port           | Length      | Shield |
| NETWORK THERMAL CAMERA (EUT) | RJ-45(PoE)         | PoE Adapter      | RJ-45(PoE)         | 3.0         | U      |
|                              | Alarm OUT          | Alarm            | Alarm IN           | 4.0         | U      |
|                              | Alarm IN           | Button Alarm     | Alarm OUT          | 3.5         | U      |
|                              | 3.5 mm             | Headset          | 3.5 mm             | 1.8         | U      |
|                              | 3.5 mm             |                  | 3.5 mm             | 1.8         | U      |
|                              | Micro SD Card Slot | Micro SD Card    | Micro SD Card Slot | -           | -      |
| PoE Adapter                  | RJ-45(LAN)         | Notebook         | RJ-45(LAN)         | 2.0         | U      |
| Notebook                     | 3.5 mm             | SmartPhone       | 3.5 mm             | 1.1         | U      |
|                              | DC Jack            | Notebook Adapter | DC Jack            | 1.9         | U      |

\* Unshielded=U, Shielded=S

## 1.7 EUT Operating Mode(s)

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

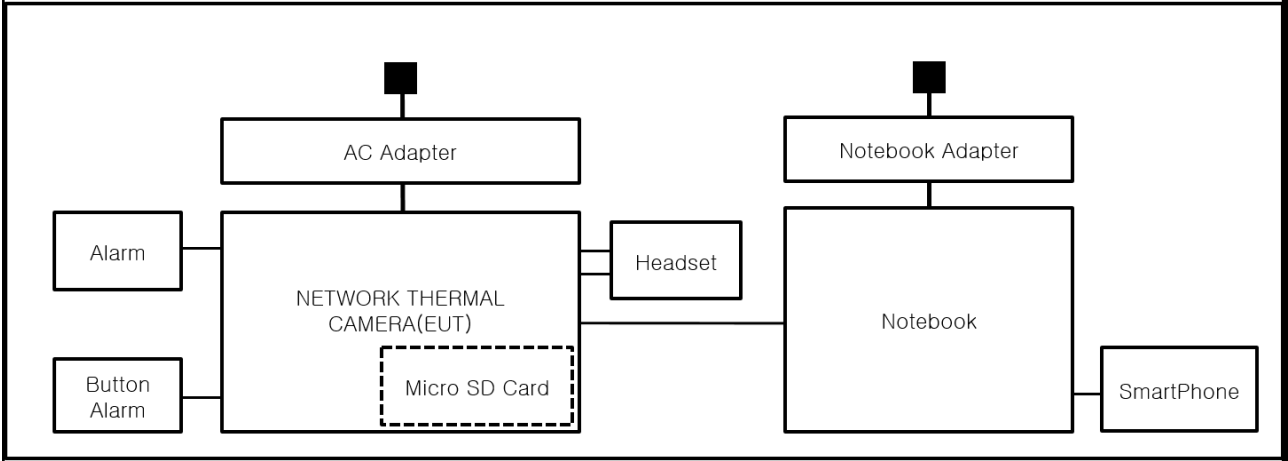
| EUT Test operating S/W |         |                        |
|------------------------|---------|------------------------|
| Name                   | Version | Manufacture Company    |
| Web Viewer             | -       | Hanwha Vision Co., Ltd |



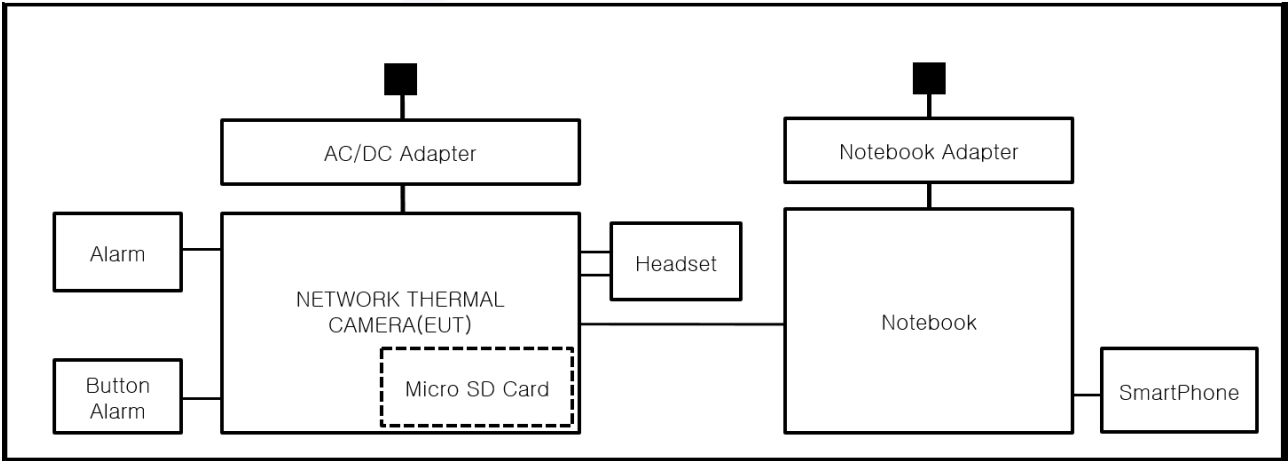
1.8 Configuration

■ AC Main  
□ DC Main

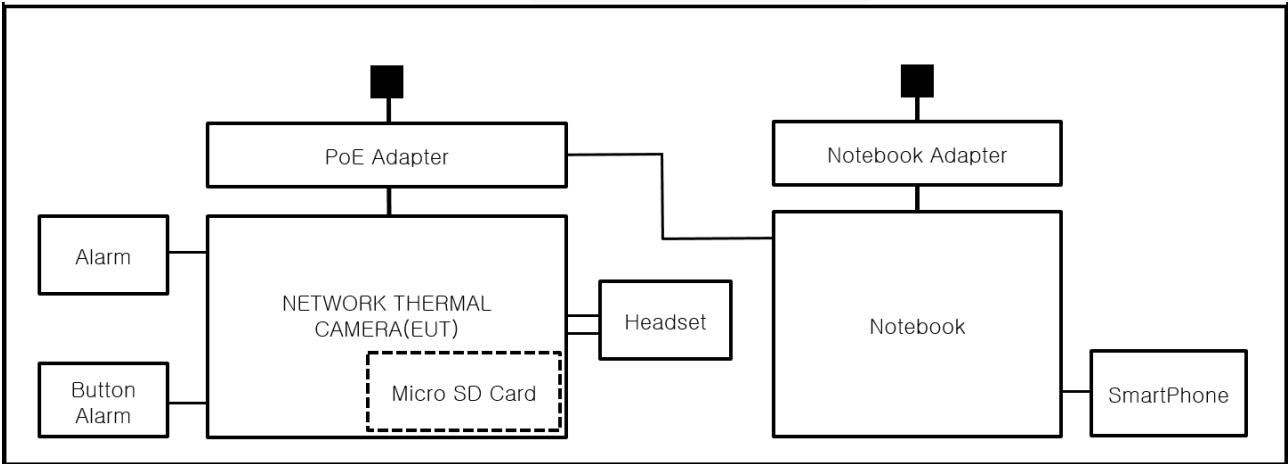
■ AC Mode



■ DC Mode



■ PoE Mode



**1.9 Remarks when standards applied**

The USB, 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)<br>EMS (ESD, RS, EFT/Burst, Surge, CS, Magnetic, Dips and interruptions) | <br>KR0100                                  |
| International | KOLAS   | EMI (3 m & 10 m Semi-Anechoic Chamber and conducted test site)<br>EMS (ESD, RS, EFT/Burst, Surge, CS, Magnetic, Dips and interruptions) | <br>KT489                                  |
| USA           | FCC     | 3 m & 10 m Semi-Anechoic Chamber Conducted test site to perform FCC Part 15/18 measurements.                                            | <br>KR0100                                |
| Canada        | ISED    | 3 m & 10 m Semi-Anechoic Chamber and Conducted test site                                                                                | <br>23298                                 |
| JAPAN         | VCCI    | EMI (3 m & 10 m Semi-Anechoic Chamber and conducted test site)                                                                          | <br>C-20136, T-20137,<br>R-20181, G-20176 |
| Europe        | TÜV SÜD | EMI (3 m & 10 m Semi-Anechoic Chamber and conducted test site)<br>EMS (ESD, RS, EFT/Burst, Surge, CS, Magnetic, Dips and interruptions) | <br>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. 21, 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: (24,7 ± 0,2) °C

Relative Humidity: (45,4 ± 0,3) % 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.



## 2.2 Conducted Emissions at Telecommunication Ports

**Test Date**

Jul. 21, 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: (24,7 ± 0,2) °C

Relative Humidity: (45,4 ± 0,2) % 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. 21, 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: (24,5 ± 0,3) °C

Relative Humidity: (44,9 ± 0,5) % 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**

Jul. 21, 2022

**Test Location**

SEMI ANECHOIC CHAMBER #5

**Test Equipment**

| Used                                | Description                | Model Number | Manufacturer     | Serial Number | Cal. Due     |
|-------------------------------------|----------------------------|--------------|------------------|---------------|--------------|
| <input checked="" type="checkbox"/> | EMI Test SW                | EP5/RE       | TOYO Corporation | 6.0.0         | -            |
| <input checked="" type="checkbox"/> | EMI TEST RECEIVER          | ESR7         | R & S            | 101190        | 08, 01, 2023 |
| <input checked="" type="checkbox"/> | PREAMPLIFIER               | 8449B        | AGILENT          | 3008A01967    | 04, 01, 2023 |
| <input checked="" type="checkbox"/> | DOUBLE RIDGED HORN ANTENNA | SAS-571      | A.H.SYSTEM,INC   | 781           | 03, 03, 2023 |

**Test Conditions**

Temperature: (24,8 ± 0,2) °C

Relative Humidity: (44,8 ± 0,4) % 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

**Remarks**See Appendix A for test data.



## 2.5 Harmonic Current Emissions

**Test Date**

Jul. 25, 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: (24,6 ± 0,2) °C

Relative Humidity: (46,8 ± 0,3) % 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. 25, 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: (24,6 ± 0,4) °C

Relative Humidity: (46,8 ± 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  $U = 130 \text{ dB}\mu\text{V}$ .

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**

Jul. 25, 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: (24,7 ± 0,1) °C  
Relative Humidity: (45,3 ± 0,1) % R.H.  
Atmospheric Pressure: (99,2 ± 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

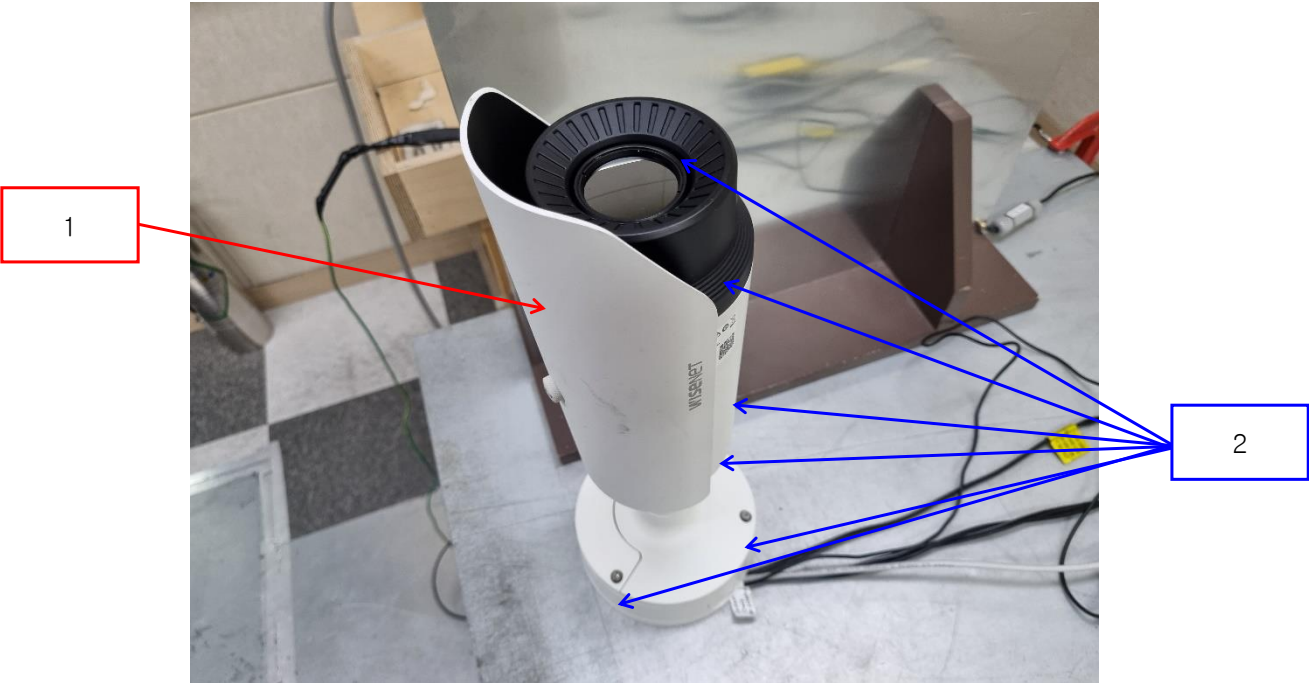
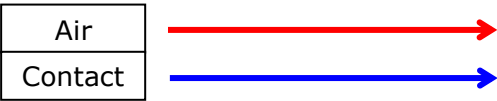
|                    |                                          |                                          |                                          |                                          |
|--------------------|------------------------------------------|------------------------------------------|------------------------------------------|------------------------------------------|
| Discharge Voltage: | Contact                                  | Air                                      | HCP                                      | VCP                                      |
|                    | <input type="checkbox"/> 2 kV            | <input checked="" type="checkbox"/> 2 kV | <input type="checkbox"/> 2 kV            | <input type="checkbox"/> 2 kV            |
|                    | <input type="checkbox"/> 4 kV            | <input checked="" type="checkbox"/> 4 kV | <input type="checkbox"/> 4 kV            | <input type="checkbox"/> 4 kV            |
|                    | <input checked="" type="checkbox"/> 6 kV | <input type="checkbox"/> 6 kV            | <input checked="" type="checkbox"/> 6 kV | <input checked="" type="checkbox"/> 6 kV |
|                    | <input type="checkbox"/> 8 kV            | <input checked="" type="checkbox"/> 8 kV | <input type="checkbox"/> 8 kV            | <input type="checkbox"/> 8 kV            |
|                    | <input type="checkbox"/> 15 kV           | <input type="checkbox"/> 15 kV           | <input type="checkbox"/> 15 kV           | <input type="checkbox"/> 15 kV           |

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

Required Performance Criteria: ☒ Complied



Location of Discharge:



**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   | Cover                             | Air Discharge     | Complied     | -       |
| 2   | Enclosure, Around the lens, 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   | Cover                             | Air Discharge     | Complied     | -       |
| 2   | Enclosure, Around the lens, Screw | 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   | Cover                             | Air Discharge     | Complied     | -       |
| 2   | Enclosure, Around the lens, 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

**Remarks**

PASS Required Performance Criteria



### 3.2 Radiated Electric Field Immunity

**Reference Standard**

EN IEC 61000-4-3:2020

**Test Date**

Jul. 23, 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 SW                     | EMC32        | R & S           | 10.10.02      | -            |
| <input checked="" type="checkbox"/> | SIGNAL GENERATOR                | SMB 100A     | Rohde & Schwarz | 108252        | 08, 03, 2022 |
| <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: (24,7 ± 0,4) °C  
Relative Humidity: (44,8 ± 0,7) % R.H.  
Atmospheric Pressure: (100,2 ± 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. 25, 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: (24,7 ± 0,2) °C  
Relative Humidity: (45,3 ± 0,3) % R.H.  
Atmospheric Pressure: (99,2 ± 0,0) 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 (LAN)         | Complied       | Complied       |
| Alarm IN            | Complied       | Complied       |
| Alarm OUT           | 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 (LAN)         | Complied       | Complied       |
| Alarm IN            | Complied       | Complied       |
| Alarm OUT           | 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(PoE)          | Complied       | Complied       |
| Alarm IN            | Complied       | Complied       |
| Alarm OUT           | 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. 25, 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<br>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: (24,7 ± 0,3) °C  
Relative Humidity: (45,3 ± 0,3) % R.H.  
Atmospheric Pressure: (99,2 ± 0,0) kPa

**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) kVDifferential 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 (LAN)         | 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 (LAN)         | 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(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. 23, 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, 01, 2023 |
| <input checked="" type="checkbox"/> | EM CLAMP                  | KEMZ 801A    | TESEQ        | 44099         | 11, 25, 2022 |

**Test Conditions**

Temperature: (24,9 ± 0,3) °C  
Relative Humidity: (45,1 ± 0,5) % R.H.  
Atmospheric Pressure: (99,9 ± 0,0) kPa



**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



**Test Data**

## ■ AC Mode

☒ Input a.c. power ports

| Coupling Location<br>(Line Stressed) | Coupling Method | Observations |
|--------------------------------------|-----------------|--------------|
| L – N                                | CDN             | Complied     |

☐ Input d.c. power ports

| Coupling Location<br>(Line Stressed) | Coupling Method | Observations |
|--------------------------------------|-----------------|--------------|
| -                                    | -               | -            |

☒ Signal ports and telecommunication ports

| Coupling Location<br>(Line Stressed) | Coupling Method | Observations |
|--------------------------------------|-----------------|--------------|
| RJ-45 (LAN)                          | CDN             | Complied     |
| Alarm IN                             | Clamp           | Complied     |
| Alarm OUT                            | Clamp           | Complied     |

## ■ DC Mode

☒ Input a.c. power ports

| Coupling Location<br>(Line Stressed) | Coupling Method | Observations |
|--------------------------------------|-----------------|--------------|
| L – N                                | CDN             | Complied     |

☐ Input d.c. power ports

| Coupling Location<br>(Line Stressed) | Coupling Method | Observations |
|--------------------------------------|-----------------|--------------|
| -                                    | -               | -            |

☒ Signal ports and telecommunication ports

| Coupling Location<br>(Line Stressed) | Coupling Method | Observations |
|--------------------------------------|-----------------|--------------|
| RJ-45 (LAN)                          | CDN             | Complied     |
| Alarm IN                             | Clamp           | Complied     |
| Alarm OUT                            | Clamp           | Complied     |



## ■ PoE Mode

☐ Input a.c. power ports

| Coupling Location<br>(Line Stressed) | Coupling Method | Observations |
|--------------------------------------|-----------------|--------------|
| L – N – PE                           | CDN             | -            |

☐ Input d.c. power ports

| Coupling Location<br>(Line Stressed) | Coupling Method | Observations |
|--------------------------------------|-----------------|--------------|
| -                                    | -               | -            |

☒ Signal ports and telecommunication ports

| Coupling Location<br>(Line Stressed) | Coupling Method | Observations |
|--------------------------------------|-----------------|--------------|
| RJ-45(PoE)                           | CDN             | Complied     |
| Alarm IN                             | Clamp           | Complied     |
| Alarm OUT                            | 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. 25, 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<br>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: (24,7 ± 0,2) °C  
Relative Humidity: (45,3 ± 0,2) % R.H.  
Atmospheric Pressure: (99,2 ± 0,0) kPa



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### Test Specifications & Observations/Remarks

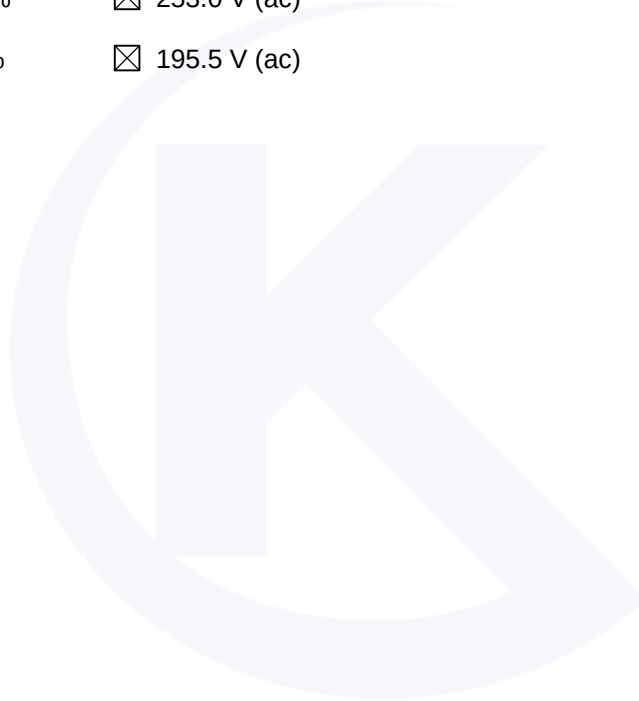
#### ■ AC Mode

##### - 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 without operator's intervention.

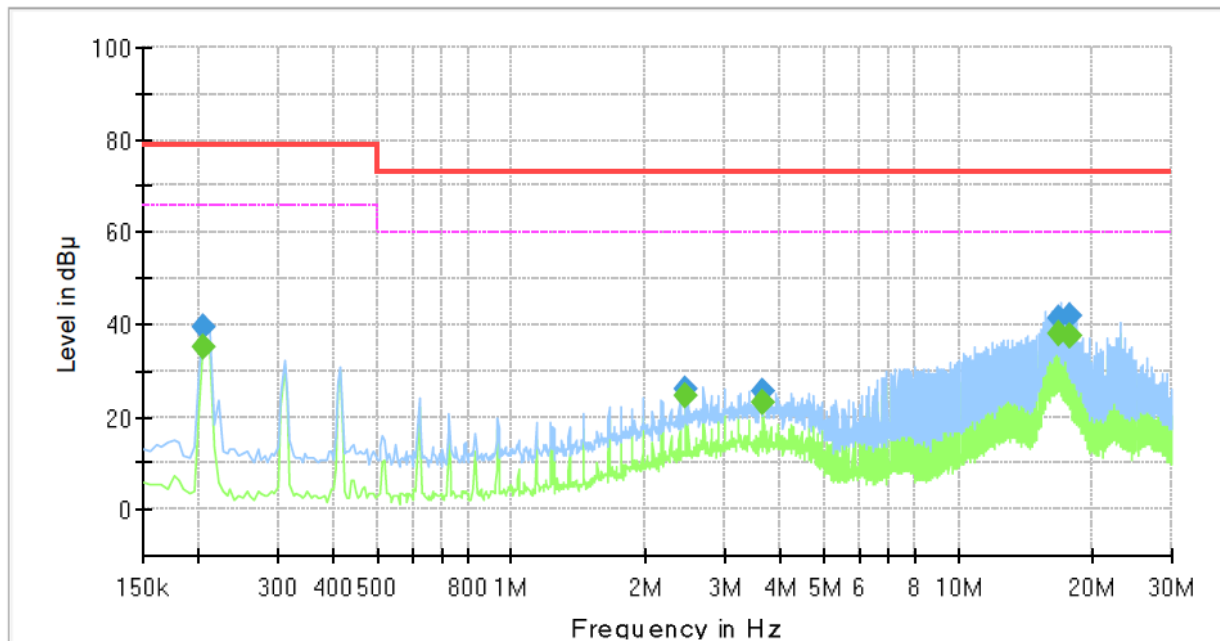
**APPENDIX A – TEST DATA****Conducted Emissions at Mains Power Ports**

■ AC Mode

[HOT]

**Common Information**

|                   |                    |
|-------------------|--------------------|
| Test Description: | Conducted Emission |
| Model No.:        | TNO-4050T          |
| Phase:            | H                  |
| Mode:             | AC                 |
| Operator Name:    | KES                |

**Final Result**

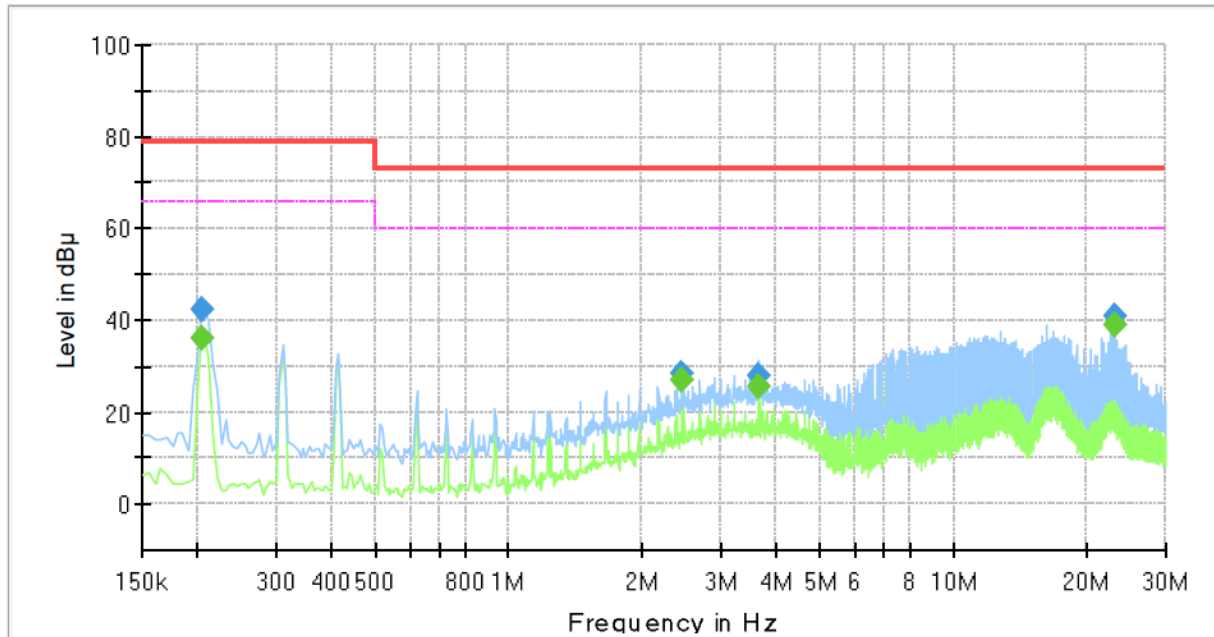
| Frequency (MHz) | QuasiPeak (dBμV) | CAverage (dBμV) | Limit (dBμV) | Margin (dB) | Meas. Time (ms) | Bandwidth (kHz) | Line | Corr. (dB) |
|-----------------|------------------|-----------------|--------------|-------------|-----------------|-----------------|------|------------|
| 0.205000        | ---              | 35.12           | 66.00        | 30.88       | 1000.0          | 9.000           | L1   | 19.4       |
| 0.205000        | 39.64            | ---             | 79.00        | 39.36       | 1000.0          | 9.000           | L1   | 19.4       |
| 2.445000        | ---              | 24.43           | 60.00        | 35.57       | 1000.0          | 9.000           | L1   | 20.3       |
| 2.445000        | 25.87            | ---             | 73.00        | 47.13       | 1000.0          | 9.000           | L1   | 20.3       |
| 3.665000        | ---              | 22.91           | 60.00        | 37.09       | 1000.0          | 9.000           | L1   | 20.0       |
| 3.665000        | 25.33            | ---             | 73.00        | 47.67       | 1000.0          | 9.000           | L1   | 20.0       |
| 16.860000       | ---              | 37.91           | 60.00        | 22.09       | 1000.0          | 9.000           | L1   | 19.9       |
| 16.860000       | 41.47            | ---             | 73.00        | 31.53       | 1000.0          | 9.000           | L1   | 19.9       |
| 17.690000       | ---              | 37.34           | 60.00        | 22.66       | 1000.0          | 9.000           | L1   | 20.0       |
| 17.690000       | 41.91            | ---             | 73.00        | 31.09       | 1000.0          | 9.000           | L1   | 20.0       |



[NEUTRAL]

## Common Information

Test Description: Conducted Emission  
Model No.: TNO-4050T  
Phase: N  
Mode: AC  
Operator Name: KES



## Final Result

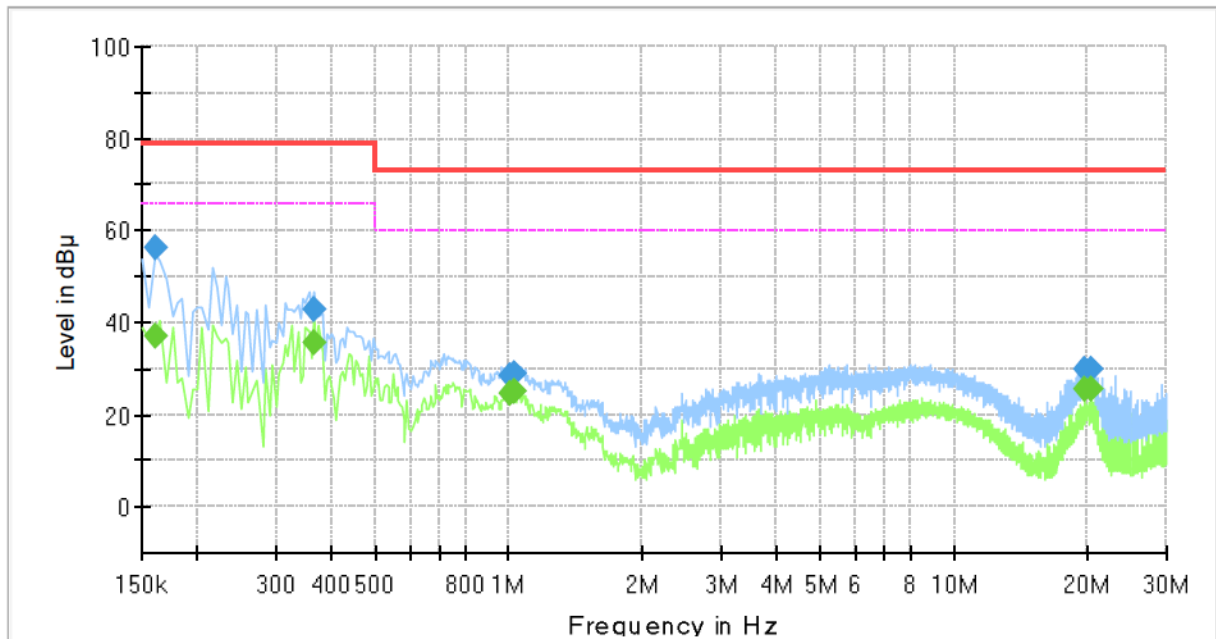
| Frequency (MHz) | QuasiPeak (dBμV) | CAverage (dBμV) | Limit (dBμV) | Margin (dB) | Meas. Time (ms) | Bandwidth (kHz) | Line | Corr. (dB) |
|-----------------|------------------|-----------------|--------------|-------------|-----------------|-----------------|------|------------|
| 0.205000        | ---              | 35.95           | 66.00        | 30.05       | 1000.0          | 9.000           | N    | 19.4       |
| 0.205000        | 42.26            | ---             | 79.00        | 36.74       | 1000.0          | 9.000           | N    | 19.4       |
| 2.445000        | ---              | 27.14           | 60.00        | 32.86       | 1000.0          | 9.000           | N    | 20.3       |
| 2.445000        | 28.55            | ---             | 73.00        | 44.45       | 1000.0          | 9.000           | N    | 20.3       |
| 3.665000        | ---              | 25.73           | 60.00        | 34.27       | 1000.0          | 9.000           | N    | 20.0       |
| 3.665000        | 28.13            | ---             | 73.00        | 44.87       | 1000.0          | 9.000           | N    | 20.0       |
| 23.130000       | ---              | 39.10           | 60.00        | 20.90       | 1000.0          | 9.000           | N    | 20.1       |
| 23.130000       | 40.79            | ---             | 73.00        | 32.21       | 1000.0          | 9.000           | N    | 20.1       |



[HOT]

## Common Information

Test Description: Conducted Emission  
Model No.: TNO-4050T  
Phase: H  
Mode: DC  
Operator Name: KES



## Final Result

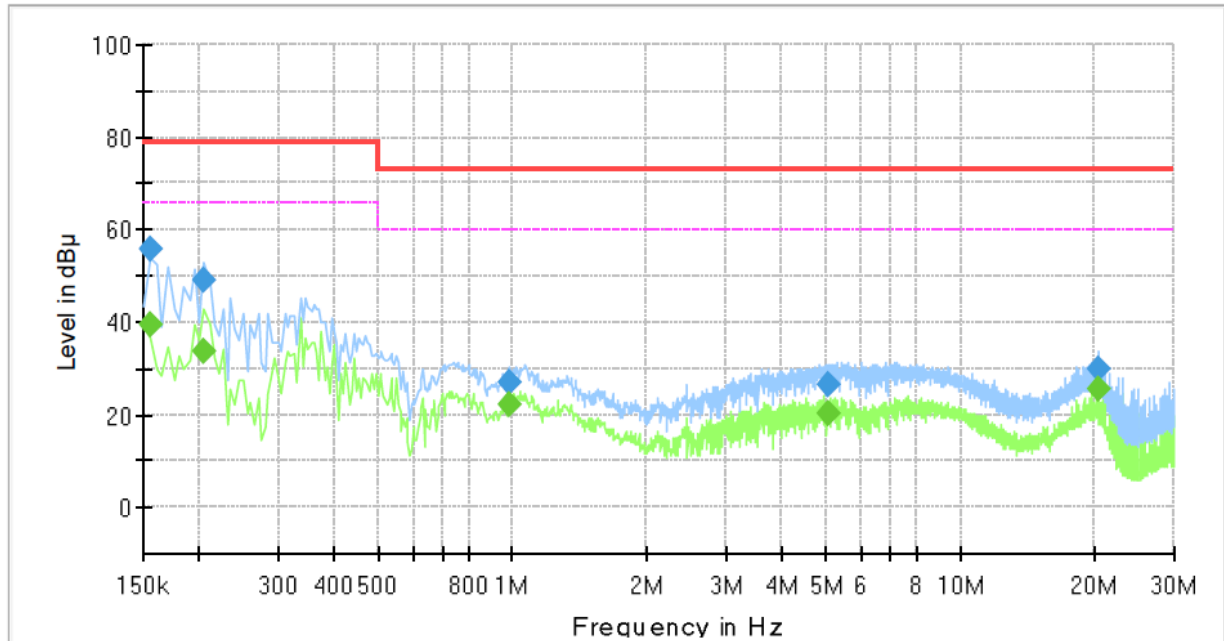
| Frequency (MHz) | QuasiPeak (dBμV) | CAverage (dBμV) | Limit (dBμV) | Margin (dB) | Meas. Time (ms) | Bandwidth (kHz) | Line | Corr. (dB) |
|-----------------|------------------|-----------------|--------------|-------------|-----------------|-----------------|------|------------|
| 0.160000        | ---              | 37.21           | 66.00        | 28.79       | 1000.0          | 9.000           | L1   | 19.4       |
| 0.160000        | 56.39            | ---             | 79.00        | 22.61       | 1000.0          | 9.000           | L1   | 19.4       |
| 0.365000        | ---              | 35.56           | 66.00        | 30.44       | 1000.0          | 9.000           | L1   | 19.6       |
| 0.365000        | 43.01            | ---             | 79.00        | 35.99       | 1000.0          | 9.000           | L1   | 19.6       |
| 1.005000        | ---              | 24.47           | 60.00        | 35.53       | 1000.0          | 9.000           | L1   | 20.0       |
| 1.005000        | 28.45            | ---             | 73.00        | 44.55       | 1000.0          | 9.000           | L1   | 20.0       |
| 1.025000        | ---              | 24.95           | 60.00        | 35.05       | 1000.0          | 9.000           | L1   | 20.1       |
| 1.025000        | 28.74            | ---             | 73.00        | 44.26       | 1000.0          | 9.000           | L1   | 20.1       |
| 19.710000       | ---              | 25.75           | 60.00        | 34.25       | 1000.0          | 9.000           | L1   | 20.1       |
| 19.710000       | 30.01            | ---             | 73.00        | 42.99       | 1000.0          | 9.000           | L1   | 20.1       |
| 20.260000       | ---              | 25.60           | 60.00        | 34.40       | 1000.0          | 9.000           | L1   | 20.1       |
| 20.260000       | 29.89            | ---             | 73.00        | 43.11       | 1000.0          | 9.000           | L1   | 20.1       |



[NEUTRAL]

## Common Information

Test Description: Conducted Emission  
Model No.: TNO-4050T  
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) |
|-----------------|------------------|-----------------|--------------|-------------|-----------------|-----------------|------|------------|
| 0.155000        | ---              | 39.60           | 66.00        | 26.40       | 1000.0          | 9.000           | N    | 19.4       |
| 0.155000        | 55.91            | ---             | 79.00        | 23.09       | 1000.0          | 9.000           | N    | 19.4       |
| 0.205000        | ---              | 33.68           | 66.00        | 32.32       | 1000.0          | 9.000           | N    | 19.4       |
| 0.205000        | 48.87            | ---             | 79.00        | 30.13       | 1000.0          | 9.000           | N    | 19.4       |
| 0.980000        | ---              | 22.41           | 60.00        | 37.59       | 1000.0          | 9.000           | N    | 20.0       |
| 0.980000        | 26.96            | ---             | 73.00        | 46.04       | 1000.0          | 9.000           | N    | 20.0       |
| 5.080000        | ---              | 20.48           | 60.00        | 39.52       | 1000.0          | 9.000           | N    | 19.6       |
| 5.080000        | 26.72            | ---             | 73.00        | 46.28       | 1000.0          | 9.000           | N    | 19.6       |
| 20.260000       | ---              | 25.68           | 60.00        | 34.32       | 1000.0          | 9.000           | N    | 20.2       |
| 20.260000       | 29.97            | ---             | 73.00        | 43.03       | 1000.0          | 9.000           | N    | 20.2       |

### ◆ Calculation

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

QuasiPeak / CAverage : The Final Value

Reading Value : Not shown in the table.

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

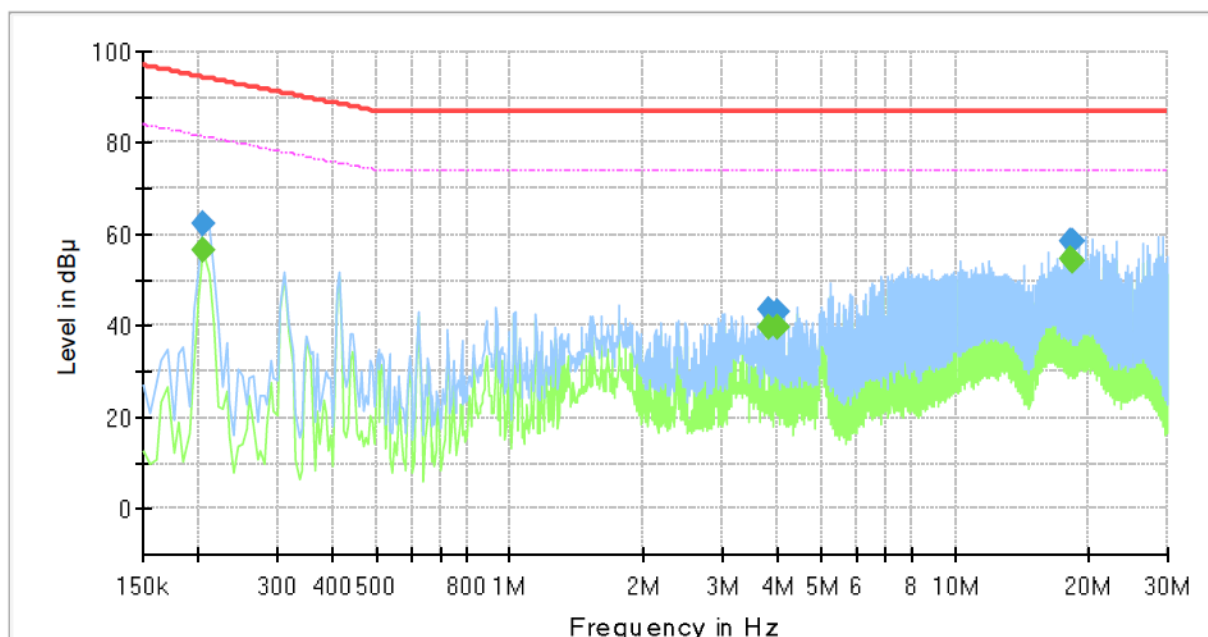
**Conducted Emissions at Telecommunication Ports**

■ AC Mode

[100 Mbps]

**Common Information**

Test Description: Telecommunication Emission  
Model No.: TNO-4050T  
Mode : AC  
Speed : 100 Mbps  
Operator Name: KES

**Final Result**

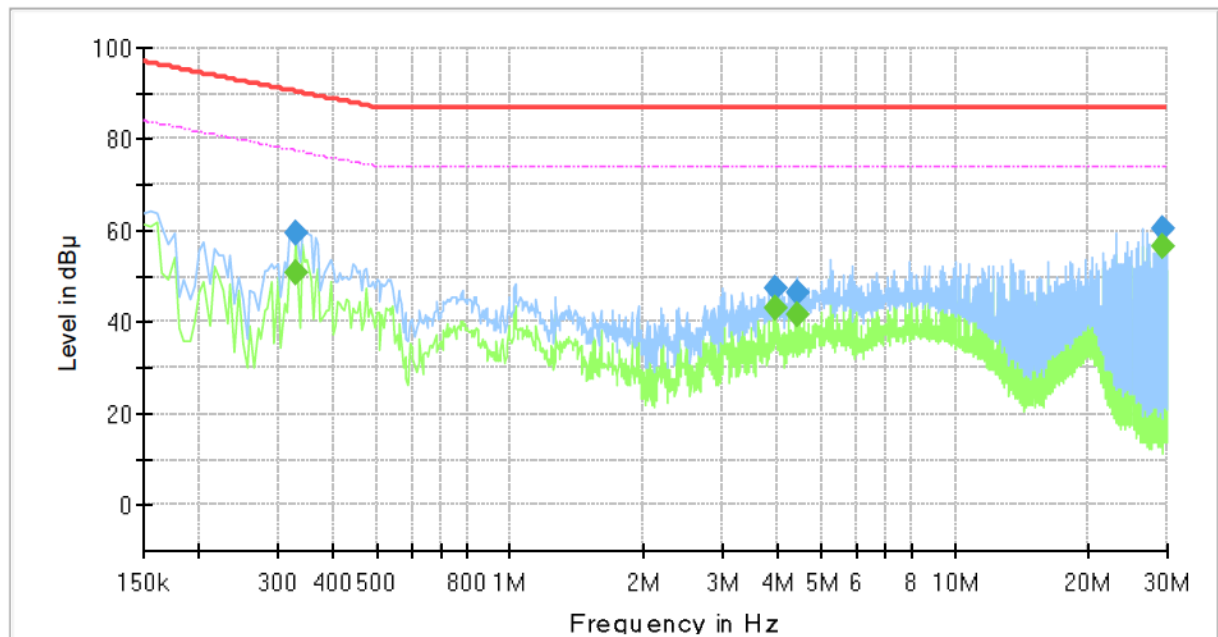
| Frequency (MHz) | QuasiPeak (dBμV) | CAverage (dBμV) | Limit (dBμV) | Margin (dB) | Meas. Time (ms) | Bandwidth (kHz) | Line        | Corr. (dB) |
|-----------------|------------------|-----------------|--------------|-------------|-----------------|-----------------|-------------|------------|
| 0.205000        | ---              | 56.58           | 81.41        | 24.83       | 1000.0          | 9.000           | Single Line | 19.7       |
| 0.205000        | 62.14            | ---             | 94.41        | 32.27       | 1000.0          | 9.000           | Single Line | 19.7       |
| 3.830000        | ---              | 39.48           | 74.00        | 34.52       | 1000.0          | 9.000           | Single Line | 19.8       |
| 3.830000        | 43.49            | ---             | 87.00        | 43.51       | 1000.0          | 9.000           | Single Line | 19.8       |
| 4.015000        | ---              | 39.48           | 74.00        | 34.52       | 1000.0          | 9.000           | Single Line | 19.7       |
| 4.015000        | 43.10            | ---             | 87.00        | 43.90       | 1000.0          | 9.000           | Single Line | 19.7       |
| 18.245000       | ---              | 54.64           | 74.00        | 19.36       | 1000.0          | 9.000           | Single Line | 19.8       |
| 18.245000       | 58.44            | ---             | 87.00        | 28.56       | 1000.0          | 9.000           | Single Line | 19.8       |
| 18.305000       | ---              | 54.30           | 74.00        | 19.70       | 1000.0          | 9.000           | Single Line | 19.8       |
| 18.305000       | 58.42            | ---             | 87.00        | 28.58       | 1000.0          | 9.000           | Single Line | 19.8       |



[100 Mbps]

## Common Information

Test Description: Telecommunication Emission  
Model No.: TNO-4050T  
Mode : DC  
Speed : 100 Mbps  
Operator Name: KES



## Final Result

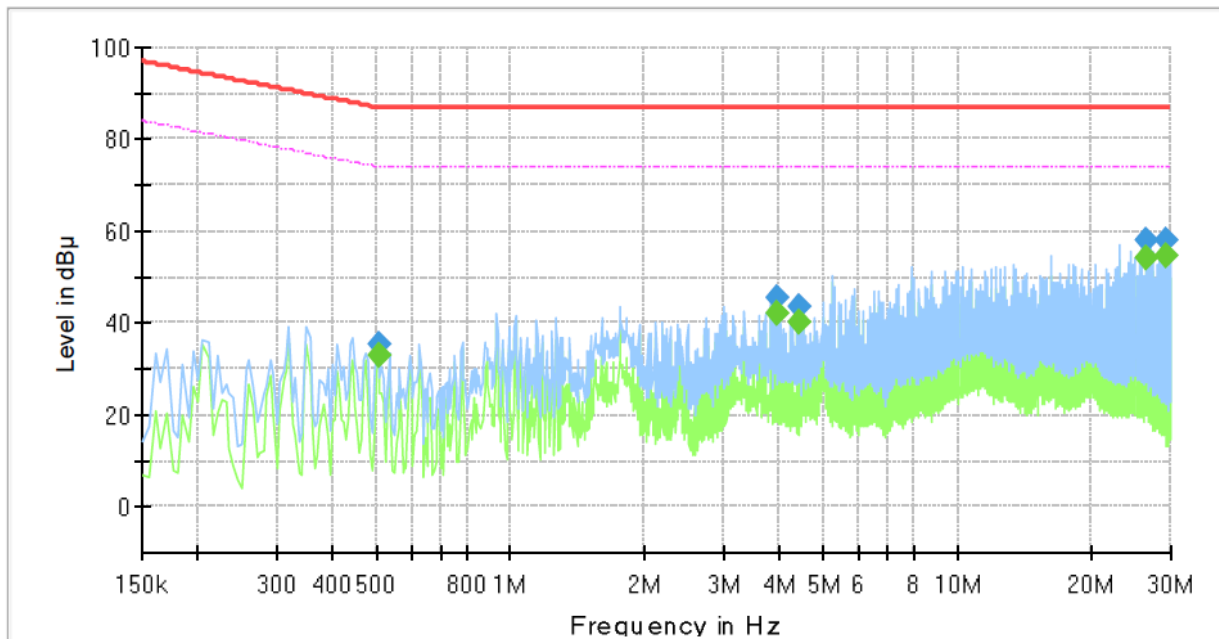
| Frequency (MHz) | QuasiPeak (dBμV) | CAverage (dBμV) | Limit (dBμV) | Margin (dB) | Meas. Time (ms) | Bandwidth (kHz) | Line        | Corr. (dB) |
|-----------------|------------------|-----------------|--------------|-------------|-----------------|-----------------|-------------|------------|
| 0.330000        | ---              | 50.56           | 77.45        | 26.89       | 1000.0          | 9.000           | Single Line | 19.7       |
| 0.330000        | 59.52            | ---             | 90.45        | 30.93       | 1000.0          | 9.000           | Single Line | 19.7       |
| 3.955000        | ---              | 42.99           | 74.00        | 31.01       | 1000.0          | 9.000           | Single Line | 19.7       |
| 3.955000        | 47.58            | ---             | 87.00        | 39.42       | 1000.0          | 9.000           | Single Line | 19.7       |
| 4.410000        | ---              | 41.42           | 74.00        | 32.58       | 1000.0          | 9.000           | Single Line | 19.6       |
| 4.410000        | 46.37            | ---             | 87.00        | 40.63       | 1000.0          | 9.000           | Single Line | 19.6       |
| 29.235000       | ---              | 56.82           | 74.00        | 17.18       | 1000.0          | 9.000           | Single Line | 20.4       |
| 29.235000       | 60.23            | ---             | 87.00        | 26.77       | 1000.0          | 9.000           | Single Line | 20.4       |



[100 Mbps]

## Common Information

Test Description: Telecommunication Emission  
Model No.: TNO-4050T  
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        | ---              | 32.84           | 74.00        | 41.16       | 1000.0          | 9.000           | Single Line | 19.8       |
| 0.505000        | 35.50            | ---             | 87.00        | 51.50       | 1000.0          | 9.000           | Single Line | 19.8       |
| 3.955000        | ---              | 42.07           | 74.00        | 31.93       | 1000.0          | 9.000           | Single Line | 19.7       |
| 3.955000        | 45.50            | ---             | 87.00        | 41.50       | 1000.0          | 9.000           | Single Line | 19.7       |
| 4.410000        | ---              | 40.36           | 74.00        | 33.64       | 1000.0          | 9.000           | Single Line | 19.6       |
| 4.410000        | 43.72            | ---             | 87.00        | 43.28       | 1000.0          | 9.000           | Single Line | 19.6       |
| 26.610000       | ---              | 54.39           | 74.00        | 19.61       | 1000.0          | 9.000           | Single Line | 20.2       |
| 26.610000       | 58.09            | ---             | 87.00        | 28.91       | 1000.0          | 9.000           | Single Line | 20.2       |
| 29.235000       | ---              | 54.43           | 74.00        | 19.57       | 1000.0          | 9.000           | Single Line | 20.4       |
| 29.235000       | 58.11            | ---             | 87.00        | 28.89       | 1000.0          | 9.000           | Single Line | 20.4       |

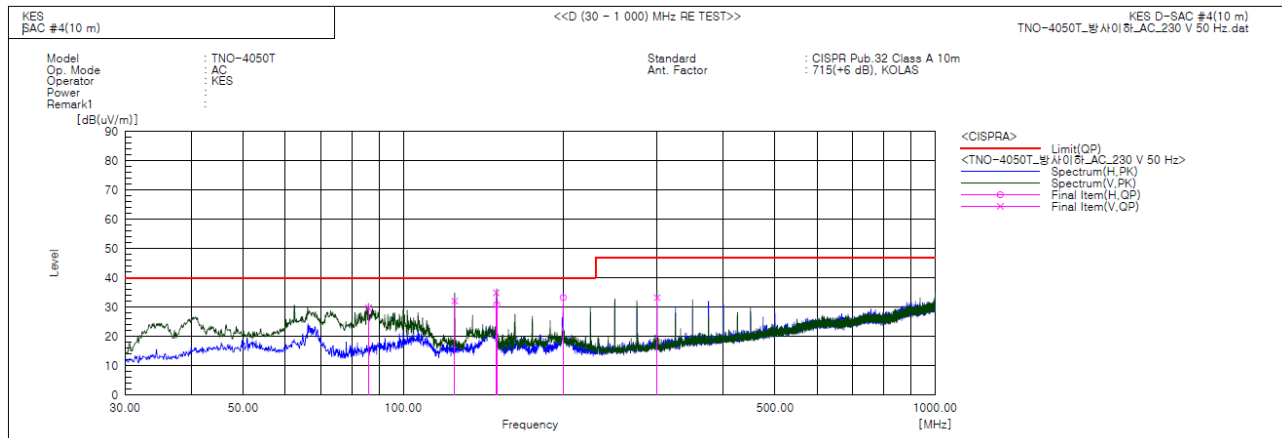
### ◆ Calculation

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

QuasiPeak / CAverage : The Final Value

Reading Value : Not shown in the table.

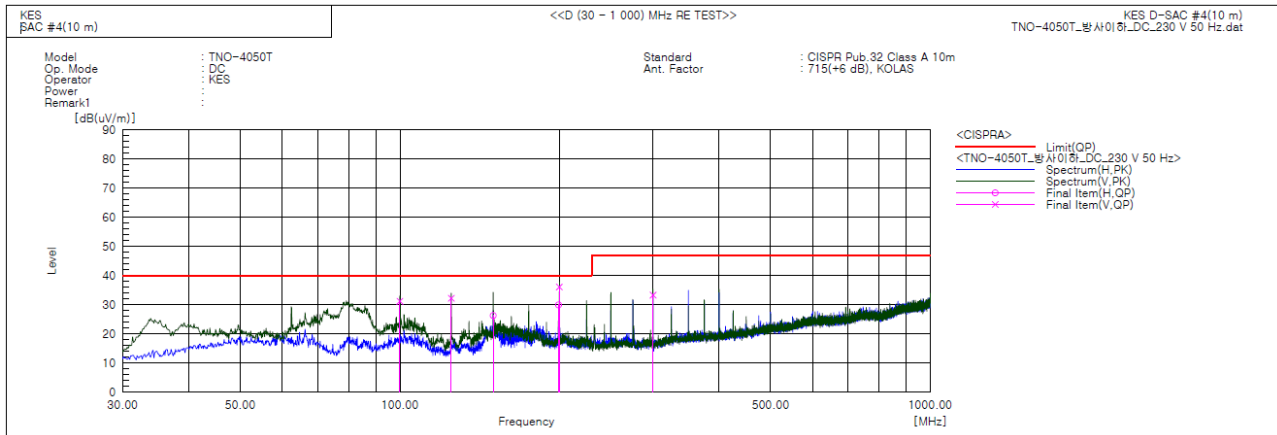
Corr. : Correction values (ISN FACTOR + (Cable Loss + Pulse Limiter FACTOR))

**Radiated Electric Field Emissions(Below 1 GHz)****■ AC Mode****Final Result**

| No. | Frequency<br>[MHz] | (P) | Reading<br>QP<br>[dB(uV)] | c.f<br>[dB(1/m)] | Result<br>QP<br>[dB(uV/m)] | Limit<br>QP<br>[dB(uV/m)] | Margin<br>QP<br>[dB] | Height<br>[cm] | Angle<br>[deg] | Remark |
|-----|--------------------|-----|---------------------------|------------------|----------------------------|---------------------------|----------------------|----------------|----------------|--------|
| 1   | 86.018             | V   | 55.4                      | -25.7            | 29.7                       | 40.0                      | 10.3                 | 117.0          | 18.0           |        |
| 2   | 124.939            | V   | 57.0                      | -24.9            | 32.1                       | 40.0                      | 7.9                  | 100.0          | 127.0          |        |
| 3   | 149.552            | V   | 60.2                      | -25.3            | 34.9                       | 40.0                      | 5.1                  | 199.0          | 250.0          |        |
| 4   | 149.916            | H   | 56.1                      | -25.3            | 30.8                       | 40.0                      | 9.2                  | 395.0          | 34.0           |        |
| 5   | 199.993            | H   | 54.3                      | -21.0            | 33.3                       | 40.0                      | 6.7                  | 400.0          | 143.0          |        |
| 6   | 300.024            | V   | 51.2                      | -18.0            | 33.2                       | 47.0                      | 13.8                 | 182.0          | 268.0          |        |



## ■ DC Mode

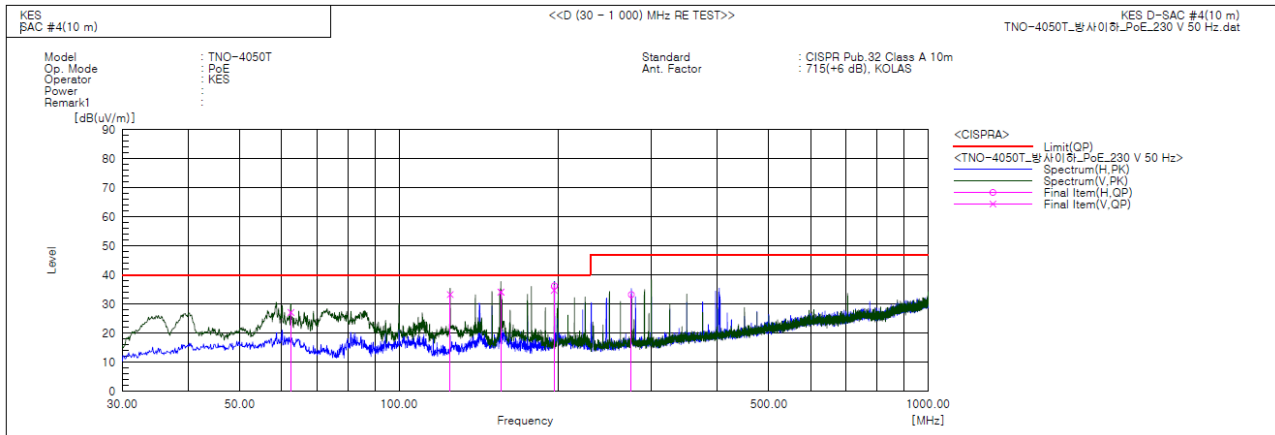


## Final Result

| No. | Frequency<br>[MHz] | (P) | Reading<br>QP<br>[dB(uV)] | c.f<br>[dB(1/m)] | Result<br>QP<br>[dB(uV/m)] | Limit<br>QP<br>[dB(uV/m)] | Margin<br>QP<br>[dB] | Height<br>[cm] | Angle<br>[deg] | Remark |
|-----|--------------------|-----|---------------------------|------------------|----------------------------|---------------------------|----------------------|----------------|----------------|--------|
| 1   | 99.961             | V   | 53.7                      | -22.5            | 31.2                       | 40.0                      | 8.8                  | 126.0          | 234.0          |        |
| 2   | 124.939            | V   | 57.1                      | -24.9            | 32.2                       | 40.0                      | 7.8                  | 194.0          | 90.0           |        |
| 3   | 149.916            | H   | 51.6                      | -25.3            | 26.3                       | 40.0                      | 13.7                 | 308.0          | 107.0          |        |
| 4   | 199.116            | H   | 50.9                      | -21.0            | 29.9                       | 40.0                      | 10.1                 | 400.0          | 53.0           |        |
| 5   | 199.744            | V   | 57.1                      | -21.0            | 36.1                       | 40.0                      | 3.9                  | 100.0          | 35.0           |        |
| 6   | 300.024            | V   | 51.3                      | -18.0            | 33.3                       | 47.0                      | 13.7                 | 187.0          | 325.0          |        |



## ■ PoE Mode



## Final Result

| No. | Frequency [MHz] | (P) | Reading QP [dB(μV)] | c.f [dB(1/m)] | Result QP [dB(μV/m)] | Limit QP [dB(μV/m)] | Margin QP [dB] | Height [cm] | Angle [deg] | Remark |
|-----|-----------------|-----|---------------------|---------------|----------------------|---------------------|----------------|-------------|-------------|--------|
| 1   | 62.495          | V   | 49.6                | -22.5         | 27.1                 | 40.0                | 12.9           | 113.0       | 69.0        |        |
| 2   | 124.939         | V   | 58.2                | -24.9         | 33.3                 | 40.0                | 6.7            | 195.0       | 33.0        |        |
| 3   | 155.858         | V   | 59.0                | -24.9         | 34.1                 | 40.0                | 5.9            | 100.0       | 160.0       |        |
| 4   | 196.476         | V   | 55.9                | -21.2         | 34.7                 | 40.0                | 5.3            | 106.0       | 141.0       |        |
| 5   | 196.719         | H   | 57.4                | -21.2         | 36.2                 | 40.0                | 3.8            | 305.0       | 104.0       |        |
| 6   | 274.925         | H   | 51.9                | -18.7         | 33.2                 | 47.0                | 13.8           | 400.0       | 287.0       |        |

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

$$\text{Result(QP)} [\text{dB}(\mu\text{V}/\text{m})] = (\text{Reading(QP)} [\text{dB}(\mu\text{V})] + \text{c.f} [\text{dB}(1/\text{m})])$$
$$\text{Margin(QP)} [\text{dB}] = \text{Limit} [\text{dB}(\mu\text{V}/\text{m})] - \text{Result(QP)} [\text{dB}(\mu\text{V}/\text{m})]$$

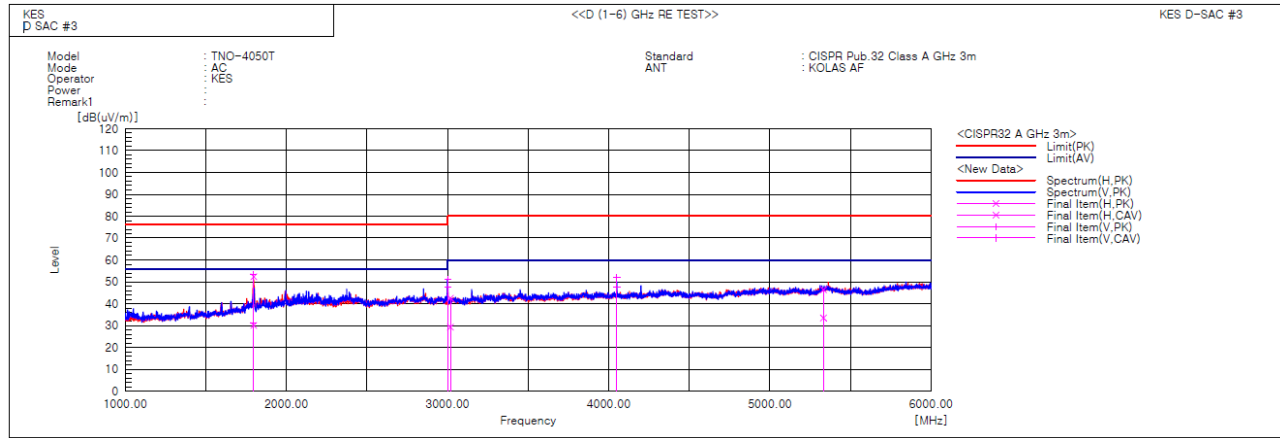
Reading(QP) : Reading value, Result(QP) : Reading value + Factor value

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



Radiated Electric Field Emissions(Above 1 GHz)

■ AC Mode

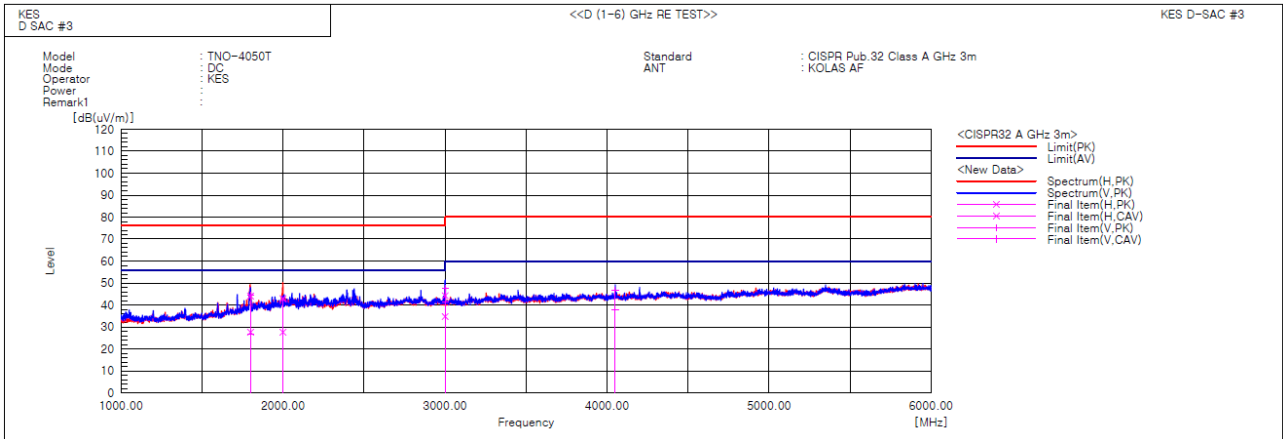


Final Result

| No. | Frequency<br>[MHz] | (P) | Reading<br>PK<br>[dB(uV)] | Reading<br>CAV<br>[dB(uV)] | c.f<br>[dB(1/m)] | Result<br>PK<br>[dB(uV/m)] | Result<br>CAV<br>[dB(uV/m)] | Limit<br>PK<br>[dB(uV/m)] | Limit<br>AV<br>[dB(uV/m)] | Margin<br>PK<br>[dB] | Margin<br>CAV<br>[dB] | Height<br>[cm] | Angle<br>[deg] | Remark |
|-----|--------------------|-----|---------------------------|----------------------------|------------------|----------------------------|-----------------------------|---------------------------|---------------------------|----------------------|-----------------------|----------------|----------------|--------|
| 1   | 1795.251           | V   | 55.6                      | 33.3                       | -2.2             | 53.4                       | 31.1                        | 76.0                      | 56.0                      | 22.6                 | 24.9                  | 100.0          | 164.8          |        |
| 2   | 1796.670           | H   | 54.6                      | 32.3                       | -2.2             | 52.4                       | 30.1                        | 76.0                      | 56.0                      | 23.6                 | 25.9                  | 100.0          | 148.4          |        |
| 3   | 3000.280           | V   | 49.1                      | 45.5                       | 2.2              | 51.3                       | 47.7                        | 80.0                      | 60.0                      | 28.7                 | 12.3                  | 100.0          | 67.5           |        |
| 4   | 3016.817           | H   | 40.3                      | 27.1                       | 2.2              | 42.5                       | 29.3                        | 80.0                      | 60.0                      | 37.5                 | 30.7                  | 100.0          | 116.8          |        |
| 5   | 4049.960           | V   | 46.2                      | 41.7                       | 5.8              | 52.0                       | 47.5                        | 80.0                      | 60.0                      | 28.0                 | 12.5                  | 100.0          | 237.7          |        |
| 6   | 5332.084           | H   | 37.2                      | 24.2                       | 9.3              | 46.5                       | 33.5                        | 80.0                      | 60.0                      | 33.5                 | 26.5                  | 100.0          | 238.7          |        |



■ DC Mode

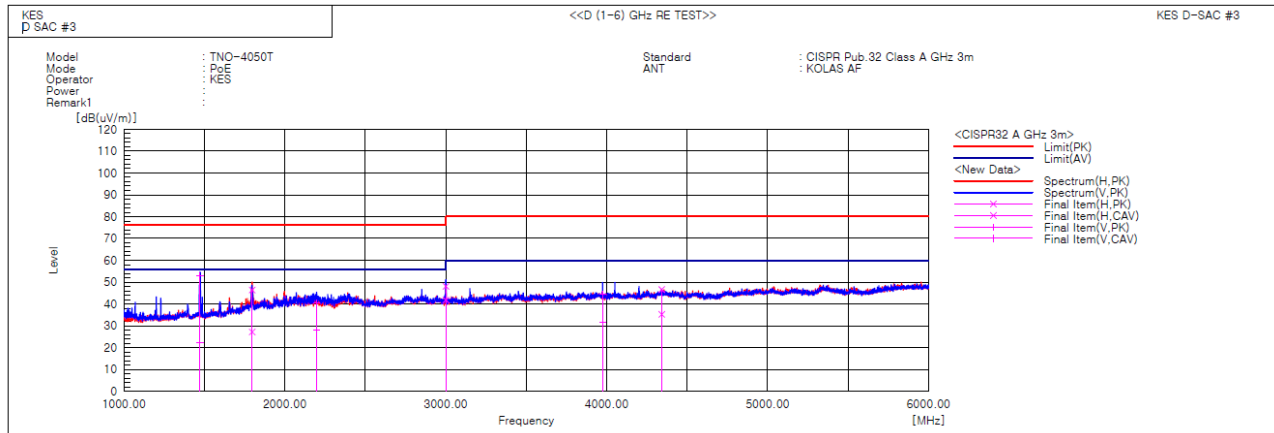


Final Result

| No. | Frequency [MHz] | (P) | Reading PK [dB(uV)] | Reading CAV [dB(uV)] | c.f [dB(1/m)] | Result PK [dB(uV/m)] | Result CAV [dB(uV/m)] | Limit PK [dB(uV/m)] | Limit AV [dB(uV/m)] | Margin PK [dB] | Margin CAV [dB] | Height [cm] | Angle [deg] | Remark |
|-----|-----------------|-----|---------------------|----------------------|---------------|----------------------|-----------------------|---------------------|---------------------|----------------|-----------------|-------------|-------------|--------|
| 1   | 1798.615        | H   | 46.3                | 29.9                 | -2.2          | 44.1                 | 27.7                  | 76.0                | 56.0                | 31.9           | 28.3            | 100.0       | 35.7        |        |
| 2   | 1799.445        | V   | 46.6                | 29.1                 | -2.2          | 44.4                 | 26.9                  | 76.0                | 56.0                | 31.6           | 29.1            | 100.0       | 169.9       |        |
| 3   | 1999.063        | H   | 43.9                | 28.7                 | -1.0          | 42.9                 | 27.7                  | 76.0                | 56.0                | 33.1           | 28.3            | 100.0       | 147.4       |        |
| 4   | 3000.116        | H   | 42.1                | 32.6                 | 2.2           | 44.3                 | 34.8                  | 80.0                | 60.0                | 35.7           | 25.2            | 100.0       | 114.5       |        |
| 5   | 3000.316        | V   | 45.2                | 39.2                 | 2.2           | 47.4                 | 41.4                  | 80.0                | 60.0                | 32.6           | 18.6            | 100.0       | 159.5       |        |
| 6   | 4051.033        | V   | 41.0                | 31.9                 | 5.8           | 46.8                 | 37.7                  | 80.0                | 60.0                | 33.2           | 22.3            | 100.0       | 248.7       |        |



## ■ PoE Mode



| No. | Frequency [MHz] | (P) | Reading PK [dB(uV)] | Reading CAV [dB(uV)] | c.f [dB(1/m)] | Result PK [dB(uV/m)] | Result CAV [dB(uV/m)] | Limit PK [dB(uV/m)] | Limit AV [dB(uV/m)] | Margin PK [dB] | Margin CAV [dB] | Height [cm] | Angle [deg] | Remark |
|-----|-----------------|-----|---------------------|----------------------|---------------|----------------------|-----------------------|---------------------|---------------------|----------------|-----------------|-------------|-------------|--------|
| 1   | 1472.561        | V   | 58.8                | 28.5                 | -6.0          | 52.8                 | 22.5                  | 76.0                | 56.0                | 23.2           | 33.5            | 100.0       | 4.9         |        |
| 2   | 1797.054        | H   | 48.6                | 29.4                 | -2.2          | 46.4                 | 27.2                  | 76.0                | 56.0                | 29.6           | 28.8            | 100.0       | 141.5       |        |
| 3   | 2196.365        | V   | 40.9                | 28.3                 | -0.3          | 40.6                 | 28.0                  | 76.0                | 56.0                | 35.4           | 28.0            | 100.0       | 57.4        |        |
| 4   | 3000.055        | H   | 45.9                | 39.6                 | 2.2           | 48.1                 | 41.8                  | 80.0                | 60.0                | 31.9           | 18.2            | 100.0       | 110.1       |        |
| 5   | 3974.184        | V   | 38.6                | 25.9                 | 5.8           | 44.4                 | 31.7                  | 80.0                | 60.0                | 35.6           | 28.3            | 100.0       | 52.9        |        |
| 6   | 4340.851        | H   | 39.8                | 28.4                 | 6.9           | 46.7                 | 35.3                  | 80.0                | 60.0                | 33.3           | 24.7            | 100.0       | 301.4       |        |

## ◆ 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

**Harmonic Current Emissions and Voltage Fluctuations and Flicker**

■ AC Mode

**Average harmonic current results**

| Hn | I <sub>eff</sub> [A] | % of Limit | Limit [A] | Result |
|----|----------------------|------------|-----------|--------|
| 1  | 0.145                |            |           |        |
| 2  | 0.001                | 0.104      | 1.080     | n/a    |
| 3  | 0.049                | 2.114      | 2.300     | PASS   |
| 4  | 0.001                | 0.234      | 0.430     | n/a    |
| 5  | 0.038                | 3.291      | 1.140     | PASS   |
| 6  | 0.001                | 0.233      | 0.300     | n/a    |
| 7  | 0.015                | 2.009      | 0.770     | PASS   |
| 8  | 0.001                | 0.287      | 0.230     | n/a    |
| 9  | 0.012                | 2.980      | 0.400     | PASS   |
| 10 | 0.001                | 0.361      | 0.184     | n/a    |
| 11 | 0.003                | 0.996      | 0.330     | n/a    |
| 12 | 0.001                | 0.404      | 0.153     | n/a    |
| 13 | 0.002                | 1.113      | 0.210     | n/a    |
| 14 | 0.001                | 0.496      | 0.131     | n/a    |
| 15 | 0.002                | 1.611      | 0.150     | n/a    |
| 16 | 0.001                | 0.571      | 0.115     | n/a    |
| 17 | 0.002                | 1.578      | 0.132     | n/a    |
| 18 | 0.001                | 0.650      | 0.102     | n/a    |
| 19 | 0.002                | 1.312      | 0.118     | n/a    |
| 20 | 0.001                | 0.860      | 0.092     | n/a    |
| 21 | 0.001                | 0.802      | 0.161     | n/a    |
| 22 | 0.001                | 0.897      | 0.084     | n/a    |
| 23 | 0.001                | 0.552      | 0.147     | n/a    |
| 24 | 0.001                | 0.831      | 0.077     | n/a    |
| 25 | 0.002                | 1.180      | 0.135     | n/a    |
| 26 | 0.001                | 0.982      | 0.071     | n/a    |
| 27 | 0.001                | 0.807      | 0.125     | n/a    |
| 28 | 0.001                | 1.200      | 0.066     | n/a    |
| 29 | 0.001                | 0.731      | 0.116     | n/a    |
| 30 | 0.001                | 1.026      | 0.061     | n/a    |
| 31 | 0.001                | 0.660      | 0.109     | n/a    |
| 32 | 0.001                | 1.083      | 0.058     | n/a    |
| 33 | 0.001                | 0.861      | 0.102     | n/a    |
| 34 | 0.001                | 1.221      | 0.054     | n/a    |
| 35 | 0.001                | 0.873      | 0.096     | n/a    |
| 36 | 0.001                | 1.173      | 0.051     | n/a    |
| 37 | 0.001                | 0.981      | 0.091     | n/a    |
| 38 | 0.001                | 1.307      | 0.048     | n/a    |
| 39 | 0.001                | 1.061      | 0.087     | n/a    |
| 40 | 0.001                | 1.301      | 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.



### Maximum harmonic current results

| Hn | I <sub>eff</sub> [A] | % of Limit | Limit [A] | Result |
|----|----------------------|------------|-----------|--------|
| 1  | 0.145                |            |           |        |
| 2  | 0.001                | 0.078      | 1.620     | n/a    |
| 3  | 0.049                | 1.423      | 3.450     | PASS   |
| 4  | 0.001                | 0.174      | 0.645     | n/a    |
| 5  | 0.038                | 2.206      | 1.710     | PASS   |
| 6  | 0.001                | 0.199      | 0.450     | n/a    |
| 7  | 0.016                | 1.356      | 1.155     | PASS   |
| 8  | 0.001                | 0.218      | 0.345     | n/a    |
| 9  | 0.012                | 2.024      | 0.600     | PASS   |
| 10 | 0.001                | 0.279      | 0.276     | n/a    |
| 11 | 0.004                | 0.818      | 0.495     | n/a    |
| 12 | 0.001                | 0.298      | 0.230     | n/a    |
| 13 | 0.003                | 0.852      | 0.315     | n/a    |
| 14 | 0.001                | 0.408      | 0.197     | n/a    |
| 15 | 0.003                | 1.131      | 0.225     | n/a    |
| 16 | 0.001                | 0.538      | 0.173     | n/a    |
| 17 | 0.002                | 1.133      | 0.199     | n/a    |
| 18 | 0.001                | 0.587      | 0.153     | n/a    |
| 19 | 0.002                | 0.954      | 0.178     | n/a    |
| 20 | 0.001                | 0.691      | 0.138     | n/a    |
| 21 | 0.001                | 0.912      | 0.161     | n/a    |
| 22 | 0.001                | 0.856      | 0.125     | n/a    |
| 23 | 0.002                | 1.227      | 0.147     | n/a    |
| 24 | 0.001                | 0.642      | 0.115     | n/a    |
| 25 | 0.002                | 1.374      | 0.135     | n/a    |
| 26 | 0.001                | 0.737      | 0.106     | n/a    |
| 27 | 0.001                | 0.930      | 0.125     | n/a    |
| 28 | 0.001                | 1.169      | 0.099     | n/a    |
| 29 | 0.001                | 0.866      | 0.116     | n/a    |
| 30 | 0.001                | 0.929      | 0.092     | n/a    |
| 31 | 0.001                | 1.110      | 0.109     | n/a    |
| 32 | 0.001                | 1.016      | 0.086     | n/a    |
| 33 | 0.001                | 0.984      | 0.102     | n/a    |
| 34 | 0.001                | 1.087      | 0.081     | n/a    |
| 35 | 0.001                | 1.048      | 0.096     | n/a    |
| 36 | 0.001                | 0.955      | 0.077     | n/a    |
| 37 | 0.001                | 1.138      | 0.091     | n/a    |
| 38 | 0.001                | 1.064      | 0.073     | n/a    |
| 39 | 0.001                | 1.241      | 0.087     | n/a    |
| 40 | 0.001                | 1.011      | 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 | I <sub>eff</sub> [A] | % of Limit | Limit [A] | Result |
|----|----------------------|------------|-----------|--------|
| 1  | 0.041                |            |           |        |
| 2  | 0.002                | 0.148      | 1.080     | n/a    |
| 3  | 0.035                | 1.514      | 2.300     | PASS   |
| 4  | 0.002                | 0.378      | 0.430     | n/a    |
| 5  | 0.035                | 3.112      | 1.140     | PASS   |
| 6  | 0.001                | 0.409      | 0.300     | n/a    |
| 7  | 0.035                | 4.532      | 0.770     | PASS   |
| 8  | 0.001                | 0.514      | 0.230     | n/a    |
| 9  | 0.032                | 8.117      | 0.400     | PASS   |
| 10 | 0.001                | 0.662      | 0.184     | n/a    |
| 11 | 0.031                | 9.357      | 0.330     | PASS   |
| 12 | 0.001                | 0.719      | 0.153     | n/a    |
| 13 | 0.029                | 13.872     | 0.210     | PASS   |
| 14 | 0.001                | 0.905      | 0.131     | n/a    |
| 15 | 0.027                | 17.983     | 0.150     | PASS   |
| 16 | 0.001                | 0.878      | 0.115     | n/a    |
| 17 | 0.025                | 18.892     | 0.132     | PASS   |
| 18 | 0.001                | 0.977      | 0.102     | n/a    |
| 19 | 0.023                | 19.302     | 0.118     | PASS   |
| 20 | 0.001                | 1.156      | 0.092     | n/a    |
| 21 | 0.021                | 12.864     | 0.161     | PASS   |
| 22 | 0.001                | 1.232      | 0.084     | n/a    |
| 23 | 0.018                | 12.526     | 0.147     | PASS   |
| 24 | 0.001                | 1.355      | 0.077     | n/a    |
| 25 | 0.016                | 12.083     | 0.135     | PASS   |
| 26 | 0.001                | 1.429      | 0.071     | n/a    |
| 27 | 0.014                | 11.463     | 0.125     | PASS   |
| 28 | 0.001                | 1.699      | 0.066     | n/a    |
| 29 | 0.012                | 10.365     | 0.116     | PASS   |
| 30 | 0.001                | 1.695      | 0.061     | n/a    |
| 31 | 0.010                | 9.567      | 0.109     | PASS   |
| 32 | 0.001                | 1.880      | 0.058     | n/a    |
| 33 | 0.009                | 8.455      | 0.102     | PASS   |
| 34 | 0.001                | 2.014      | 0.054     | n/a    |
| 35 | 0.007                | 7.379      | 0.096     | PASS   |
| 36 | 0.001                | 2.037      | 0.051     | n/a    |
| 37 | 0.006                | 6.644      | 0.091     | PASS   |
| 38 | 0.001                | 2.271      | 0.048     | n/a    |
| 39 | 0.005                | 5.775      | 0.087     | n/a    |
| 40 | 0.001                | 2.128      | 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.



### Maximum harmonic current results

| Hn | I <sub>eff</sub> [A] | % of Limit | Limit [A] | Result |
|----|----------------------|------------|-----------|--------|
| 1  | 0.042                |            |           |        |
| 2  | 0.002                | 0.136      | 1.620     | n/a    |
| 3  | 0.036                | 1.030      | 3.450     | PASS   |
| 4  | 0.002                | 0.295      | 0.645     | n/a    |
| 5  | 0.036                | 2.090      | 1.710     | PASS   |
| 6  | 0.001                | 0.318      | 0.450     | n/a    |
| 7  | 0.035                | 3.041      | 1.155     | PASS   |
| 8  | 0.001                | 0.403      | 0.345     | n/a    |
| 9  | 0.033                | 5.473      | 0.600     | PASS   |
| 10 | 0.001                | 0.501      | 0.276     | n/a    |
| 11 | 0.031                | 6.292      | 0.495     | PASS   |
| 12 | 0.001                | 0.554      | 0.230     | n/a    |
| 13 | 0.029                | 9.300      | 0.315     | PASS   |
| 14 | 0.001                | 0.679      | 0.197     | n/a    |
| 15 | 0.027                | 12.052     | 0.225     | PASS   |
| 16 | 0.001                | 0.728      | 0.173     | n/a    |
| 17 | 0.025                | 12.668     | 0.199     | PASS   |
| 18 | 0.001                | 0.774      | 0.153     | n/a    |
| 19 | 0.023                | 12.960     | 0.178     | PASS   |
| 20 | 0.001                | 0.899      | 0.138     | n/a    |
| 21 | 0.021                | 12.948     | 0.161     | PASS   |
| 22 | 0.001                | 0.986      | 0.125     | n/a    |
| 23 | 0.019                | 12.620     | 0.147     | PASS   |
| 24 | 0.001                | 1.055      | 0.115     | n/a    |
| 25 | 0.016                | 12.195     | 0.135     | PASS   |
| 26 | 0.001                | 1.079      | 0.106     | n/a    |
| 27 | 0.014                | 11.598     | 0.125     | PASS   |
| 28 | 0.001                | 1.316      | 0.099     | n/a    |
| 29 | 0.012                | 10.523     | 0.116     | PASS   |
| 30 | 0.001                | 1.263      | 0.092     | n/a    |
| 31 | 0.011                | 9.703      | 0.109     | PASS   |
| 32 | 0.001                | 1.467      | 0.086     | n/a    |
| 33 | 0.009                | 8.652      | 0.102     | PASS   |
| 34 | 0.001                | 1.551      | 0.081     | n/a    |
| 35 | 0.007                | 7.511      | 0.096     | PASS   |
| 36 | 0.001                | 1.593      | 0.077     | n/a    |
| 37 | 0.006                | 6.782      | 0.091     | PASS   |
| 38 | 0.001                | 1.711      | 0.073     | n/a    |
| 39 | 0.005                | 5.948      | 0.087     | PASS   |
| 40 | 0.001                | 1.628      | 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.



## 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     |



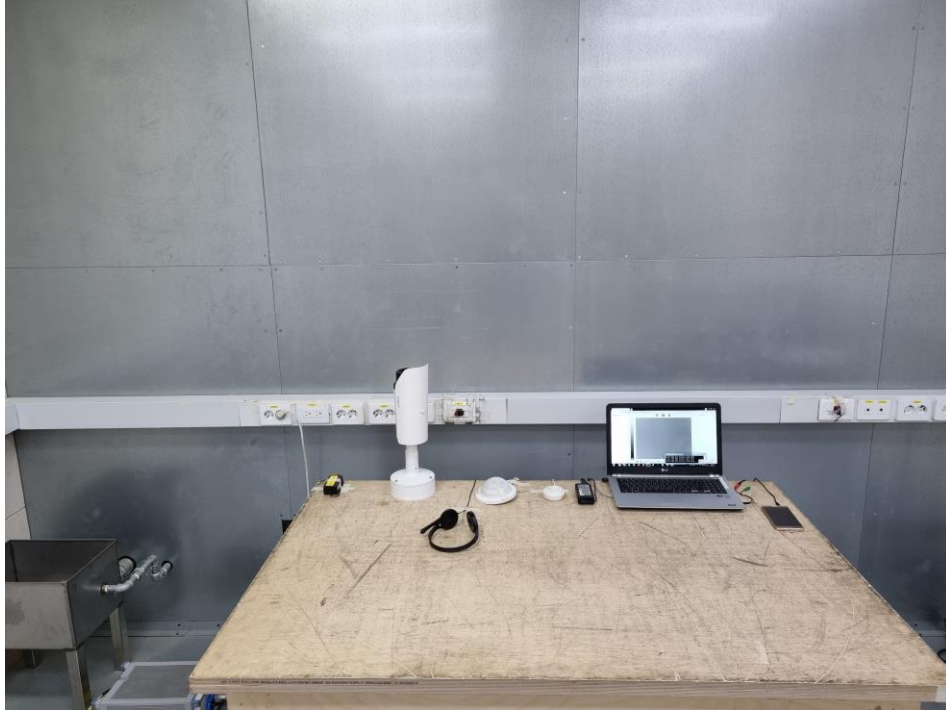
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## Test Setup Photos and Configuration

### Conducted Emissions at Mains Power Ports

■ AC, DC Mode





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## Conducted Emissions at Telecommunication Ports

■ AC, DC Mode





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■ PoE Mode



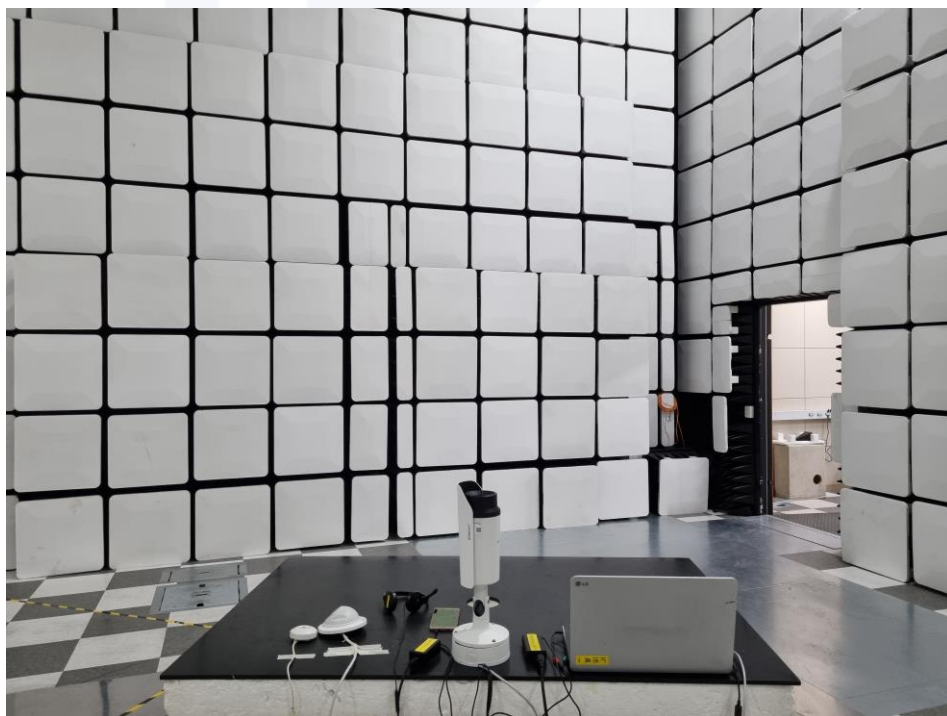


Report No. : KES-EM-22T0674-R3

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## Radiated Electric Field Emissions(Below 1 GHz)

■ AC, DC Mode

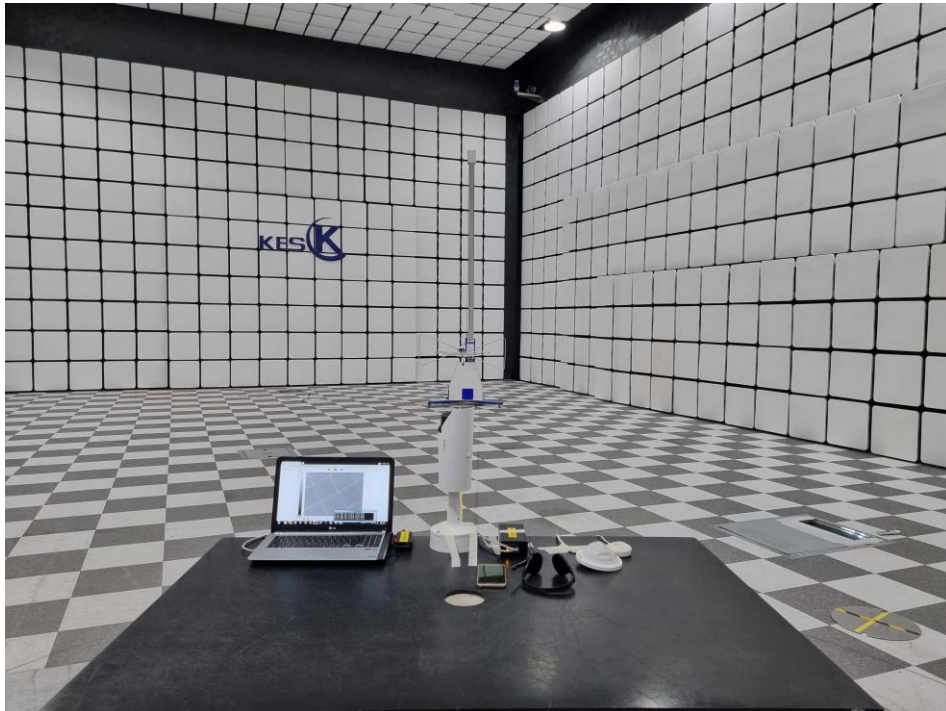




Report No. : KES-EM-22T0674-R3

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■ PoE Mode



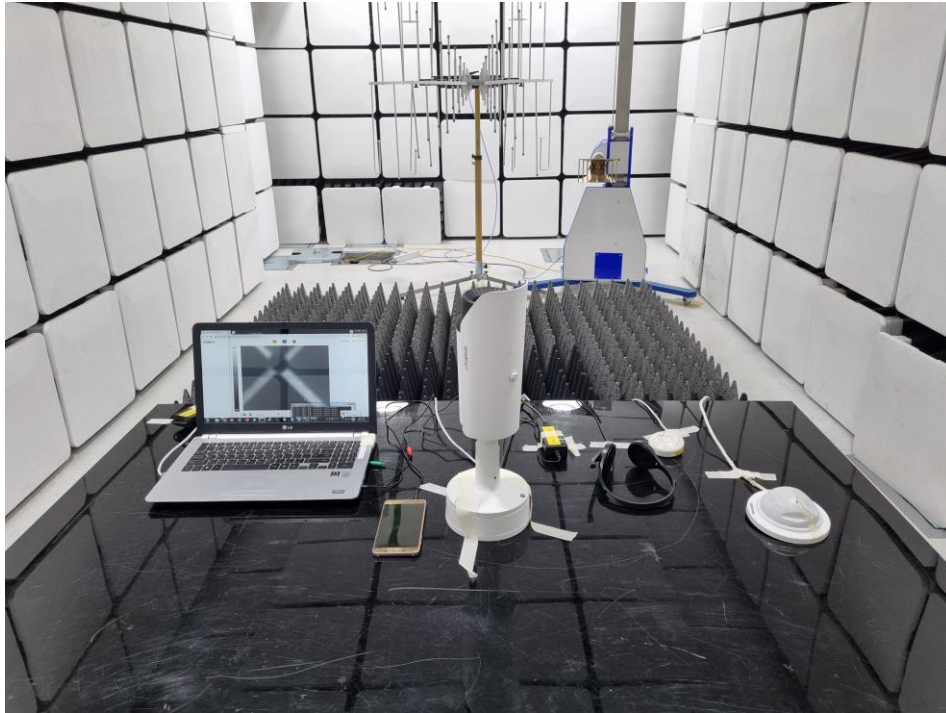


Report No. : KES-EM-22T0674-R3

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## Radiated Electric Field Emissions(Above 1 GHz)

■ AC, DC Mode

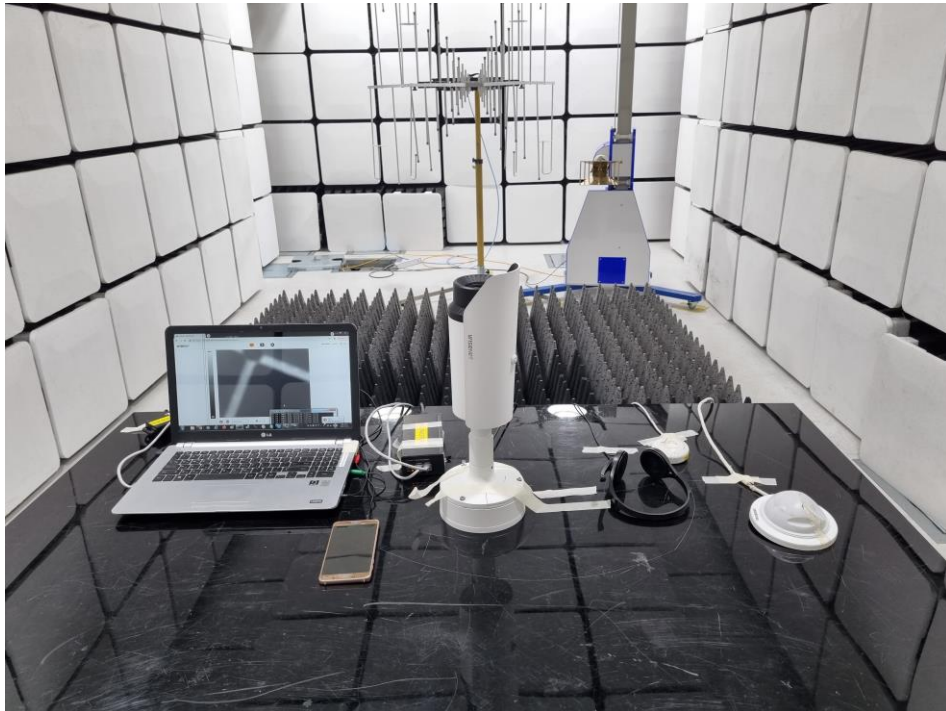




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■ PoE Mode





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## Harmonic Current Emissions and Voltage Fluctuations and Flicker

■ AC, DC Mode





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## Electrostatic Discharge

■ AC, DC Mode



■ PoE Mode





Report No. : KES-EM-22T0674-R3

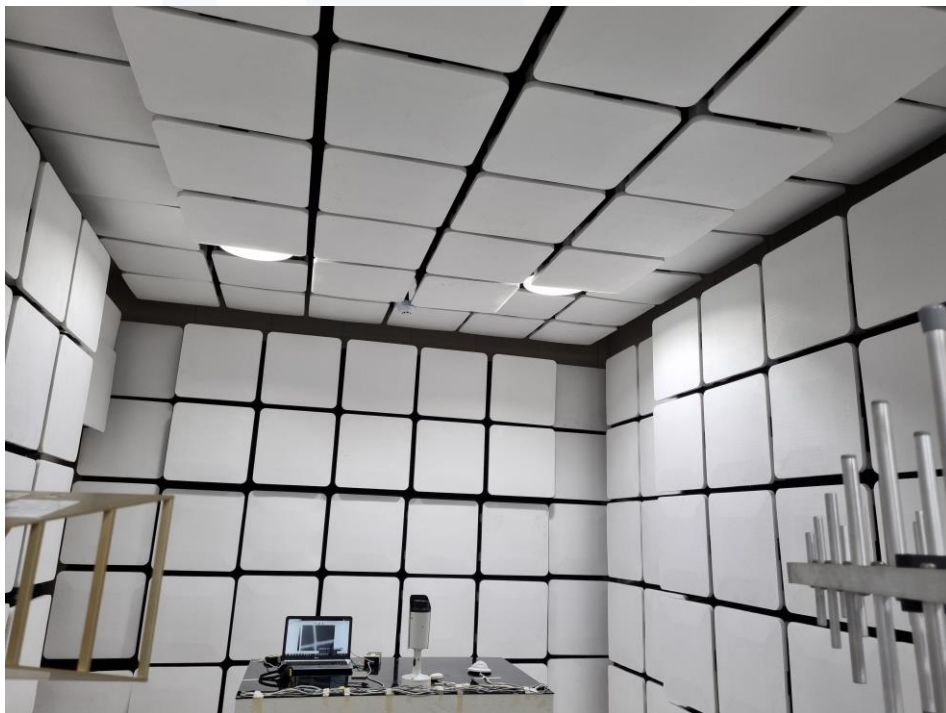
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## **Radiated Electric Field Immunity**

■ AC, DC Mode



■ PoE Mode



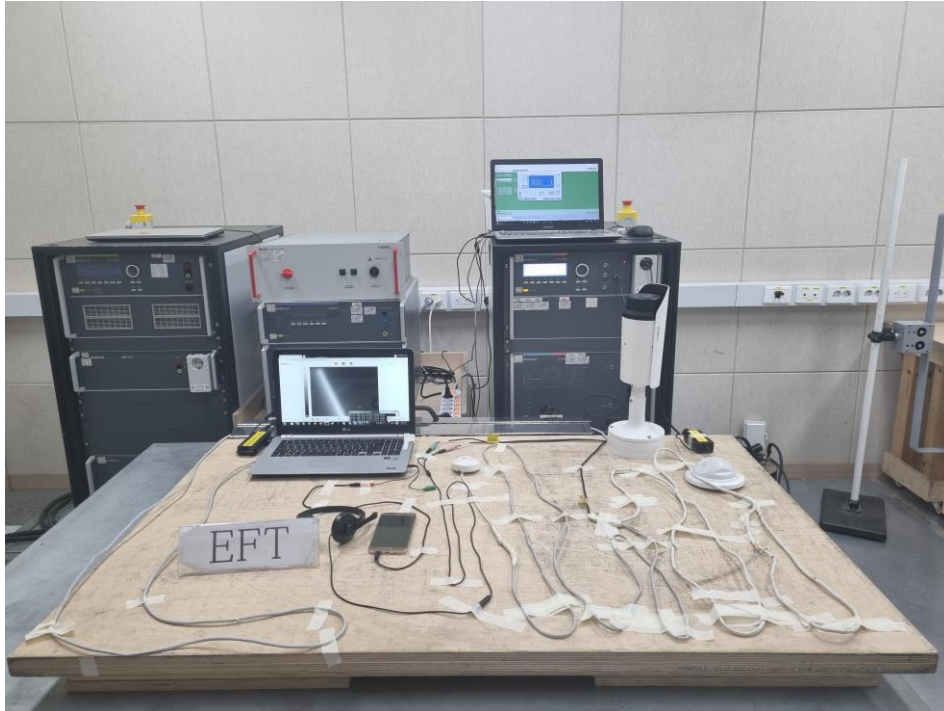


Report No. : KES-EM-22T0674-R3

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## Electrical Fast Transients/Bursts

■ AC, DC Mode



■ PoE Mode





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## Surge Transients

■ AC, DC Mode



■ PoE Mode





Report No. : KES-EM-22T0674-R3

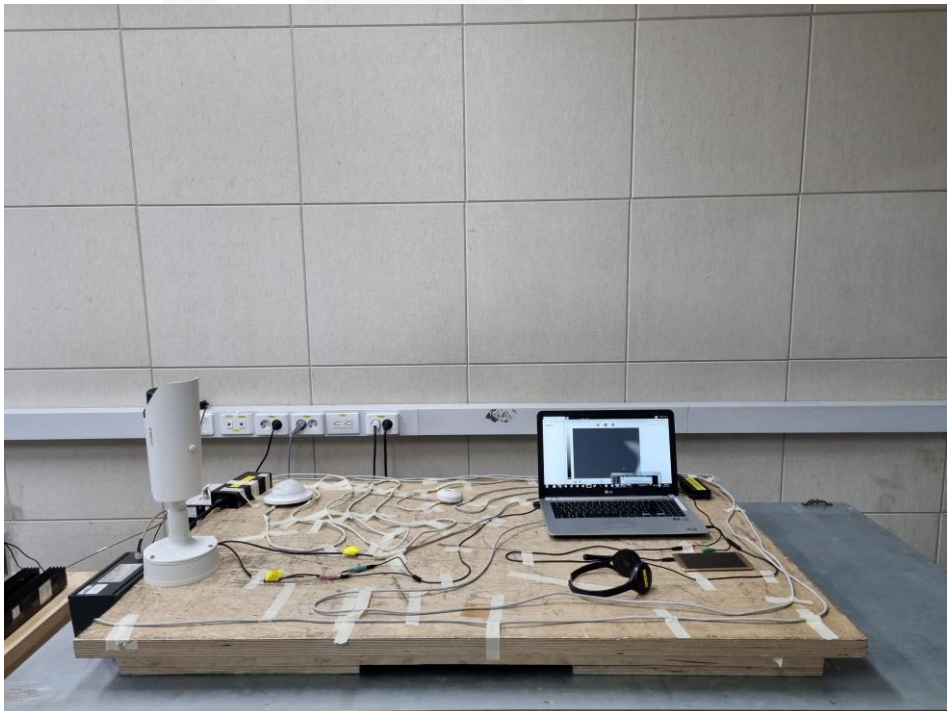
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## Conducted Disturbance

■ AC, DC Mode



■ PoE Mode





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## Voltage Dips and Short Interruptions

■ AC, DC Mode





## EUT External Photographs

(Top)



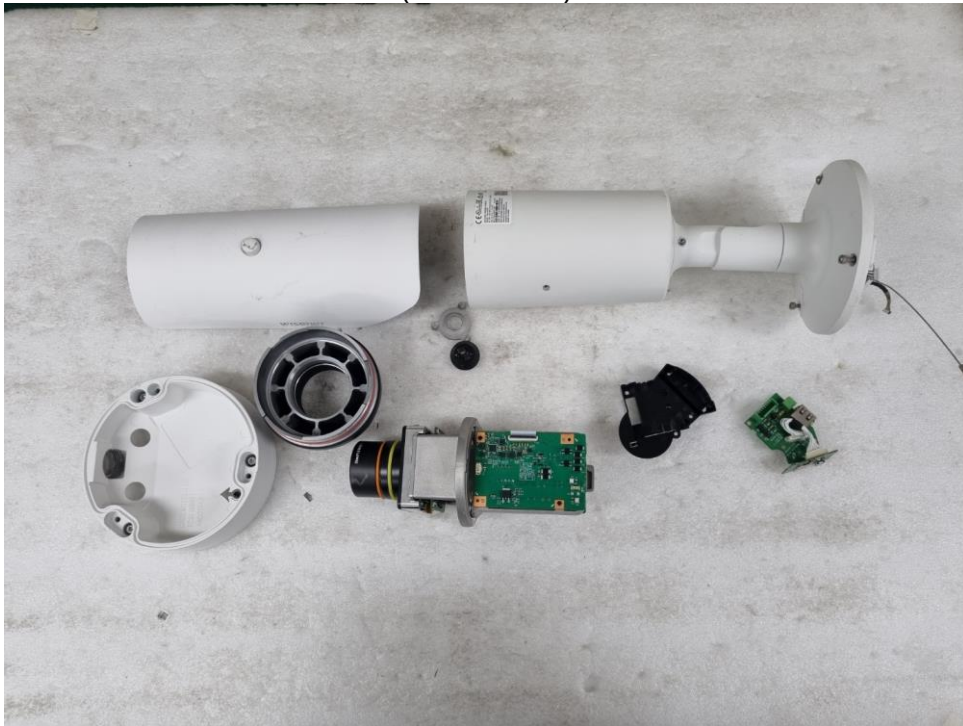
(Bottom)





## EUT Internal Photographs

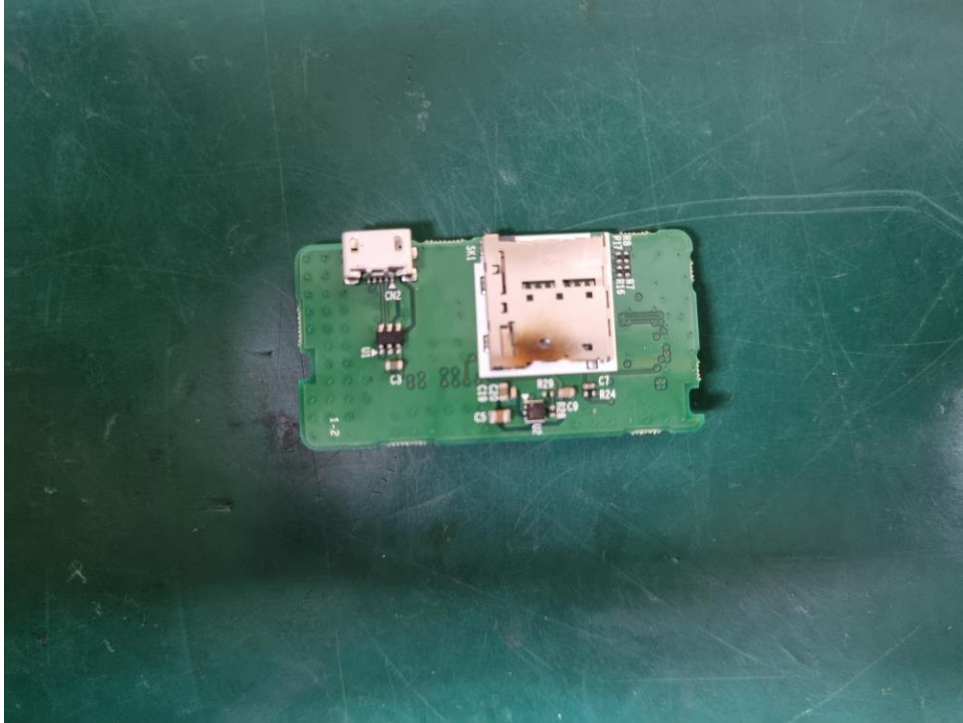
(Internal View)





## EUT Internal View – Board 1

(Top)



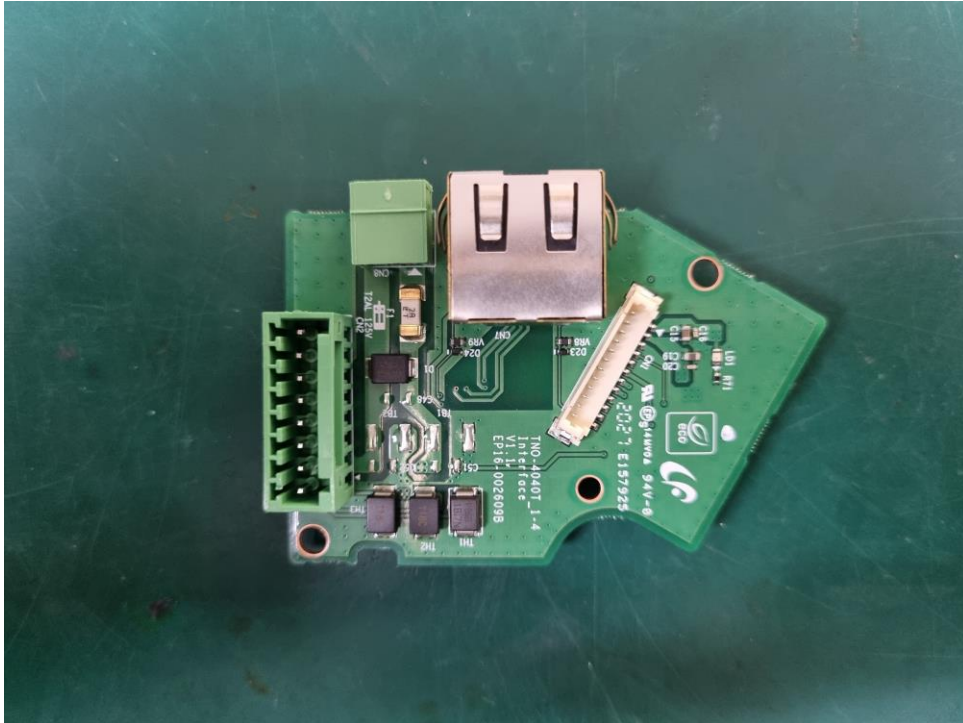
(Bottom)



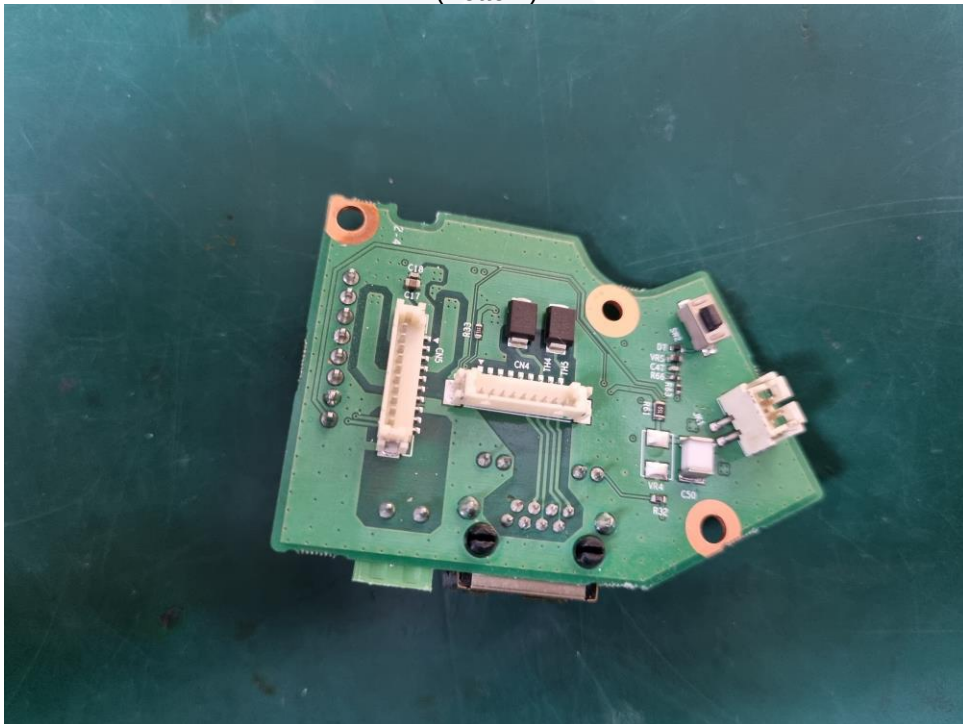


## EUT Internal View – Board 2

(Top)



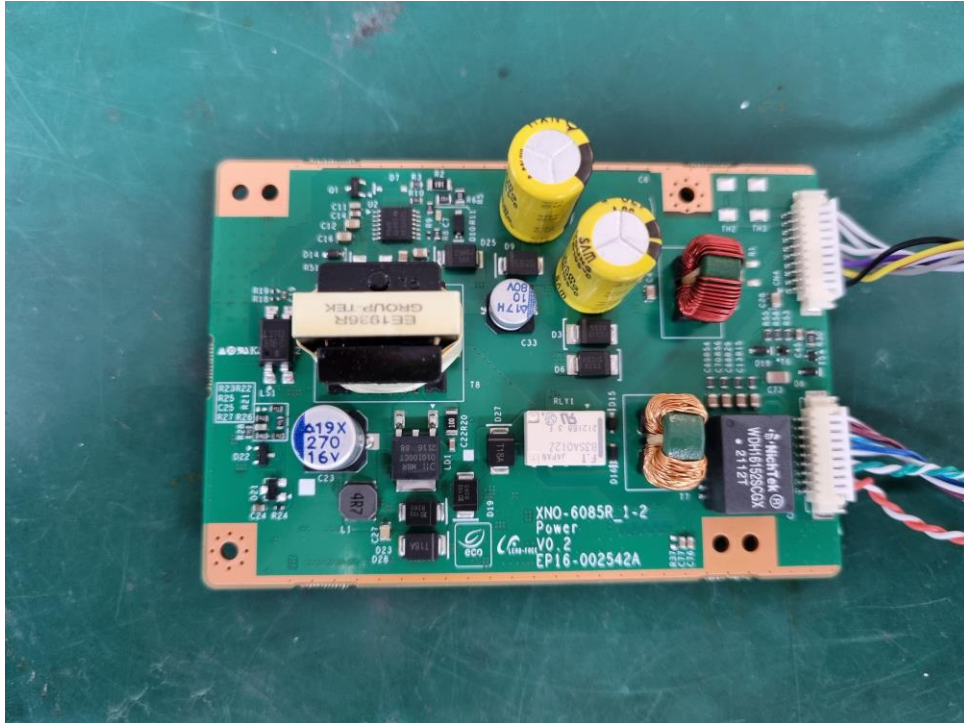
(Bottom)



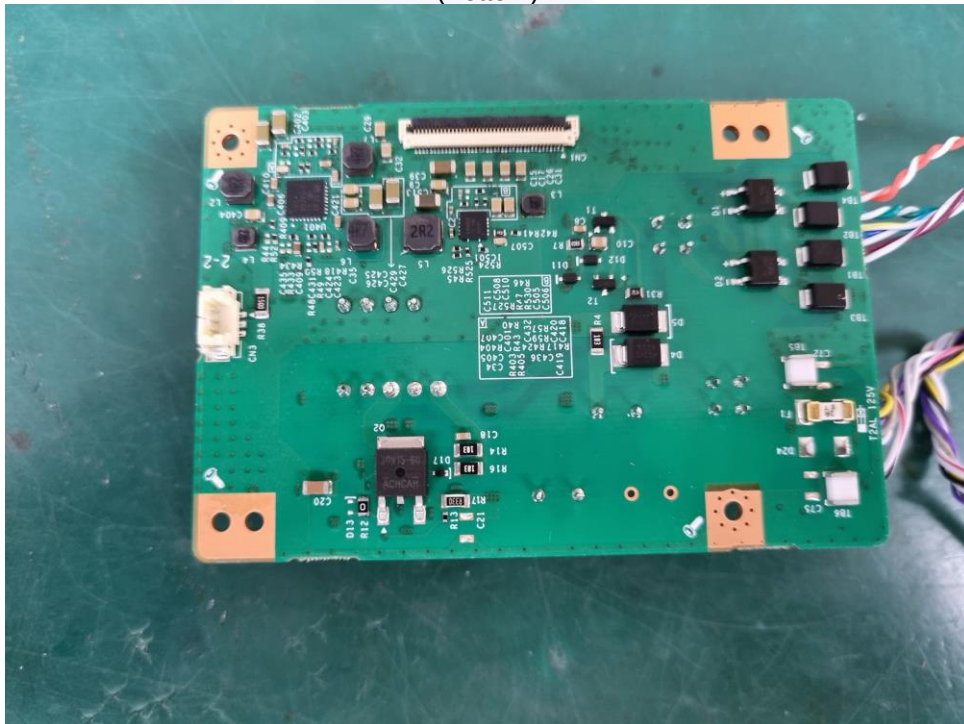


### EUT Internal View – Board 3

(Top)



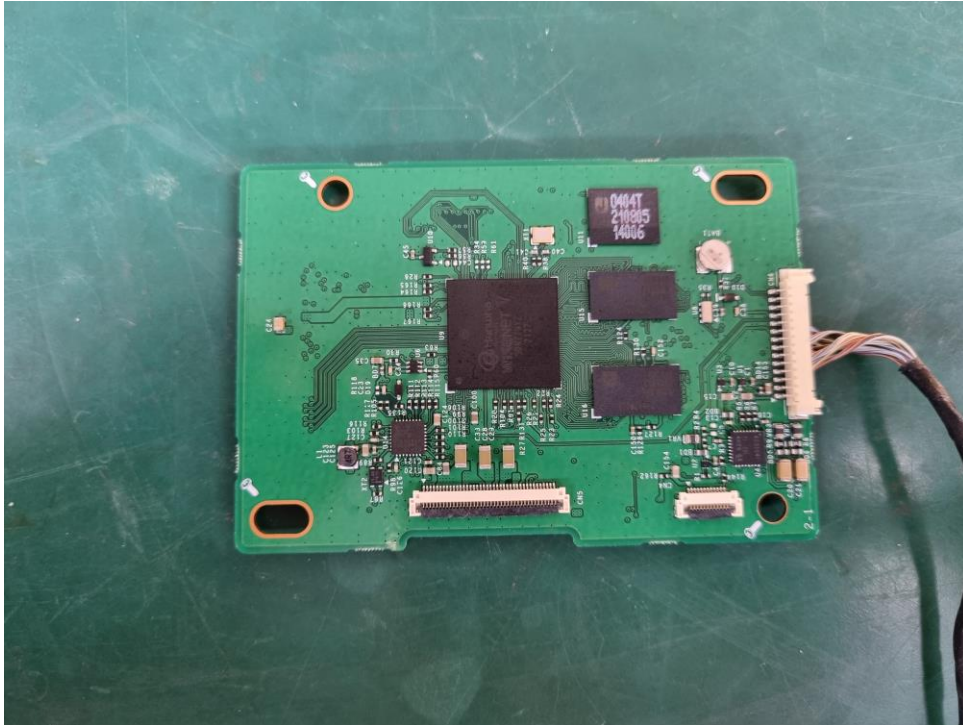
(Bottom)



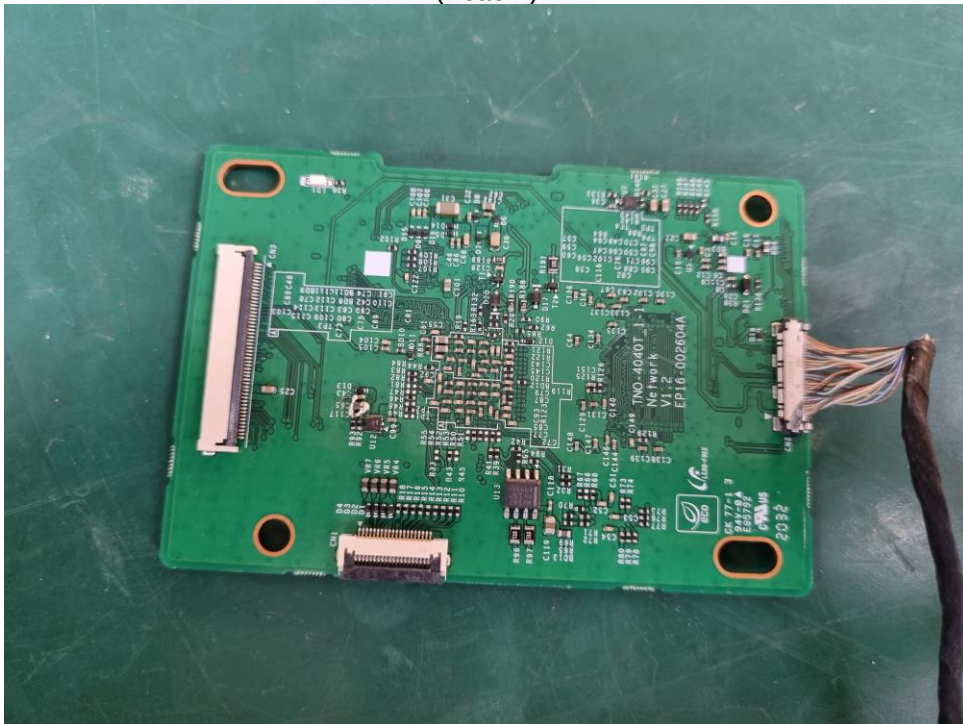


## EUT Internal View – Board 4

(Top)



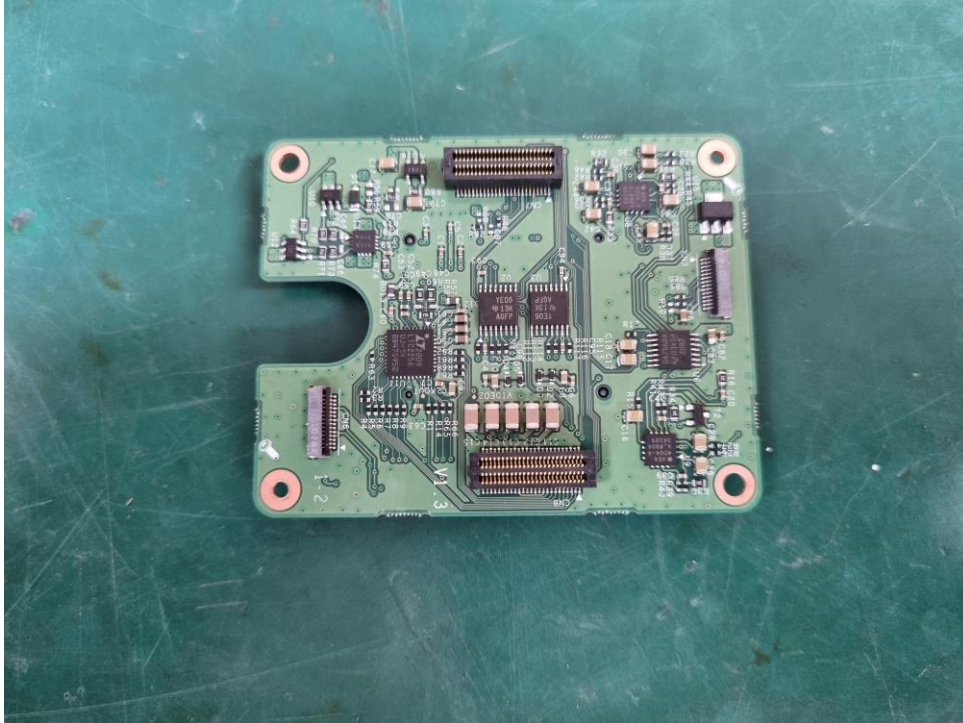
(Bottom)



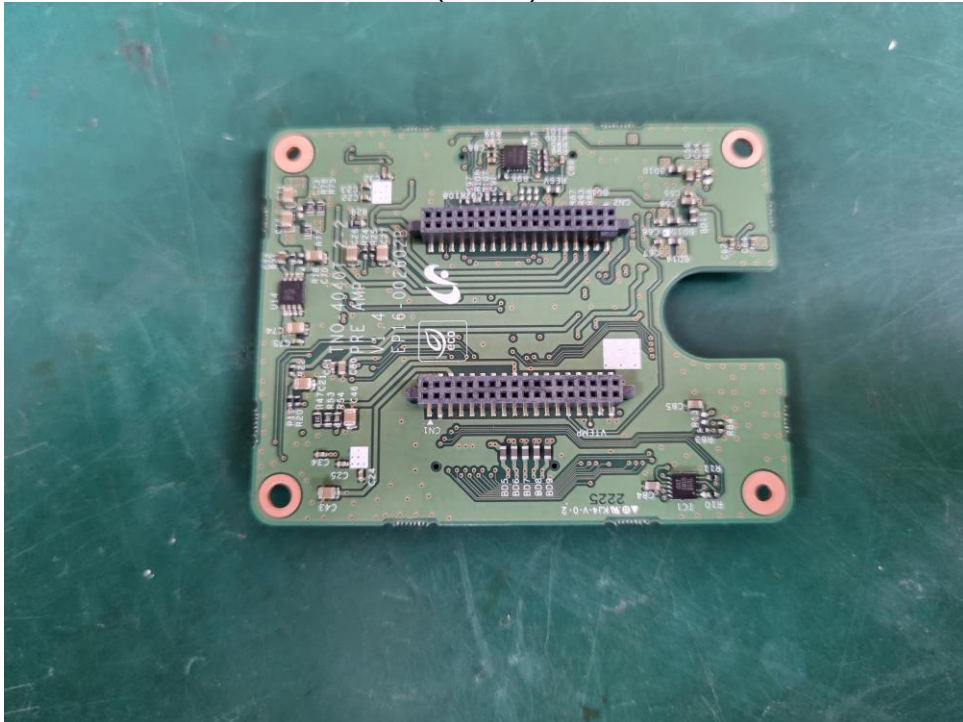


## EUT Internal View – Board 5

(Top)



(Bottom)



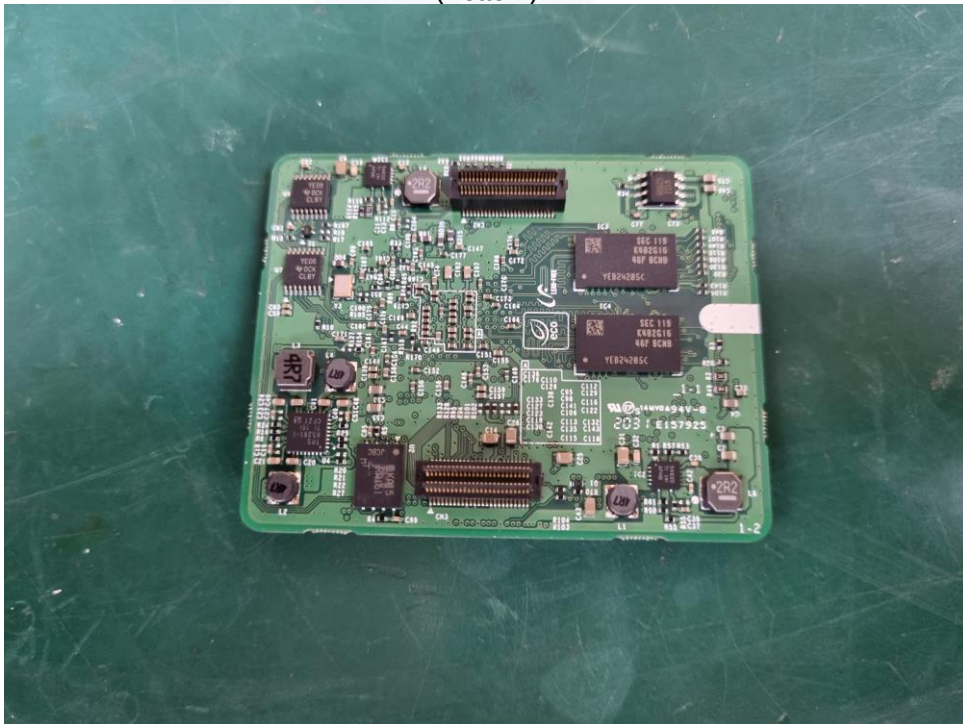


## EUT Internal View – Board 6

(Top)



(Bottom)



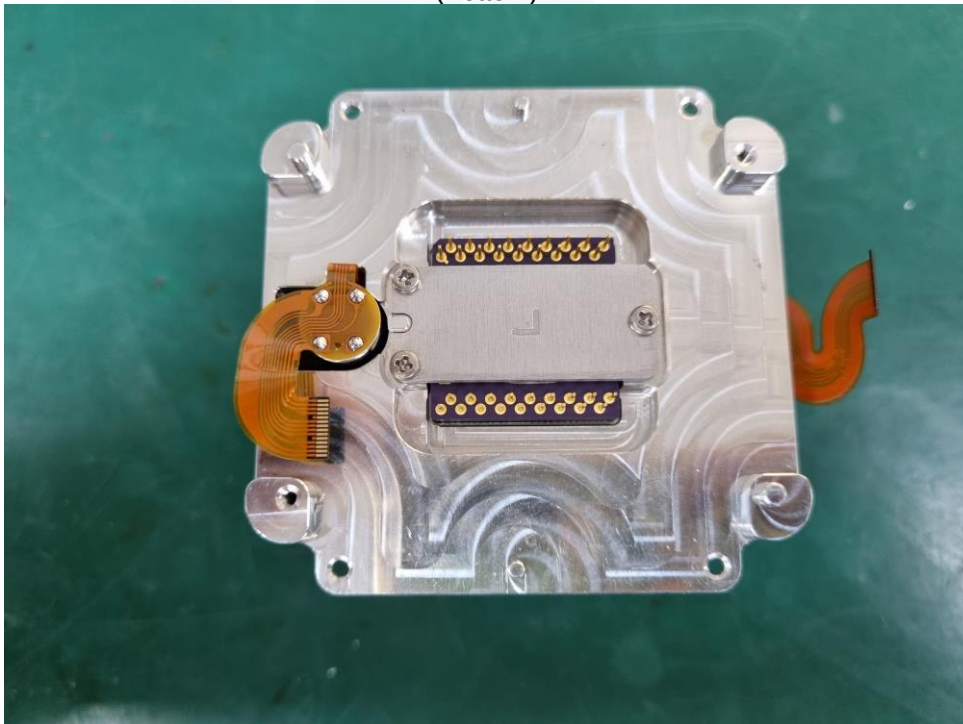


### EUT Internal View – Lens

(Top)

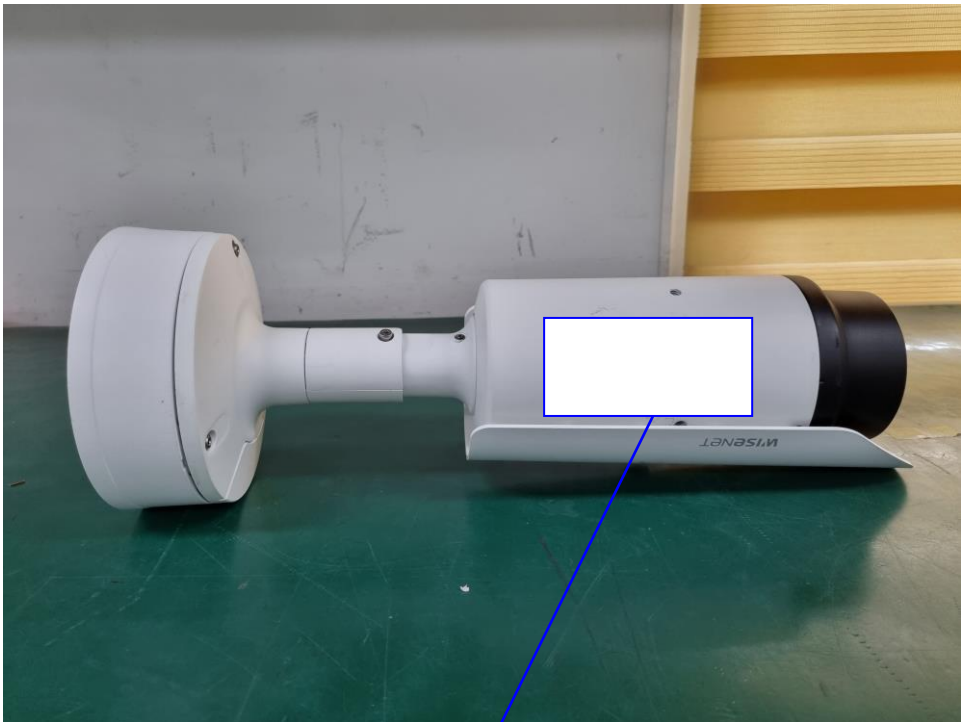


(Bottom)





Label and Location



**NETWORK THERMAL CAMERA**

Model No : TNO-4050T  
Manufacturer : D-TECH CO.,LTD.  
Made in Korea

