



EMC TEST REPORT For CE

Test Report No. : KES-E1-18T0639-R1

Date of Issue : May. 15, 2019

Product name : Thermal Camera

Model/Type No. : TNO-4041TR

Variant Model : -

Applicant : Hanwha Techwin Co., Ltd.

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

Manufacturer : 1. Hanwha Techwin (Tianjin) Co.,Ltd.
2. HANWHA TECHWIN SECURITY VIETNAM CO.,LTD.
3. D-TECH CO.,LTD.

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

Date of Receipt : Nov. 06, 2018

Test date : Nov. 12, 2018 ~ Nov. 13, 2018

Test Results : ☒ In Compliance ☐ Not in Compliance

Tested by

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EMC Test Engineer

Reviewed by

Dong-Hun, Jang
EMC Technical Manager

This test report is not related to KOLAS.

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REPORT REVISION HISTORY

Date	Test Report No.	Revision History
Nov. 17, 2018	KES-E1-18T0639	Issued
May. 15, 2019	KES-E1-18T0639-R1	Re-issue due to regulations update

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1.0 General Product Description

Main Specifications of EUT are:

VIDEO	
Imaging Device	Uncooled microbolometer, Pixel size : 17 μ m
Effective Pixels	640(H) x 480(V)
NETD	<50mK
Video Out	CVBS: 1.0Vpp / 75 Ω composite, 720 x 480(N), 720 x 576(P), for installation
LENS	
Focal Length (Zoom Ratio)	19mm fixed
Max. Aperture Ratio	F1.0
Angular Field of View	H: 32° / V: 24.3° / D: 39.2°
Min. Object Distance	11m (36.09ft)
Focus Control	Fixed
Lens / Mount Type	Board-in type
OPERATIONAL	
Camera Title	Off / On - W/W : English / Numeric / Special characters - China : English / Numeric / Special / Chinese characters - Common : Multi-line (Max. 5), Color (Gray / Green / Red / Blue / Black / White), Transparency, Auto scale by resolution
Motion Detection	Off / On (8ea, 8point polygonal zones), Handover
Privacy Masking	Off / On (32ea, polygonal zones) - Color : Gray / Green / Red / Blue / Black / White - Mosaic
Flip / Mirror	Off / On
Video & Audio Analytics	Tampering, Loitering, Directional detection, Virtual line, Enter/Exit, (Dis) Appear, Audio detection, Motion detection, Sound classification, Shock detection, Temperature change detection
Alarm I/O	Input 1ea / Output 2ea
Digital Image Stabilization	Off / On (Built-in Gyro sensor)
Remote Control Interface	RS485
RS-485 Protocol	Pelco D/P, Samsung T, Honeywell, Bosch, Panasonic, Sungin, AD, Vicon, GE
Alarm Triggers	Alarm input, Motion detection, Video & Audio analytics, Network disconnect
Alarm Events	File upload Via FTP, E-mail, Notification Via E-mail, Local storage (SD/SDHC/ SDXC) or NAS recording at event triggers, External output
Pixel count	Support
NETWORK	
Ethernet	RJ-45 (10/100 BASE-T)
Video Compression Format	H.265 / H.264 (MPEG-4 part 10/AVC) : Main / Baseline / High, MJPEG
Resolution	640 x 480, 640 x 360, 320 x 240
Max. Framerate	H.265 / H.264 : Max. 30fps at all resolutions, MJPEG : Max. 30fps
WiseStreamII	Support
Video Quality Adjustment	H.265 / H.264 / MJPEG : Target Bitrate Level Control
Bitrate Control Method	H.265 / H.264 : CBR or VBR, MJPEG : VBR
Streaming Capability	Multiple streaming (Up to 10 profiles)
Audio In	Selectable (Mic In / Line In), Supply voltage : 2.5V DC (4mA), Input impedance : approx. 2K Ohm
Audio Out	Line out, Max output level : 1 Vrms
Audio Compression Format	G.711 u-law / G.726 selectable, G.726 (ADPCM) 8KHz, G.711 8KHz, G.726 : 16Kbps, 24Kbps, 32Kbps, 40Kbps, 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, UPnP, Bonjour



1.1 Test Voltage & Frequency

Unless indicated otherwise on the individual data sheet or test results, the test voltage and frequency was as indicated below.

Voltage ☐ 230Vac ☐ 100 Vac ☒ 24 Vac ☒ 12 Vdc ☒ PoE
Frequency ☐ 50 Hz ☐ 60 Hz ☐ Hz

1.2 Variant Model Differences

Not applicable

1.3 Device Modifications

Not applicable

1.4 Equipment Under Test

Description	Model Number	Serial Number	Manufacturer	Remarks
Thermal Camera	TNO-4041TR	-	Hanwha Techwin (Tianjin) Co.,Ltd.	EUT

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1.5 Support Equipments

Description	Model Number	Serial Number	Manufacturer	Remarks
AC Adaptor	DRL-46000AC	-	Dream Tech	-
PoE Adaptor	PD-9601GR	-	Microsemi	-
Notebook	ProBook4430s	-	HP	-
Notebook Adaptor	SeriesPPP0009H	-	CHICONY POWER TECHNOLOGY (SUZHOU) CO.,LTD,	-
Speaker	BR1000A	-	DONGGUAN 1 TECHNOLOGY Co., Ltd	-
MIC	MP1000	-	-	-
Alarm	-	-	-	-
Button Alarm	-	-	-	-
controller	SPC-1010	C50E67WG10100F	SamSung Techwin Co.,Ltd	
iPod	A1367	C3TDG2JGDCP9	APPLE .Inc	-
Micro SD Card	-	-	SanDisk	8 GB

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1.6 External I/O Cabling

■ AC 24 V, DC 12 V MODE

Start		END		Cable Spec.	
Description	I / O Port	Description	I / O Port	Length	Shield
Thermal Camera (EUT)	RJ-45	Notebook	RJ-45	3.0	U
	Thermal 2Pin	Speaker	3.5 mm	1.4	U
	Thermal 2Pin	MIC	3.5 mm	1.4	U
	Thermal 2Pin	Alarm	Thermal 2Pin	3.0	U
	Thermal 2Pin	Button Alarm	Thermal 2Pin	3.0	U
	Thermal 2Pin	controller	Thermal 2Pin	3.0	U
	SLOT	Micro SD Card	SLOT	-	-
Notebook	3.5 mm	Phone	3.5 mm	0.8	U

■ PoE MODE

Start		END		Cable Spec.	
Description	I / O Port	Description	I / O Port	Length	Shield
Thermal Camera (EUT)	RJ-45 (PoE)	PoE Adaptor	RJ-45 (PoE)	3.0	U
	Thermal 2Pin	Speaker	3.5 mm	1.4	U
	Thermal 2Pin	MIC	3.5 mm	1.4	U
	Thermal 2Pin	Alarm	Thermal 2Pin	3.0	U
	Thermal 2Pin	Button Alarm	Thermal 2Pin	3.0	U
	Thermal 2Pin	controller	Thermal 2Pin	3.0	U
	SLOT	Micro SD Card	SLOT	-	-
Notebook	RJ-45 (DATA)	PoE Adaptor	RJ-45 (DATA)	1.5	U
	3.5 mm	Phone	3.5 mm	0.8	U

* Unshielded=U, Shielded=S

1.7 EUT Operating Mode(s)

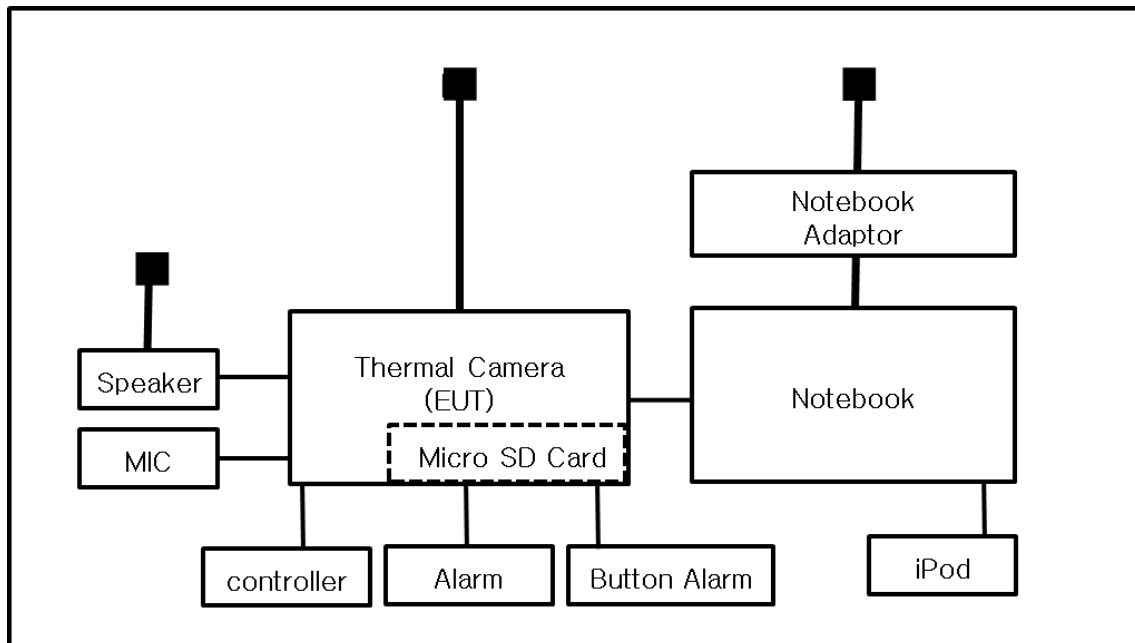
Test Mode	operating
AC 24V DC 12 V PoE	EUT Monitoring, Ping Test

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

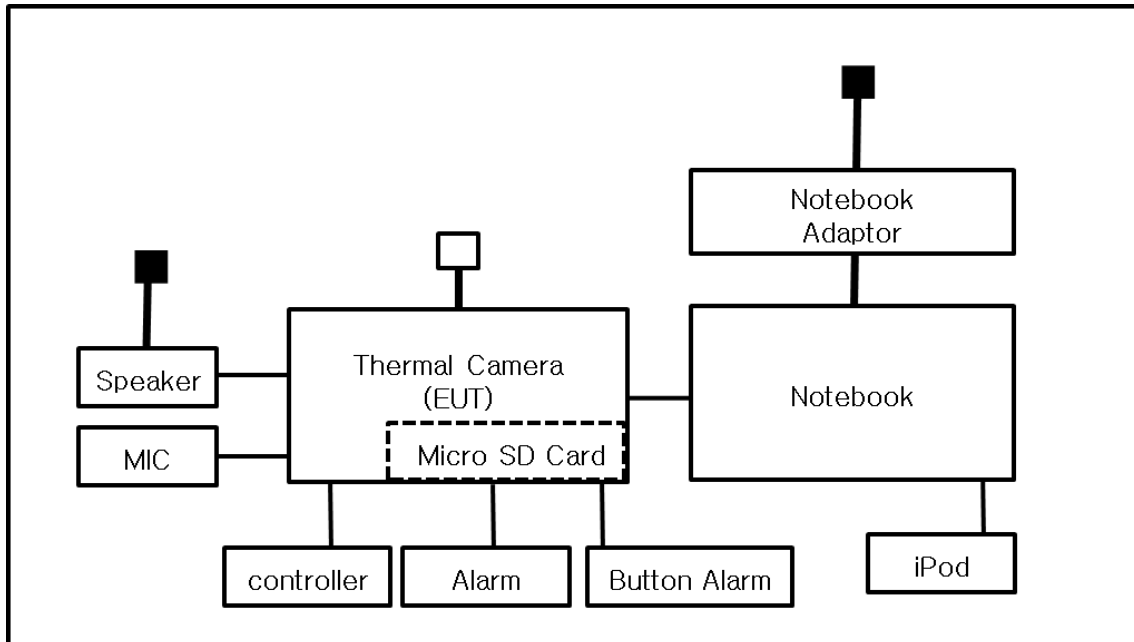
1.8 Configuration

■ AC Main
 □ DC Main

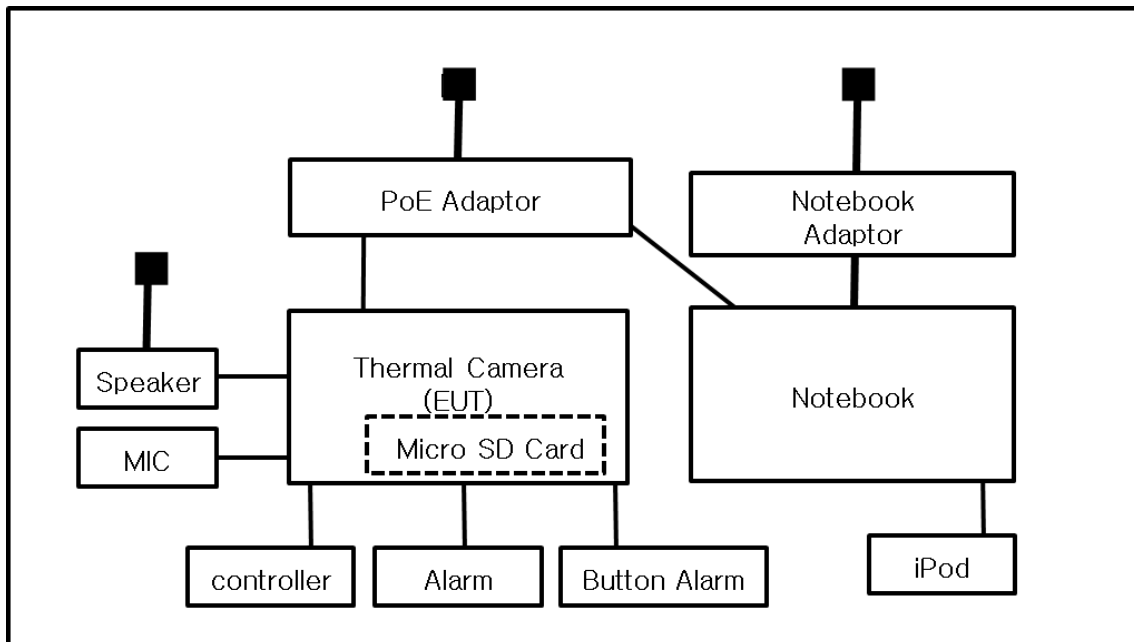
■ AC 24 V MODE



■ DC 12 V MODE



■ PoE MODE



1.9 Remarks when standards applied

N/A

1.10 Calibration Details of Equipment Used for Measurement

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

1.11 Test Facility

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

1.12 Laboratory Accreditations and Listings

Country	Agency	Scope of Accreditation	Logo
KOREA	RRA	EMI (3 m & 10 m Semi-Aechoic Chamber , 10 m Open Area and conducted test site) EMS (ESD, RS, EFT/Burst, Surge, CS, Magnetic, Dips and interruptions)	 KR0100
International	KOLAS	EMI (3 m & 10 m Semi-Aechoic Chamber , and conducted test site) EMS (ESD, RS, EFT/Burst, Surge, CS, Magnetic, Dips and interruptions)	 KT489
USA	FCC	3 m & 10 m Semi-Aechoic Chamber, 10 m Open Area and Conducted test site to perform FCC Part 15/18 measurements.	 KR0100
Canada	ISED	3 m & 10 m Semi-Aechoic Chamber and Conducted test site	 23298-1
JAPAN	VCCI	Mains Ports Conducted Interference Measurement, Telecommunication Ports Conducted Disturbance Measurement and Radiation 10 meter site, Facility for measuring radiated disturbance above 1 GHz	 R-4308, C-4798, T-2311, G-914
Europe	TÜV SÜD	EMI (3 m & 10 m Semi-Aechoic Chamber , 10 m Open Area and conducted test site) EMS (ESD, RS, EFT/Burst, Surge, CS, Magnetic, Dips and interruptions)	 CARAT 17 07 01633 001

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2.0 Test Regulations

The emissions tests were performed according to following regulations:

☒ **EMC – Directive 2014/30/EU**

☐ EN 61000-6-3:2011

☐ EN 61000-6-1:2007

☐ EN 61000-6-4:2007 +A1:2011

☐ EN 61000-6-2:2005

☐ EN 55011:2007 +A1:2010

☐ Group 1
☐ Class A

☐ Group 2
☐ Class B

☐ EN 55014-1:2006 +A2:2011

☐ EN 55014-2:1997 +A2:2008

☐ EN 55015:2013

☐ EN 61547:2009

☒ EN 55032:2012/AC:2013

☒ Class A

☐ Class B

☐ EN 55024:2010 +A1:2015

☒ EN 50130-4:2011+A1:2014

☒ EN 61000-3-2:2014

☒ EN 61000-3-3:2013

☐ EN 61326-1:2013



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- | | | |
|---|----------------------------------|----------------------------------|
| ☐ VCCI V-3 / 2015.04 | ☐ Class A | ☐ Class B |
| ☐ AS/NZS CISPR22:2009 + A1:2010 | ☐ Class A | ☐ Class B |
| ☐ 47 CFR Part 15, Subpart B | | |
| ☐ CISPR 22:2009 + A1:2010 | ☐ Class A | ☐ Class B |
| ☐ ANSI C63.4-2009 | | |
| ☐ IC Regulation ICES-003 : 2016 | | |
| ☐ CAN/CSA CISPR 22-10 | ☐ Class A | ☐ Class B |
| ☐ ANSI C63.4-2014 | | |
| ☐ RE- Directive 2014/53/EU | | |
| ☐ EN 301 489-1 V1.9.2 | | |
| ☐ Equipment for fixed use | | |
| ☐ Equipment for vehicular use | | |
| ☐ Equipment for portable use | | |
| ☐ EN 301 489-3 V1.6.1 | | |
| ☐ EN 301 489-17 V2.2.1 | | |
| ☐ EN 60945:2002 | | |

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2.1 Conducted Emissions at Mains Power Ports

Test Date

Nov. 12, 2018

Test Location

Electro wave Shieldroom #3

Test Equipment

Used	Description	Model Number	Manufacturer	Serial Number	Cal. Due
☒	EMI Test S/W	EMC32	R & S	9.12.00	-
☒	EMI TEST RECEIVER	ESR3	R & S	101783	04, 25, 2019
☒	LISN	ENV216	R & S	101137	01, 31, 2019
☒	LISN	ENV216	R & S	101786	04, 25, 2019

Test Conditions

Temperature: 22,9 °C

Relative Humidity: 52,7 % 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

Nov. 12, 2018

Test Location

Electro wave Shieldroom #3

Test Equipment

Used	Description	Model Number	Manufacturer	Serial Number	Cal. Due
☒	SHIELD ROOM #3	-	SEMITEC	-	-
☒	EMI Test S/W	EMC32	R & S	9.12.00	-
☒	EMI TEST RECEIVER	ESR3	R & S	101783	04, 25, 2019
☒	LISN	ENV216	R & S	101137	01, 31, 2019
☒	LISN	ENV216	R & S	101786	04, 25, 2018
☒	8-WIRE ISN CAT3	CAT3 8158	SCHWARZBECK	8158-0019	03, 22, 2019
☒	8-WIRE ISN CAT5	CAT5 8158	SCHWARZBECK	8158-0030	03, 22, 2019
☐	8-WIRE ISN CAT6	NTFM 8158	SCHWARZBECK	8158-0029	08, 10, 2019

Test Conditions

Temperature: 22,9 °C
Relative Humidity: 52,7 % 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.



2.3 Radiated Electric Field Emissions(Below 1 GHz)

Test Date

Nov. 12, 2018

Test Location

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

Test Equipment

Used	Description	Model Number	Manufacturer	Serial Number	Cal. Due
☒	EMI Test S/W	EP5/RE	TOYO Corporation	6.0.0	-
☒	EMI TEST RECEIVER	ESU26	R & S	100551	04, 11, 2019
☒	AMPLIFIER	SCU 01	R & S	100603	11, 27, 2018
☒	TRILOG-BROADBAND ANTENNA	VULB9163	Schwarzbeck	714	11, 28, 2018

Test Conditions

Temperature: 22,0 °C
Relative Humidity: 53,9 % 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

Nov. 12, 2018

Test Location

SEMI ANECHOIC CHAMBER #3

Test Equipment

Used	Description	Model Number	Manufacturer	Serial Number	Cal. Due
☒	EMI Test S/W	EP5/RE	TOYO Corporation	6.0.0	-
☒	EMI TEST RECEIVER	ESR7	R & S	101190	08, 06, 2019
☒	PREAMPLIFIER	8449B	AGILENT	3008A01967	05, 31, 2019
☐	ATTENUATOR	8491A	HP	35496	03, 21, 2019
☒	DOUBLE RIDGED HORN ANTENNA	SAS-571	A.H.SYSTEM,INC	781	05, 02, 2019

Test Conditions

Temperature: 23,0 °C

Relative Humidity: 53,9 % 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

Nov. 12, 2018

Test Location

Electro wave Shieldroom #3

Test Equipment

Used	Description	Model Number	Manufacturer	Serial Number	Cal. Due
☒	EMI Test S/W	dpa.control	EM TEST	5.4.11.0	-
☒	DIGITAL POWER ANALYZER	DPA 500N	EM TEST	V1024106759	08, 08, 2019
☒	POWER SOURCE	ACS 500N6	EM TEST	V1024106760	-

Test Conditions

Temperature: 22,9 °C

Relative Humidity: 52,7 % 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.

It was tested only at the AC 24 MODE with the AC/AC Adapter.



2.6 Voltage Fluctuations and Flicker

Test Date

Nov. 12, 2018

Test Location

Electro wave Shieldroom #3

Test Equipment

Used	Description	Model Number	Manufacturer	Serial Number	Cal. Due
☒	EMI Test S/W	dpa.control	EM TEST	5.4.11.0	-
☒	DIGITAL POWER ANALYZER	DPA 500N	EM TEST	V1024106759	08, 08, 2019
☒	POWER SOURCE	ACS 500N6	EM TEST	V1024106760	-

Test Conditions

Temperature: 22,9 °C

Relative Humidity: 52,7 % R.H.

Test Results

The requirements are:

- ☒ PASS
☐ NOT PASS
☐ NOT APPLICABLE

Remarks

See Appendix A for test data.

It was tested only at the AC 24 MODE with the AC/AC Adapter.

3.0 Criteria for compliance

Criteria for compliance was based on the following guidelines:

EN 50130-4:2011+A1:2014 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

Nov. 13, 2018

Test Location

EMS-ESD: Electro wave Shieldroom #7

Test Equipment

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

Test Conditions

Temperature: 23,0 °C
Relative Humidity: 53,1 % R.H.
Atmospheric Pressure: 101,0 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 ☐ 2 kV ☐ 4 kV ☒ 6 kV ☐ 8 kV ☐ 15 kV	Air ☒ 2 kV ☒ 4 kV ☐ 6 kV ☒ 8 kV ☐ 15 kV	HCP ☐ 2 kV ☐ 4 kV ☒ 6 kV ☐ 8 kV ☐ 15 kV	VCP ☐ 2 kV ☐ 4 kV ☒ 6 kV ☐ 8 kV ☐ 15 kV
--------------------	---	---	---	---

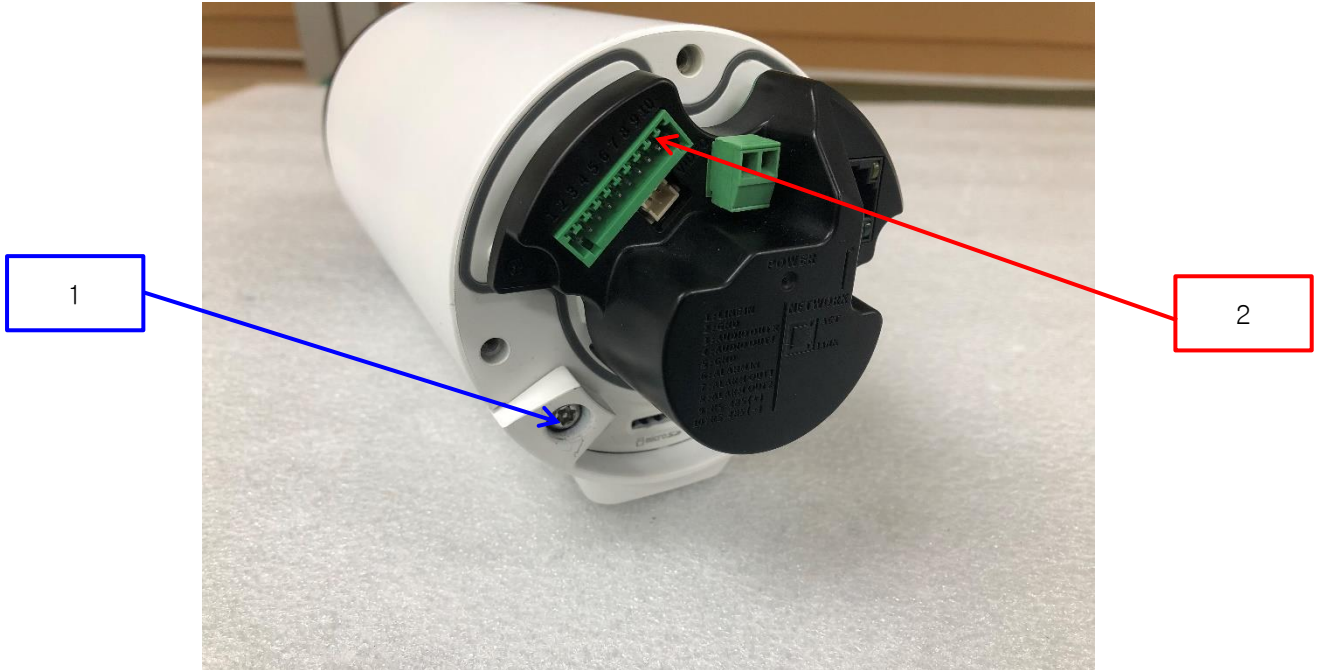
Notes: HCP: Horizontal coupling plane
VCP: Vertical coupling plane

Required Performance Criteria: ☒ Complied

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Location of Discharge:

Air
Contact





Test Data

■ AC 24 V 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	Screw	Contact Discharge	Complied	-
2	Port	Air Discharge	Complied	-

Note: "Blank" = Not performed

■ DC 12 V 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	Screw	Contact Discharge	Complied	-
2	Port	Air Discharge	Complied	-

Note: "Blank" = Not performed

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■ PoE MODE**Indirect Discharge**

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

Direct Discharge

No.	Test Point	Discharge Method	Observations	Remarks
1	Screw	Contact Discharge	Complied	-
2	Port	Air 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

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3.2 Radiated Electric Field Immunity

Reference Standard

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

Test Date

Nov. 13, 2018

Test Location

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

Test Equipment

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

Test Conditions

Temperature: 22,6 °C
Relative Humidity: 53,8 % R.H.
Atmospheric Pressure: 101,0 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 24 V MODE

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

■ DC 12 V 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

RemarksPASS Required Performance Criteria



3.3 Electrical Fast Transients / Bursts

Reference Standard

EN 61000-4-4:2012

Test Date

Nov. 13, 2018

Test Location

EMS-EFT: Electro wave Shieldroom #3

Test Equipment

Used	Description	Model Number	Manufacturer	Serial Number	Cal. Due
☒	EMS Test S/W	iec.control	AMETEK CTS	7.1.2	-
☒	ULTRA COMPACT SIMULATOR	UCS 500 N5	EM TEST	V0936105120	06, 26, 2019
☒	MOTOR VARIAC	MV2616	EM TEST	V0936105123	06, 26, 2019
☒	CAPACITIVE COUPLING CLAMP	HFK	EM TEST	070925	06, 26, 2019

Test Conditions

Temperature: 22,8 °C
Relative Humidity: 52,8 % R.H.
Atmospheric Pressure: 101,2 kPa

Test Specifications

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

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

Burst Period: ☒ 300 ms ☐ 2 s

Repetition Rate: ☐ 5 kHz ☒ 100 kHz

Duration of Test Voltage: ☒ ≥ 1 min

Required Performance Criteria: ☒ Complied

Test Data

■ AC 24 V MODE

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

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

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

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

☒ Signal ports and telecommunication ports – Coupling Clamp used

Mode of Application	Observations	
	(+) Burst (kV)	(-) Burst (kV)
RJ-45	Complied	Complied
Alarm	Complied	Complied
Button Alarm	Complied	Complied
Controller	Complied	Complied

■ DC 12 V MODE

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

Mode of Application	Observations	
	(+) Burst (kV)	(-) Burst (kV)
L1	Complied	Complied
L2	Complied	Complied
L1 – L2	Complied	Complied

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

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

☒ Signal ports and telecommunication ports – Coupling Clamp used

Mode of Application	Observations	
	(+) Burst (kV)	(-) Burst (kV)
RJ-45	Complied	Complied
Alarm	Complied	Complied
Button Alarm	Complied	Complied
Controller	Complied	Complied

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■ PoE MODE

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

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

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

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

☒ Signal ports and telecommunication ports – Coupling Clamp used

Mode of Application	Observations	
	(+) Burst (kV)	(-) Burst (kV)
RJ-45	Complied	Complied
Alarm	Complied	Complied
Button Alarm	Complied	Complied
Controller	Complied	Complied

Note: "Blank" = Not performed

Observations:

Complied – No degradation of function

Test Results

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

RemarksPASS Required Performance Criteria

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3.4 Surge Transients

Reference Standard

EN 61000-4-5:2014

Test Date

Nov. 13, 2018

Test Location

EMS-Surge: Electro wave Shieldroom #3

Test Equipment

Used	Description	Model Number	Manufacturer	Serial Number	Cal. Due
☒	EMS Test S/W	iec.control	AMETEK CTS	7.1.2	-
☒	ULTRA COMPACT SIMULATOR	UCS 500 N5	EM TEST	V0936105120	06, 26, 2019
☒	MOTOR VARIAC	MV2616	EM TEST	V0936105123	06, 26, 2019
☒	CDN	CNV 508N1	EM TEST	P1551168979	04, 25, 2019
☐	CDN	CNV 508T5	EM TEST	P1549168422	04, 25, 2019

Test Conditions

Temperature: 22,8 °C
Relative Humidity: 52,8 % R.H.
Atmospheric Pressure: 101,2 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) kV
Differential Mode
☒ (0,5 / 1,0) kV

Number of Surges: ☒ 5 surges per angle

Angle: ☒ 0°, 90°, 180°, 270° (input a.c. power port)

Polarity: ☒ Positive & Negative

Repetition Rate: ☒ 1 surge per min ☐ 1 surge per 30 sec.

Required Performance Criteria: ☒ Complied

Other supply / Signal Lines

Source Impedance: 42 ohm for common Mode

Surge Amplitude: Common Mode
☒ (0,5 / 1,0) kV

Number of Surges: ☒ 5 Surges

Polarity: ☒ Positive & Negative

Repetition Rate: ☐ 1 surge per min ☒ 1 surge per 30 sec.

Required Performance Criteria: ☒ Complied

Test Data

■ AC 24 V 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	Complied	Complied
N - PE	Complied	Complied

Signal Lines

☒ Line to Earth – Common Mode

Mode of Application	Observations	
	(+) Surge (kV)	(-) Surge (kV)
RJ-45	Complied	Complied
Alarm	Complied	Complied
Button Alarm	Complied	Complied
Controller	Complied	Complied

■ DC 12 V MODE

☐ Line to Line – Differential Mode

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

☒ Line to Earth – Common Mode

Mode of Application	Observations	
	(+) Surge (kV)	(-) Surge (kV)
L1 – PE	Complied	Complied
L2 - PE	Complied	Complied

Signal Lines

☒ Line to Earth – Common Mode

Mode of Application	Observations	
	(+) Surge (kV)	(-) Surge (kV)
RJ-45	Complied	Complied
Alarm	Complied	Complied
Button Alarm	Complied	Complied
Controller	Complied	Complied

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■ PoE MODE

☐ Line to Line – Differential Mode

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

☐ Line to Earth – Common Mode

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

Signal Lines☒ Line to Earth – Common Mode

Mode of Application	Observations	
	(+) Surge (kV)	(-) Surge (kV)
RJ-45	Complied	Complied
Alarm	Complied	Complied
Button Alarm	Complied	Complied
Controller	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

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3.5 Conducted Disturbance

Reference Standard

EN 61000-4-6:2014

Test Date

Nov. 13, 2018

Test Location

EMS-CS: Electro wave Shieldroom #3

Test Equipment

Used	Description	Model Number	Manufacturer	Serial Number	Cal. Due
☒	EMS Test S/W	icd.control	EM TEST	5.3.7	-
☒	CONTINUOUS WAVE SIMULATOR	CWS 500N1	EM TEST	V0936105119	08, 09, 2019
☒	ATTENUATOR	ATT6	EM TEST	1208-34	08, 08, 2019
☒	CDN	CDN-M2/M3N	EM TEST	0909-06	08, 06, 2019
☒	CDN	CDN T8RJ45	EM TEST	0909-09	08, 06, 2019
☒	EM INJECTION CLAMP	EM 101	Liithi	35943	02, 02, 2019

Test Conditions

Temperature: 22,8 °C
Relative Humidity: 52,8 % R.H.
Atmospheric Pressure: 101,2 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

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Test Data

■ AC 24 V MODE

☒ Input a.c. power ports

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

☐ Input d.c. power ports

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

☒ Signal ports and telecommunication ports

Coupling Location (Line Stressed)	Coupling Method	Observations
RJ-45	CDN T800	Complied
Alarm	Clamp	Complied
Button Alarm	Clamp	Complied
Controller	Clamp	Complied

■ DC 12 V MODE

☐ Input a.c. power ports

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

☒ Input d.c. power ports

Coupling Location (Line Stressed)	Coupling Method	Observations
L1 – L2	CDN	Complied

☒ Signal ports and telecommunication ports

Coupling Location (Line Stressed)	Coupling Method	Observations
RJ-45	CDN T800	Complied
Alarm	Clamp	Complied
Button Alarm	Clamp	Complied
Controller	Clamp	Complied

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■ PoE MODE☐ Input a.c. power ports

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

☐ Input d.c. power ports

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

☒ Signal ports and telecommunication ports

Coupling Location (Line Stressed)	Coupling Method	Observations
RJ-45	CDN T800	Complied
Alarm	Clamp	Complied
Button Alarm	Clamp	Complied
Controller	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 61000-4-11:2004

Test Date

Nov. 13, 2018

Test Location

EMS-Voltage dip: Electro wave Shieldroom #3

Test Equipment

Used	Description	Model Number	Manufacturer	Serial Number	Cal. Due
☒	EMS Test S/W	iec.control	AMETEK CTS	7.1.2	-
☒	ULTRA COMPACT SIMULATOR	UCS 500 N5	EM TEST	V0936105120	06, 26, 2019
☒	MOTOR VARIAC	MV2616	EM TEST	V0936105123	11, 27, 2018

Test Conditions

Temperature: 22,8 °C
Relative Humidity: 52,8 % R.H.
Atmospheric Pressure: 101,2 kPa



Test Specifications & Observations / Remarks

■ AC 24 V MODE

(Test Voltage : 230 V)

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

- Voltage variations

☒ Unom + 10 %	☒ 253.0 V (ac)	<u>Complied</u>
☒ Unom - 15 %	☒ 195.5 V (ac)	<u>Complied</u>

Observations:

Complied – No degradation of function

Test Results

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

Remarks

PASS Required Performance Criteria

The test has been tested using the AC Adaptor



APPENDIX A – TEST DATA

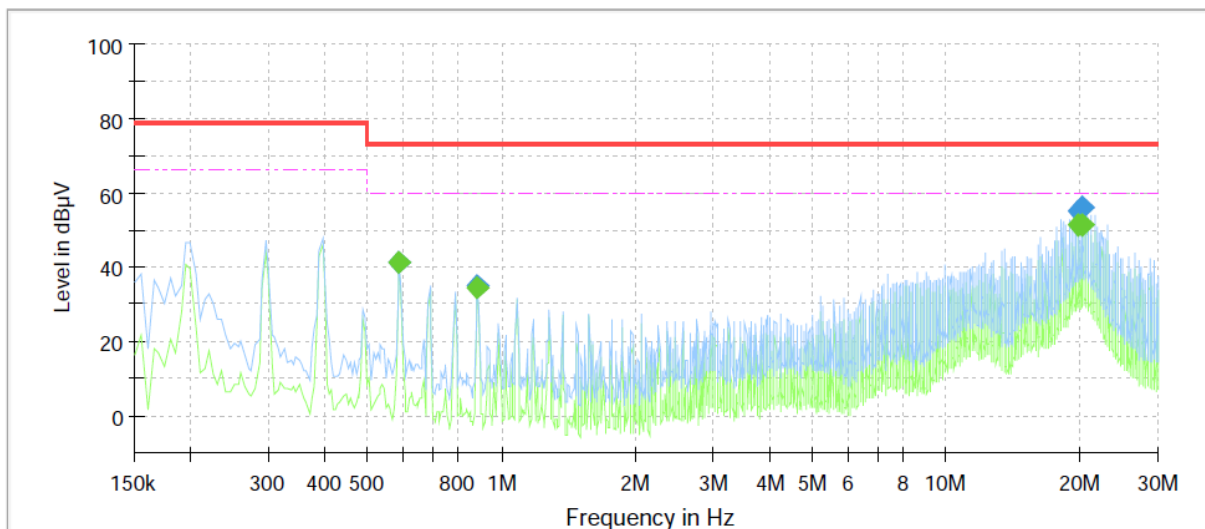
Conducted Emissions at Mains Power Ports

■ AC 24 V MODE

[HOT]

Common Information

Test Description: Conducted Emission
Model No.: TNO-4041TR
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)
0.590000	---	41.23	60.00	18.77	1000.0	9.000	L1	9.8
0.590000	41.27	---	73.00	31.73	1000.0	9.000	L1	9.8
0.885000	---	34.61	60.00	25.39	1000.0	9.000	L1	10.1
0.885000	35.01	---	73.00	37.99	1000.0	9.000	L1	10.1
19.710000	---	51.60	60.00	8.40	1000.0	9.000	L1	10.5
19.710000	55.27	---	73.00	17.73	1000.0	9.000	L1	10.5
20.260000	---	51.58	60.00	8.42	1000.0	9.000	L1	10.5
20.260000	55.86	---	73.00	17.14	1000.0	9.000	L1	10.5



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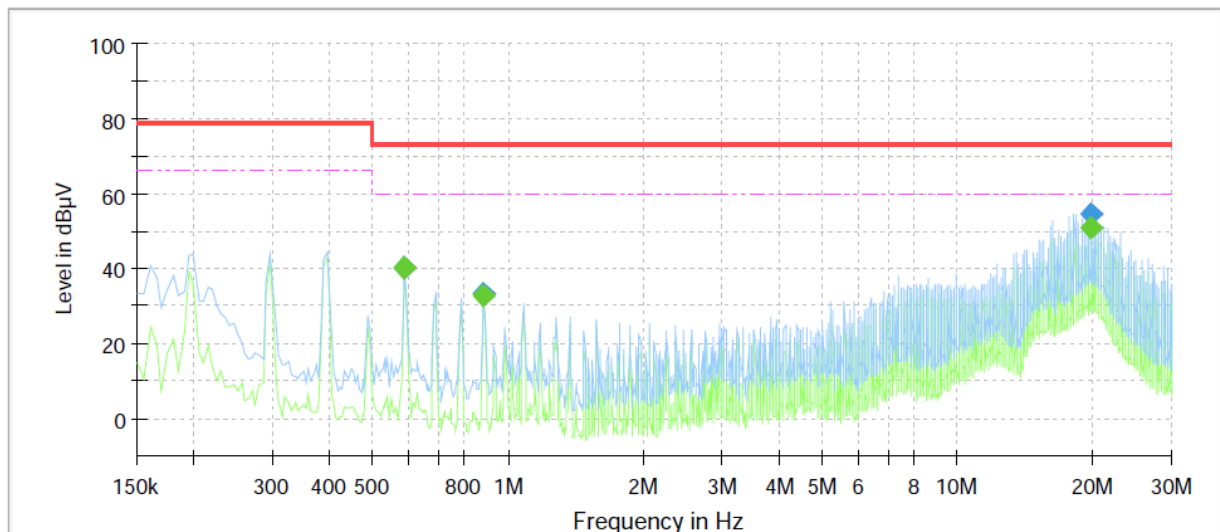
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[NEUTRAL]

Common Information

Test Description: Conducted Emission
Model No.: TNO-4041TR
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)
0.590000	---	39.98	60.00	20.02	1000.0	9.000	N	9.8
0.590000	40.07	---	73.00	32.93	1000.0	9.000	N	9.8
0.885000	---	33.00	60.00	27.00	1000.0	9.000	N	10.0
0.885000	33.43	---	73.00	39.57	1000.0	9.000	N	10.0
19.710000	---	50.95	60.00	9.05	1000.0	9.000	N	10.2
19.710000	54.61	---	73.00	18.39	1000.0	9.000	N	10.2

◆ Calculation

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

QuasiPeak / CAverage : The Final Value

Reading Value : Not shown in the table.

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

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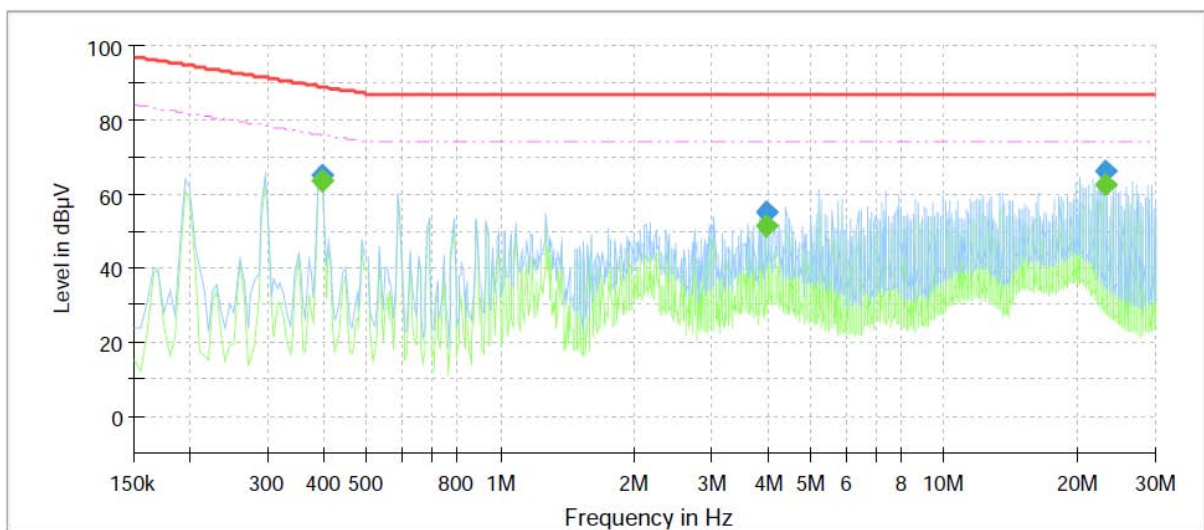
Conducted Emissions at Telecommunication Ports

■ AC 24 V MODE

[10 Mbps]

Common Information

Test Description: Telecommunication Emission
Model No.: TNO-4041TR
Mode: AC 10
Operator Name: KES



Final Result

Frequency (MHz)	QuasiPeak (dBμV)	CAverage (dBμV)	Limit (dBμV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.395000	---	63.58	75.96	12.38	1000.0	9.000	Single Line	10.1
0.395000	65.01	---	88.96	23.95	1000.0	9.000	Single Line	10.1
3.955000	---	51.43	74.00	22.57	1000.0	9.000	Single Line	10.2
3.955000	55.06	---	87.00	31.94	1000.0	9.000	Single Line	10.2
23.130000	---	62.69	74.00	11.31	1000.0	9.000	Single Line	10.1
23.130000	66.31	---	87.00	20.69	1000.0	9.000	Single Line	10.1

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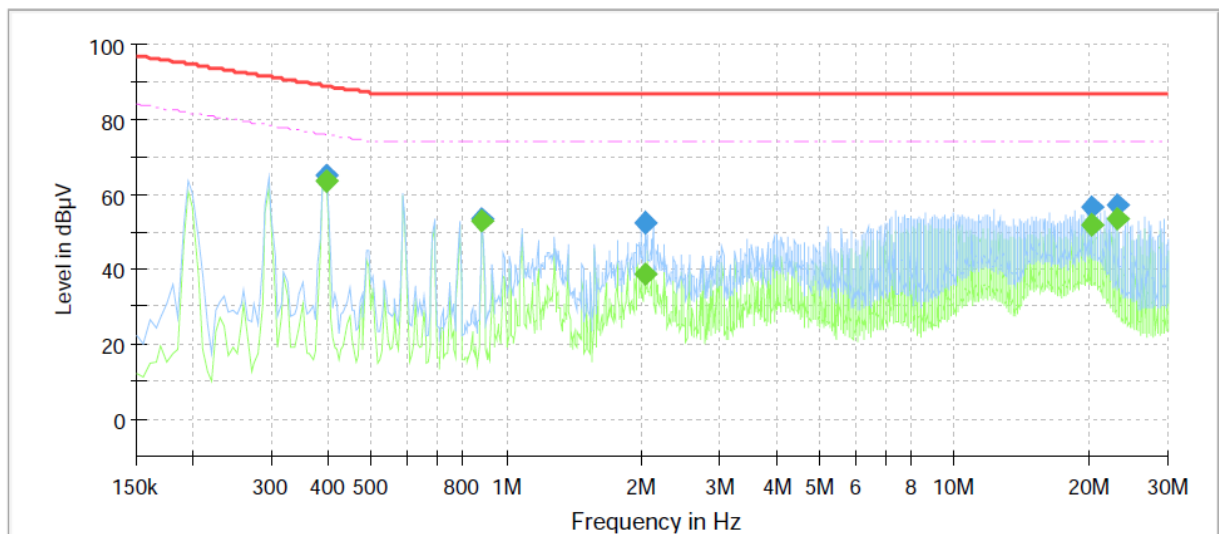
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[100 Mbps]

Common Information

Test Description: Telecommunication Emission
Model No.: TNO-4041TR
Mode: AC 100
Operator Name: KES



Final Result

Frequency (MHz)	QuasiPeak (dBμV)	CAverage (dBμV)	Limit (dBμV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.395000	---	63.53	75.96	12.43	1000.0	9.000	Single Line	9.6
0.395000	64.98	---	88.96	23.98	1000.0	9.000	Single Line	9.6
0.885000	---	53.17	74.00	20.83	1000.0	9.000	Single Line	9.7
0.885000	53.62	---	87.00	33.38	1000.0	9.000	Single Line	9.7
2.045000	---	38.86	74.00	35.14	1000.0	9.000	Single Line	9.8
2.045000	52.60	---	87.00	34.40	1000.0	9.000	Single Line	9.8
20.260000	---	51.85	74.00	22.15	1000.0	9.000	Single Line	9.6
20.260000	56.64	---	87.00	30.36	1000.0	9.000	Single Line	9.6
23.130000	---	53.45	74.00	20.55	1000.0	9.000	Single Line	9.6
23.130000	56.93	---	87.00	30.07	1000.0	9.000	Single Line	9.6

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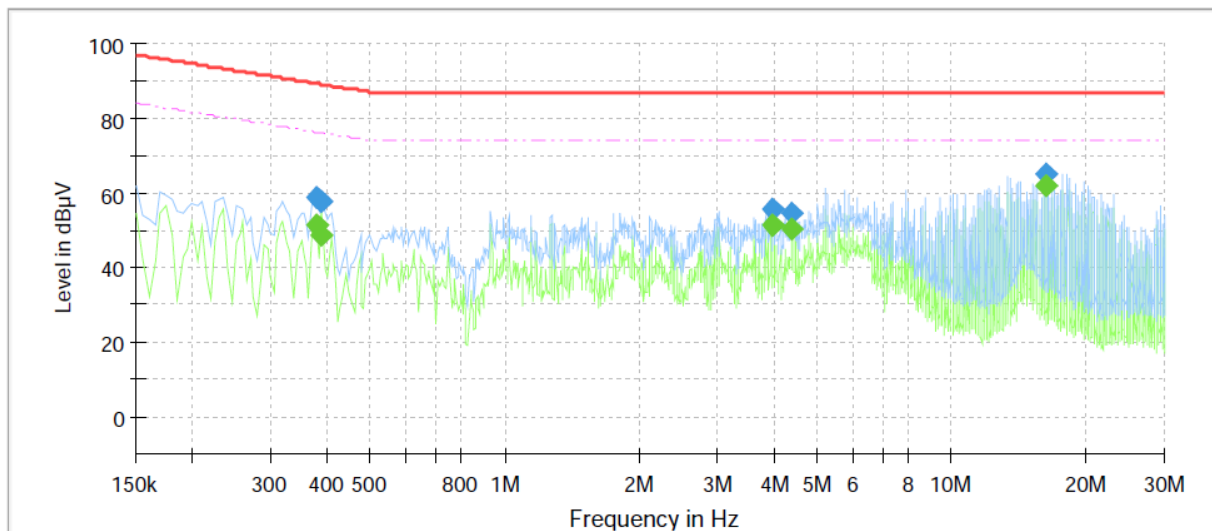
Report No.:
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■ DC 12 V MODE

[10 Mbps]

Common Information

Test Description: Telecommunication Emission
Model No.: TNO-4041TR
Mode: DC 10
Operator Name: KES



Final Result

Frequency (MHz)	QuasiPeak (dBμV)	CAverage (dBμV)	Limit (dBμV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.380000	---	51.34	76.28	24.94	1000.0	9.000	Single Line	10.1
0.380000	58.51	---	89.28	30.77	1000.0	9.000	Single Line	10.1
0.390000	---	48.91	76.06	27.15	1000.0	9.000	Single Line	10.1
0.390000	57.62	---	89.06	31.44	1000.0	9.000	Single Line	10.1
3.955000	---	51.51	74.00	22.49	1000.0	9.000	Single Line	10.2
3.955000	55.77	---	87.00	31.23	1000.0	9.000	Single Line	10.2
4.410000	---	50.12	74.00	23.88	1000.0	9.000	Single Line	10.2
4.410000	54.72	---	87.00	32.28	1000.0	9.000	Single Line	10.2
16.230000	---	61.92	74.00	12.08	1000.0	9.000	Single Line	10.2
16.230000	65.16	---	87.00	21.84	1000.0	9.000	Single Line	10.2

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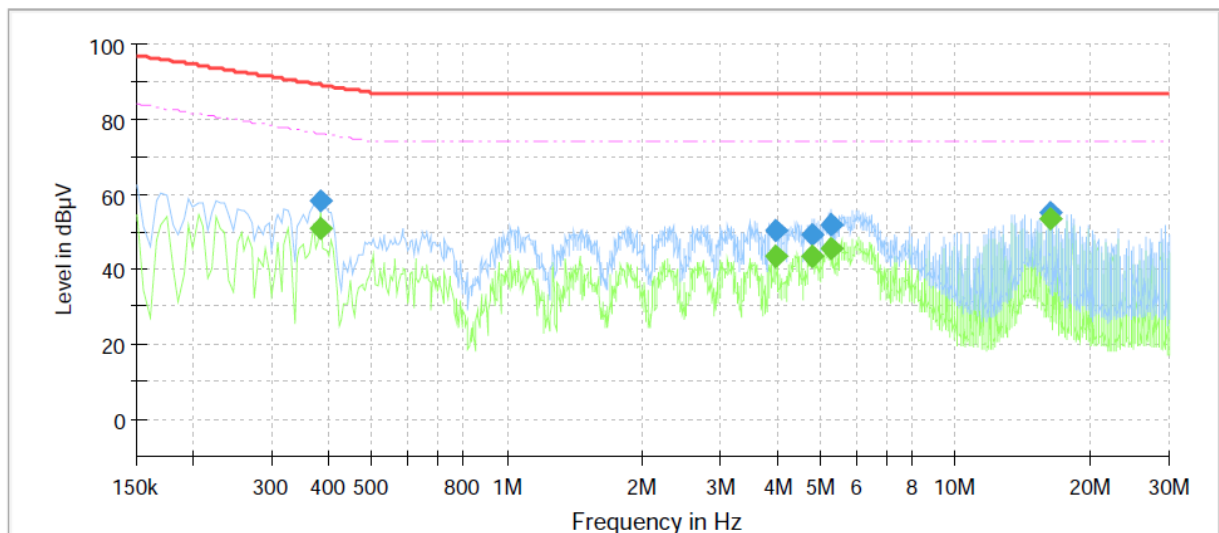
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[100 Mbps]

Common Information

Test Description: Telecommunication Emission
Model No.: TNO-4041TR
Mode: DC 100
Operator Name: KES



Final Result

Frequency (MHz)	QuasiPeak (dBμV)	CAverage (dBμV)	Limit (dBμV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.385000	---	50.56	76.17	25.61	1000.0	9.000	Single Line	9.6
0.385000	58.34	---	89.17	30.83	1000.0	9.000	Single Line	9.6
3.955000	---	43.56	74.00	30.44	1000.0	9.000	Single Line	9.7
3.955000	50.49	---	87.00	36.51	1000.0	9.000	Single Line	9.7
4.785000	---	43.17	74.00	30.83	1000.0	9.000	Single Line	9.7
4.785000	49.28	---	87.00	37.72	1000.0	9.000	Single Line	9.7
5.300000	---	45.66	74.00	28.34	1000.0	9.000	Single Line	9.6
5.300000	51.85	---	87.00	35.15	1000.0	9.000	Single Line	9.6
16.230000	---	53.50	74.00	20.50	1000.0	9.000	Single Line	9.7
16.230000	55.07	---	87.00	31.93	1000.0	9.000	Single Line	9.7

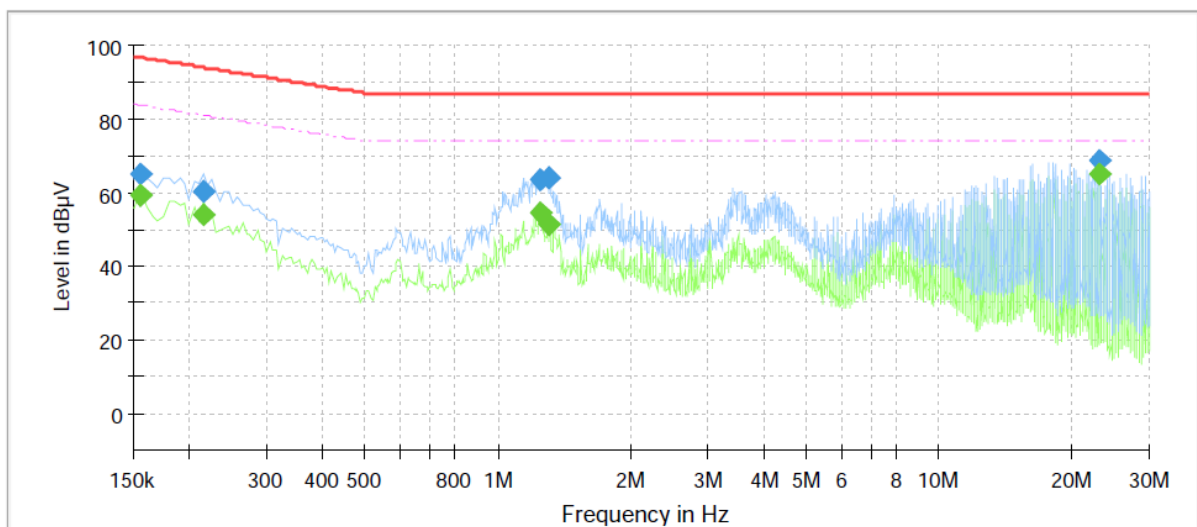
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■ PoE MODE

[10 Mbps]

Common Information

Test Description: Telecommunication Emission
Model No.: TNO-4041TR
Mode: PoE 10
Operator Name: KES



Final Result

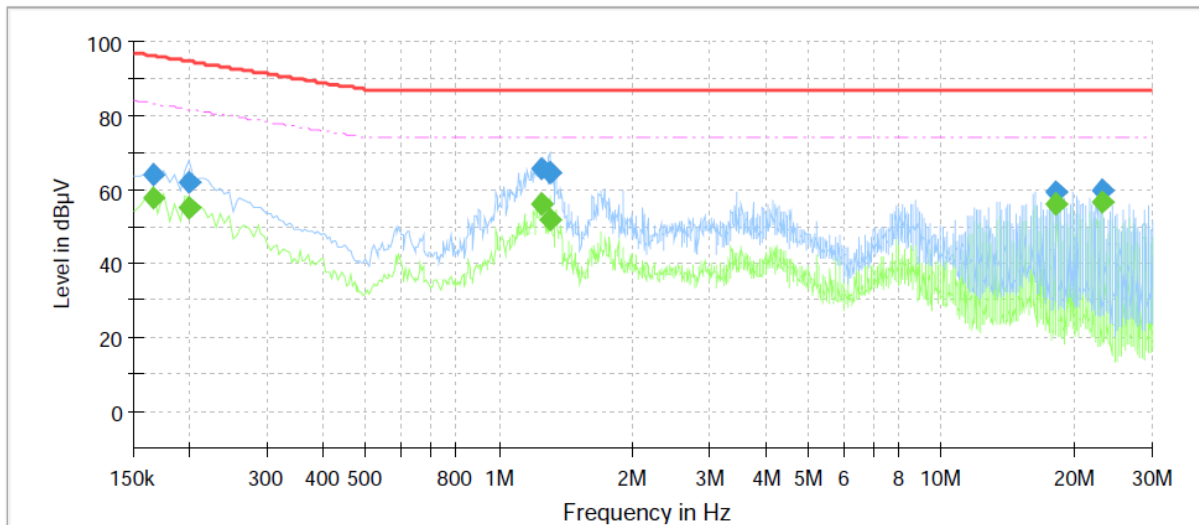
Frequency (MHz)	QuasiPeak (dBμV)	CAverage (dBμV)	Limit (dBμV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.155000	---	59.12	83.73	24.61	1000.0	9.000	Single Line	10.2
0.155000	65.29	---	96.73	31.44	1000.0	9.000	Single Line	10.2
0.215000	---	54.19	81.01	26.82	1000.0	9.000	Single Line	10.1
0.215000	60.56	---	94.01	33.45	1000.0	9.000	Single Line	10.1
1.245000	---	54.42	74.00	19.58	1000.0	9.000	Single Line	10.3
1.245000	63.40	---	87.00	23.60	1000.0	9.000	Single Line	10.3
1.300000	---	51.41	74.00	22.59	1000.0	9.000	Single Line	10.3
1.300000	63.85	---	87.00	23.15	1000.0	9.000	Single Line	10.3
23.130000	---	65.31	74.00	8.69	1000.0	9.000	Single Line	10.1
23.130000	68.89	---	87.00	18.11	1000.0	9.000	Single Line	10.1



[100 Mbps]

Common Information

Test Description: Telecommunication Emission
Model No.: TNO-4041TR
Mode: PoE 100
Operator Name: KES



Final Result

Frequency (MHz)	QuasiPeak (dBμV)	CAverage (dBμV)	Limit (dBμV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.165000	---	57.76	83.21	25.45	1000.0	9.000	Single Line	9.7
0.165000	63.99	---	96.21	32.22	1000.0	9.000	Single Line	9.7
0.200000	---	55.29	81.61	26.32	1000.0	9.000	Single Line	9.6
0.200000	61.92	---	94.61	32.69	1000.0	9.000	Single Line	9.6
1.245000	---	56.22	74.00	17.78	1000.0	9.000	Single Line	9.8
1.245000	65.45	---	87.00	21.55	1000.0	9.000	Single Line	9.8
1.300000	---	51.74	74.00	22.26	1000.0	9.000	Single Line	9.8
1.300000	64.34	---	87.00	22.66	1000.0	9.000	Single Line	9.8
18.245000	---	56.04	74.00	17.96	1000.0	9.000	Single Line	9.7
18.245000	59.35	---	87.00	27.65	1000.0	9.000	Single Line	9.7
23.130000	---	56.56	74.00	17.44	1000.0	9.000	Single Line	9.6
23.130000	59.73	---	87.00	27.27	1000.0	9.000	Single Line	9.6

◆ 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))



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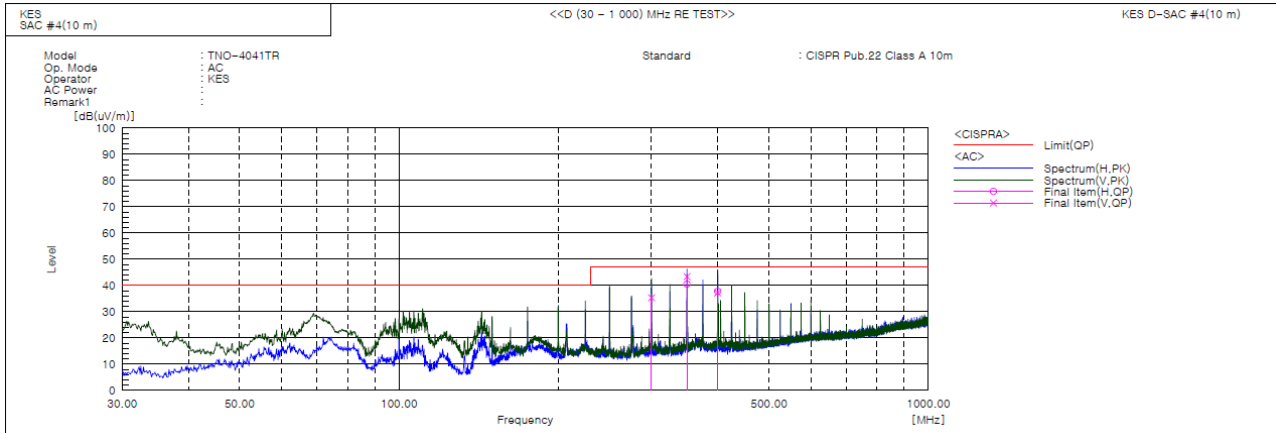
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Radiated Electric Field Emissions(Below 1 GHz)

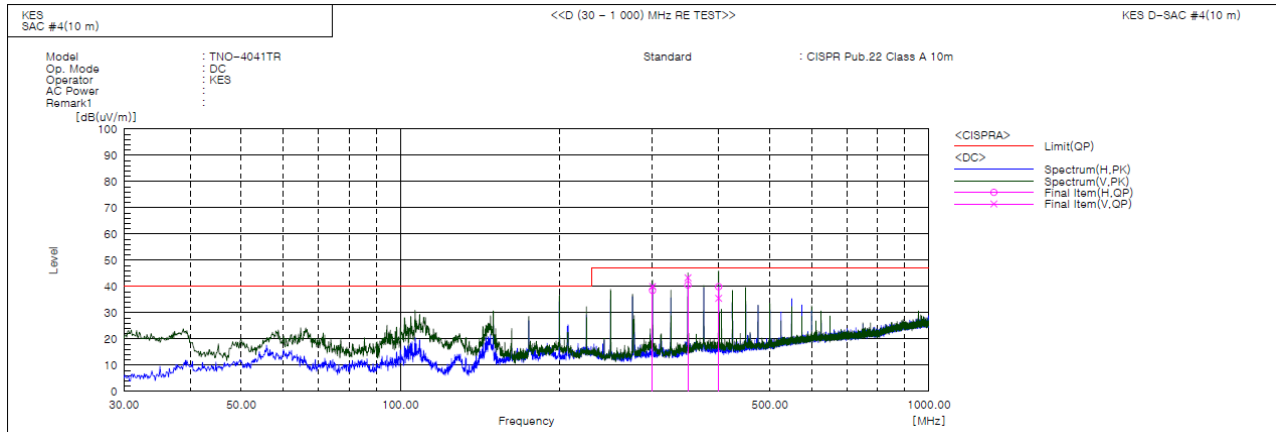
■ AC 24 V MODE



Final Result

No.	Frequency [MHz]	(P)	Reading QP [dB(uV)]	c.f [dB(1/m)]	Result QP [dB(uV/m)]	Limit QP [dB(uV/m)]	Margin QP [dB]	Height [cm]	Angle [deg]	Remark
1	300.024	V	60.1	-24.8	35.3	47.0	11.7	100.0	324.0	
2	349.979	H	63.7	-23.2	40.5	47.0	6.5	400.0	349.0	
3	349.979	V	66.6	-23.2	43.4	47.0	3.6	100.0	102.0	
4	399.934	V	58.6	-21.4	37.2	47.0	9.8	100.0	169.0	
5	400.055	H	59.2	-21.4	37.8	47.0	9.2	400.0	36.0	

■ DC 12 V MODE



Final Result

No.	Frequency [MHz]	(P)	Reading QP [dB(uV)]	c.f [dB(1/m)]	Result QP [dB(uV/m)]	Limit QP [dB(uV/m)]	Margin QP [dB]	Height [cm]	Angle [deg]	Remark
1	300.024	H	63.3	-24.8	38.5	47.0	8.5	400.0	317.0	
2	300.024	V	64.8	-24.8	40.0	47.0	7.0	100.0	296.0	
3	349.979	H	63.8	-23.2	40.6	47.0	6.4	400.0	92.0	
4	349.979	V	66.5	-23.2	43.3	47.0	3.7	100.0	106.0	
5	400.055	H	61.3	-21.4	39.9	47.0	7.1	400.0	24.0	
6	400.055	V	56.9	-21.4	35.5	47.0	11.5	100.0	272.0	

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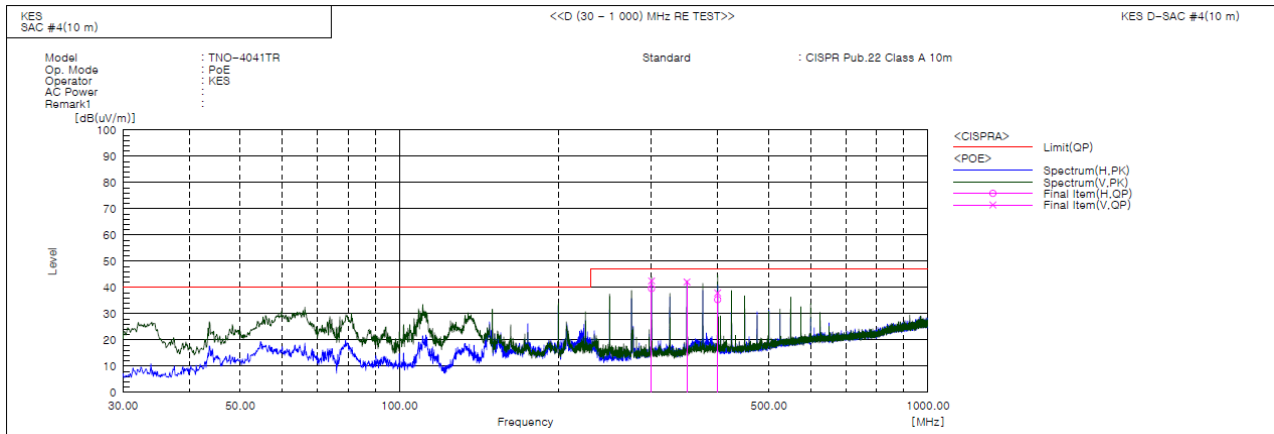
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■ PoE MODE



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	300.024	H	64.4	-24.8	39.6	47.0	7.4	400.0	289.0	
2	300.024	V	67.3	-24.8	42.5	47.0	4.5	100.0	334.0	
3	349.979	V	65.3	-23.2	42.1	47.0	4.9	100.0	218.0	
4	400.055	H	56.8	-21.4	35.4	47.0	11.6	400.0	15.0	
5	400.055	V	59.3	-21.4	37.9	47.0	9.1	100.0	282.0	

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

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

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

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

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

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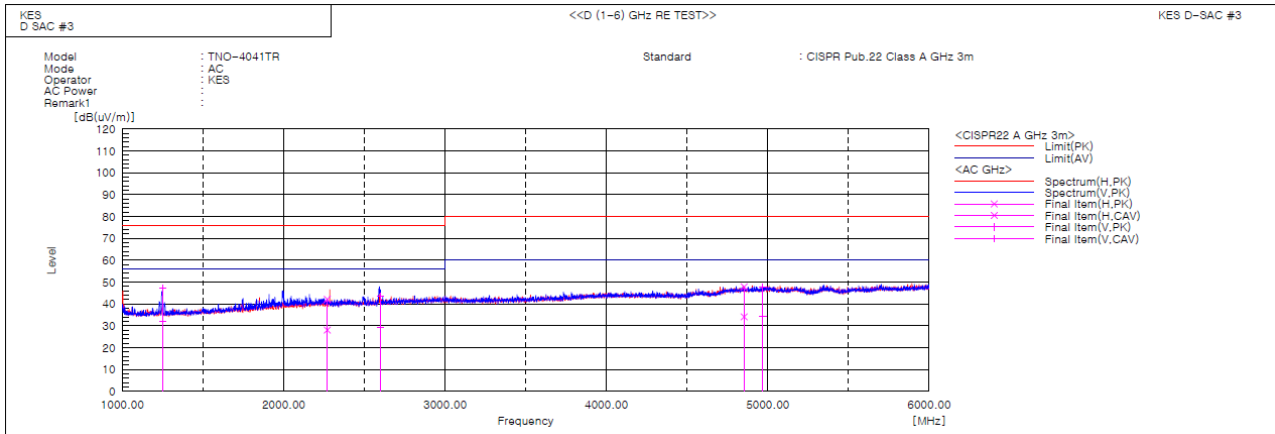
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Radiated Electric Field Emissions(Above 1 GHz)

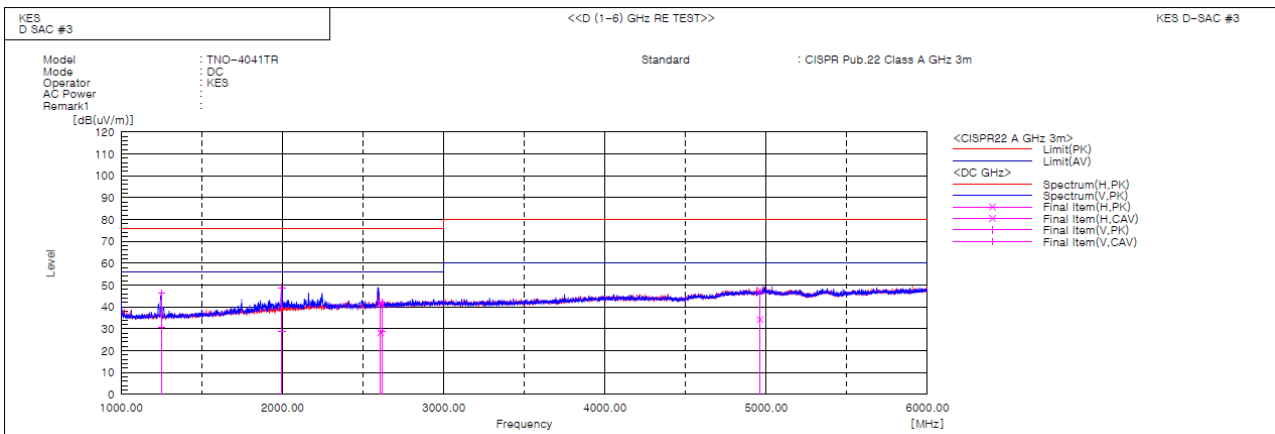
■ AC 24 V MODE



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	1249.519	V	54.2	38.9	-7.0	47.2	31.9	76.0	56.0	28.8	24.1	100.0	221.7	
2	2269.983	H	43.0	28.8	-0.8	42.2	28.0	76.0	56.0	33.8	28.0	100.0	187.4	
3	2600.509	V	43.3	28.9	0.3	43.6	29.2	76.0	56.0	32.4	26.8	100.0	340.6	
4	4853.799	H	39.8	26.1	8.0	47.8	34.1	80.0	60.0	32.2	25.9	100.0	183.3	
5	4968.818	V	39.4	25.8	8.4	47.8	34.2	80.0	60.0	32.2	25.8	100.0	93.8	

■ DC 12 V 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	1249.670	V	53.3	37.5	-7.0	46.3	30.5	76.0	56.0	29.7	25.5	100.0	243.6	
2	1996.870	V	51.0	30.8	-2.1	48.9	28.7	76.0	56.0	27.1	27.3	100.0	2.6	
3	2608.716	H	41.2	27.8	0.4	41.6	28.2	76.0	56.0	34.4	27.8	100.0	67.0	
4	2617.516	V	41.8	28.3	0.4	42.2	28.7	76.0	56.0	33.8	27.3	100.0	298.2	
5	4962.604	H	39.3	25.9	8.4	47.7	34.3	80.0	60.0	32.3	25.7	100.0	121.2	

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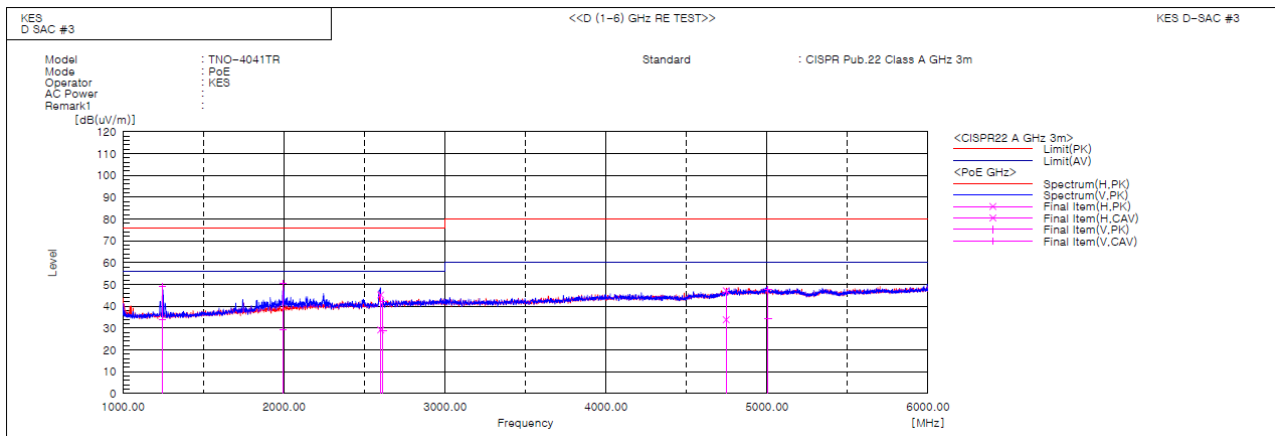
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■ PoE MODE



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	1245.470	V	56.2	41.1	-7.0	49.2	34.1	76.0	56.0	26.8	21.9	100.0	221.4	
2	1993.310	V	52.4	31.2	-2.1	50.3	29.1	76.0	56.0	25.7	26.9	100.0	2.7	
3	2600.048	H	44.9	28.9	0.3	45.2	29.2	76.0	56.0	30.8	26.8	100.0	65.5	
4	2615.987	V	41.7	28.3	0.4	42.1	28.7	76.0	56.0	33.9	27.3	100.0	65.7	
5	4746.330	H	40.0	26.6	7.2	47.2	33.8	80.0	60.0	32.8	26.2	100.0	70.2	
6	5006.988	V	39.3	25.8	8.4	47.7	34.2	80.0	60.0	32.3	25.8	100.0	88.1	

◆ Calculation

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

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

Reading(PK/CAV) : Reading value, Result(PK/CAV) : Reading value + Factor value

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

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

Average harmonic current results				
Hn	I _{eff} [A]	% of Limit	Limit [A]	Result
1	182.017E-3			
2	1.619E-3			PASS
3	61.582E-3	2.677	2.30	PASS
4	1.167E-3			PASS
5	36.063E-3	3.163	1.14	PASS
6	607.466E-6			PASS
7	15.924E-3	2.068	770.00E-3	PASS
8	751.171E-6			PASS
9	11.649E-3	2.912	400.00E-3	PASS
10	643.101E-6			PASS
11	3.600E-3			PASS
12	612.338E-6			PASS
13	1.866E-3			PASS
14	601.793E-6			PASS
15	2.357E-3			PASS
16	540.959E-6			PASS
17	2.480E-3			PASS
18	741.383E-6			PASS
19	1.322E-3			PASS
20	712.104E-6			PASS
21	983.806E-6			PASS
22	646.162E-6			PASS
23	1.122E-3			PASS
24	574.006E-6			PASS
25	840.296E-6			PASS
26	535.412E-6			PASS
27	860.760E-6			PASS
28	771.061E-6			PASS
29	904.083E-6			PASS
30	645.101E-6			PASS
31	619.649E-6			PASS
32	589.235E-6			PASS
33	1.020E-3			PASS
34	667.099E-6			PASS
35	548.256E-6			PASS
36	568.682E-6			PASS
37	1.057E-3			PASS
38	671.990E-6			PASS
39	783.437E-6			PASS
40	625.762E-6			PASS

Harmonic currents less than 0.6% of the input current measured under the test conditions, or less than 5 mA, whichever is greater, are disregarded.



Test Data - Harmonics (continued)

Maximum harmonic current results				
Hn	I _{eff} [A]	% of Limit	Limit [A]	Result
1	183.080E-3			
2	1.802E-3			PASS
3	61.697E-3	1.788	3.45	PASS
4	1.283E-3			PASS
5	36.265E-3	2.121	1.71	PASS
6	888.978E-6			PASS
7	16.069E-3	1.391	1.15	PASS
8	822.747E-6			PASS
9	11.949E-3	1.992	600.00E-3	PASS
10	776.107E-6			PASS
11	3.709E-3			PASS
12	735.703E-6			PASS
13	2.247E-3			PASS
14	834.687E-6			PASS
15	2.497E-3			PASS
16	708.796E-6			PASS
17	2.751E-3			PASS
18	898.382E-6			PASS
19	1.501E-3			PASS
20	1.008E-3			PASS
21	1.153E-3			PASS
22	724.526E-6			PASS
23	1.505E-3			PASS
24	705.564E-6			PASS
25	1.242E-3			PASS
26	638.899E-6			PASS
27	950.921E-6			PASS
28	1.051E-3			PASS
29	1.031E-3			PASS
30	755.637E-6			PASS
31	882.855E-6			PASS
32	807.228E-6			PASS
33	1.121E-3			PASS
34	745.943E-6			PASS
35	666.269E-6			PASS
36	675.953E-6			PASS
37	1.168E-3			PASS
38	1.022E-3			PASS
39	890.184E-6			PASS
40	717.235E-6			PASS

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.

**KES Co., Ltd.**

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Report No.:
KES-E1-18T0639-R1
Page (54) of (72)

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

	EUT values	Limit	Result
Pst	0.028	1.00	PASS
Plt	0.028	0.65	PASS
dc [%]	0.000	3.30	PASS
dmax [%]	0.185	4.00	PASS
Tmax [s]	0.000	0.50	PASS

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Test Setup Photos and Configuration

Conducted Voltage Emissions



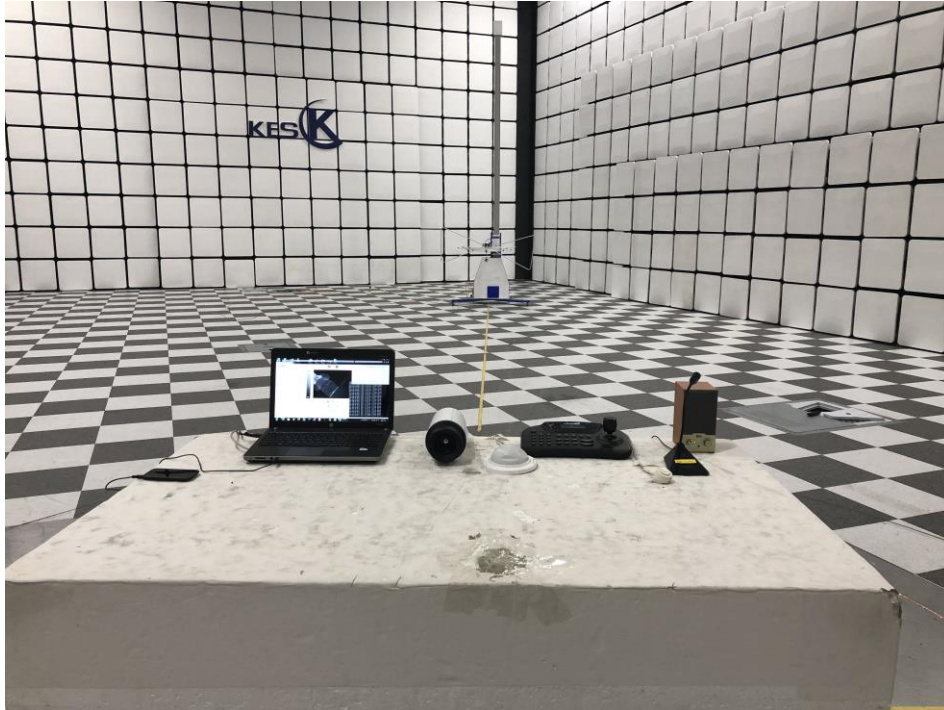
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Conducted Telecommunication Emissions



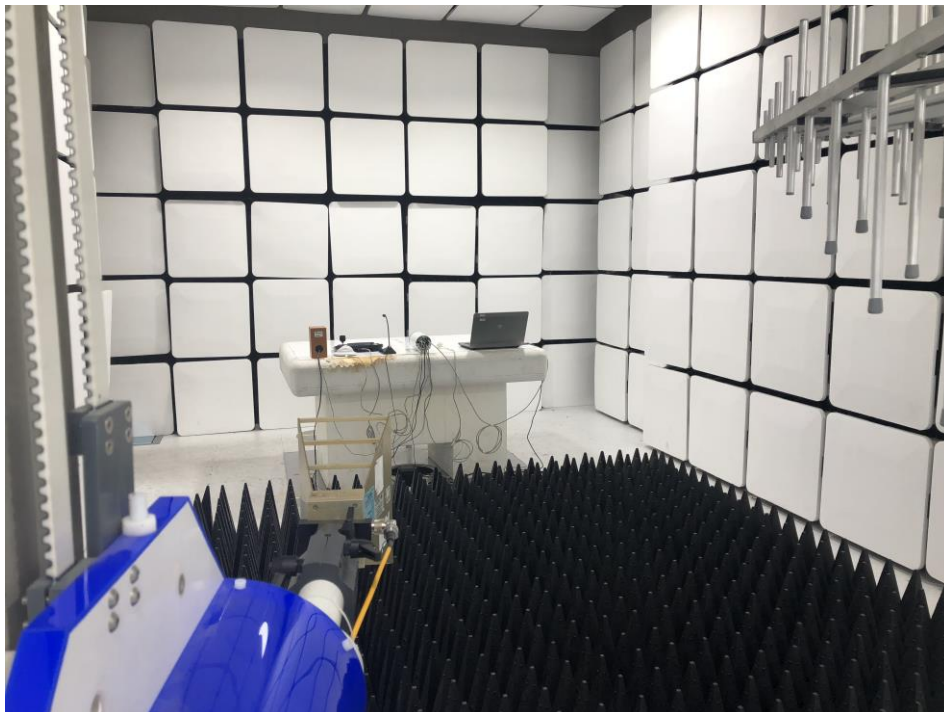
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Radiated Electric Field Emissions(Below 1 GHz)



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Radiated Electric Field Emissions(Above 1 GHz)



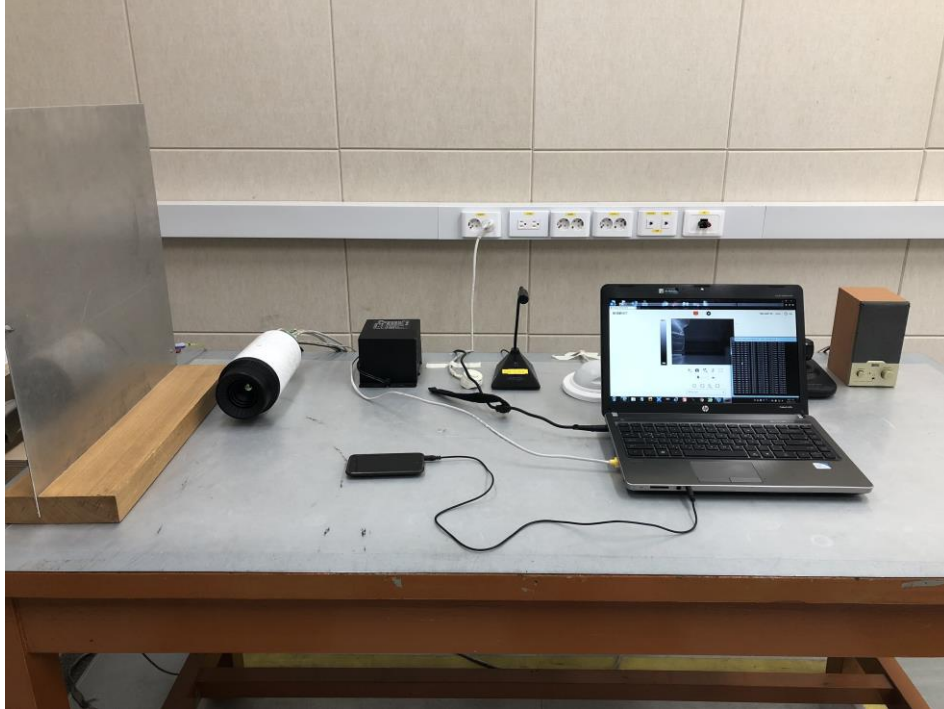
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Harmonic Current Emissions and Voltage Fluctuations and Flicker

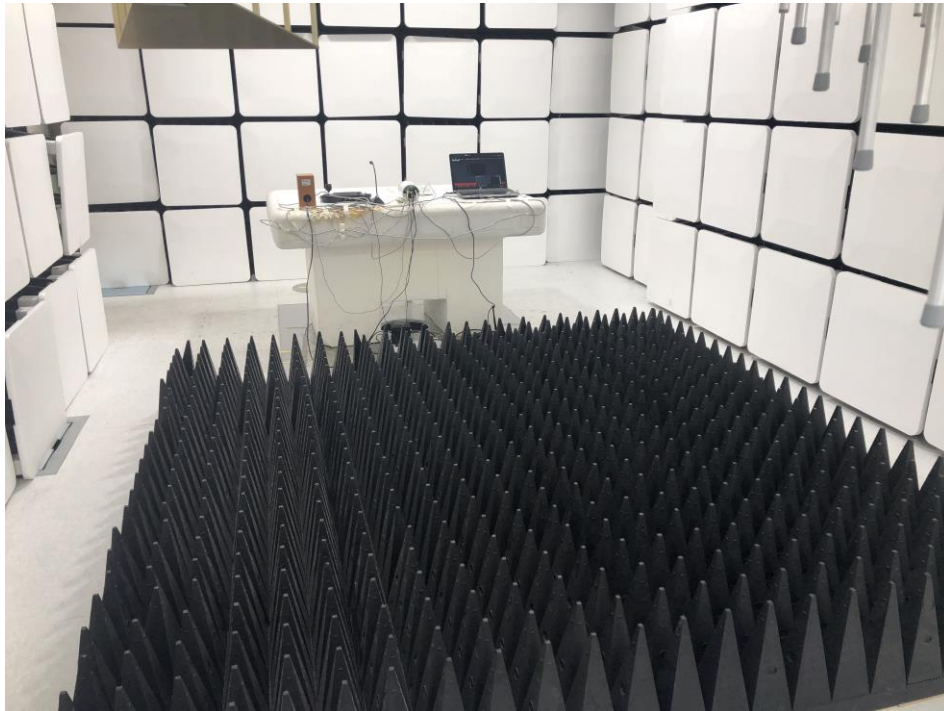


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Electrostatic Discharge



Radiated Electric Field Immunity



Electrical Fast Transients / Bursts



Surge Transients



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Conducted Disturbance



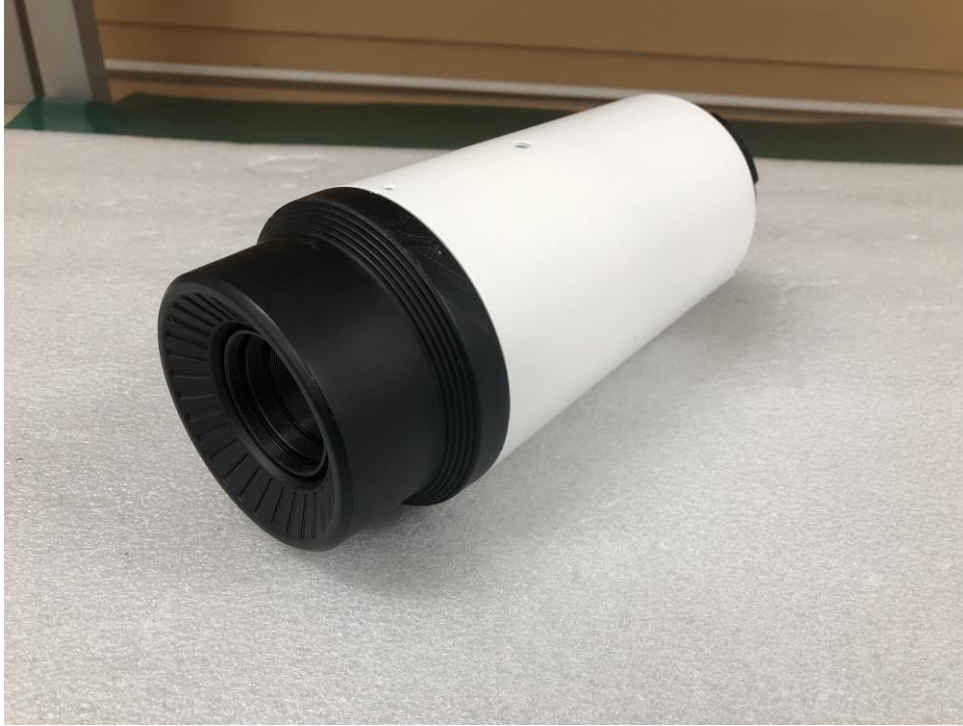
Voltage Dips and Short Interruptions



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EUT External Photographs

(Top)

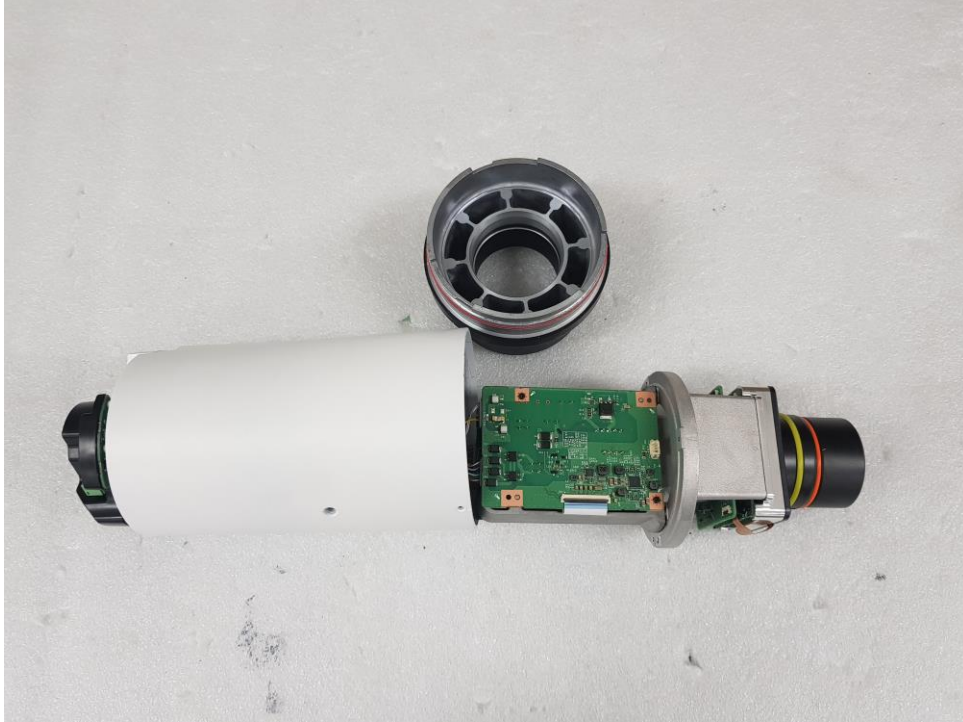


(Bottom)



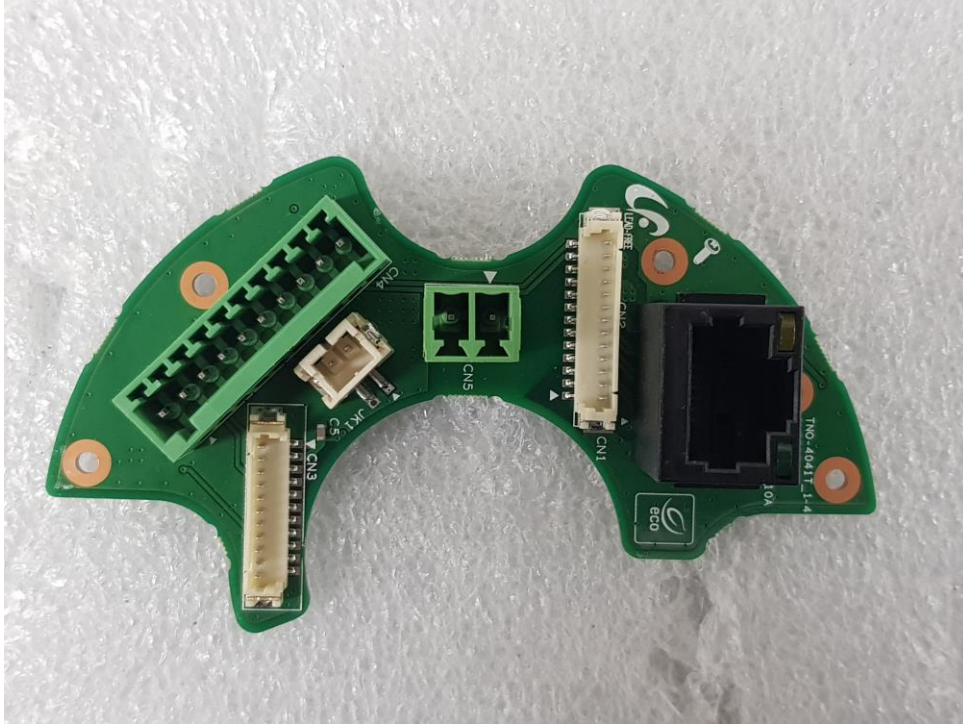
EUT Internal Photographs

(Internal View)



EUT Internal View – Interface Board

(Top)



(Bottom)



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EUT Internal View – Lens

(Top)



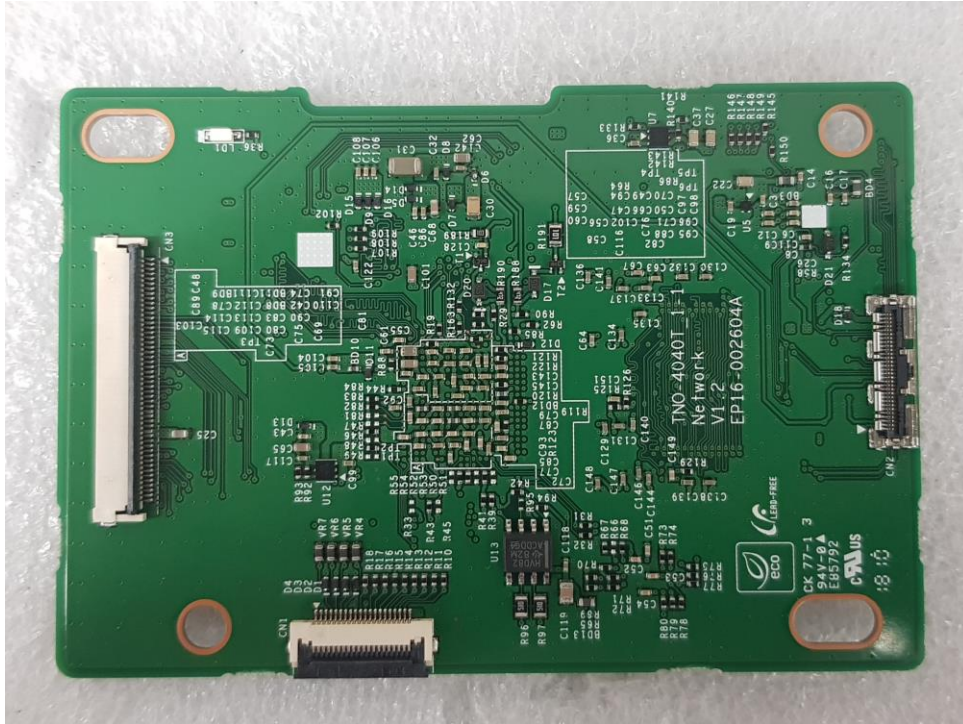
(Bottom)



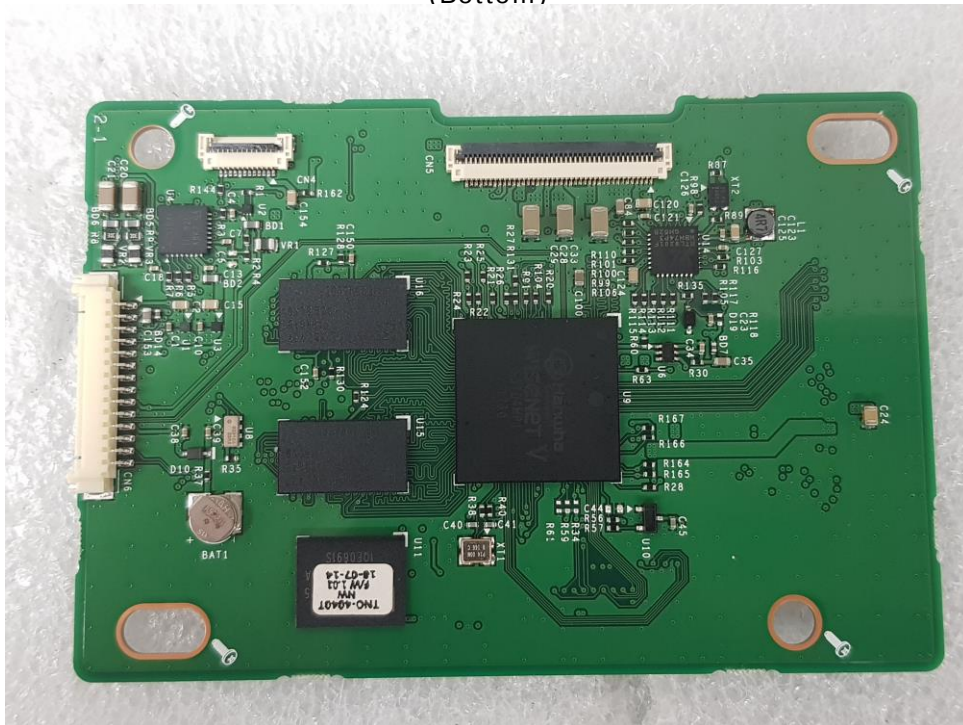
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EUT Internal View – Network Board

(Top)



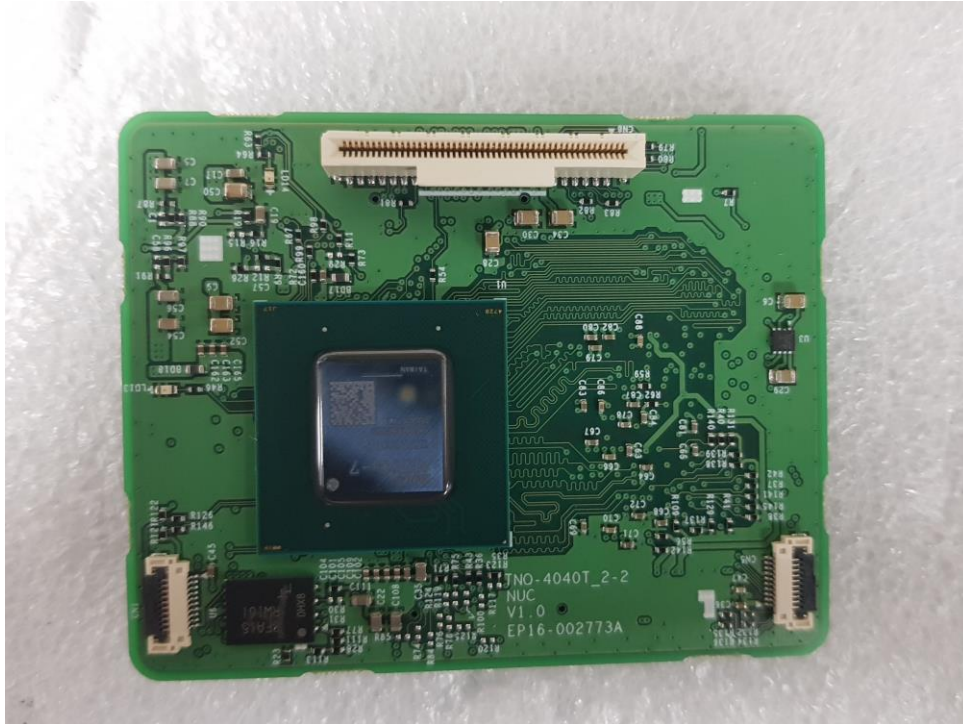
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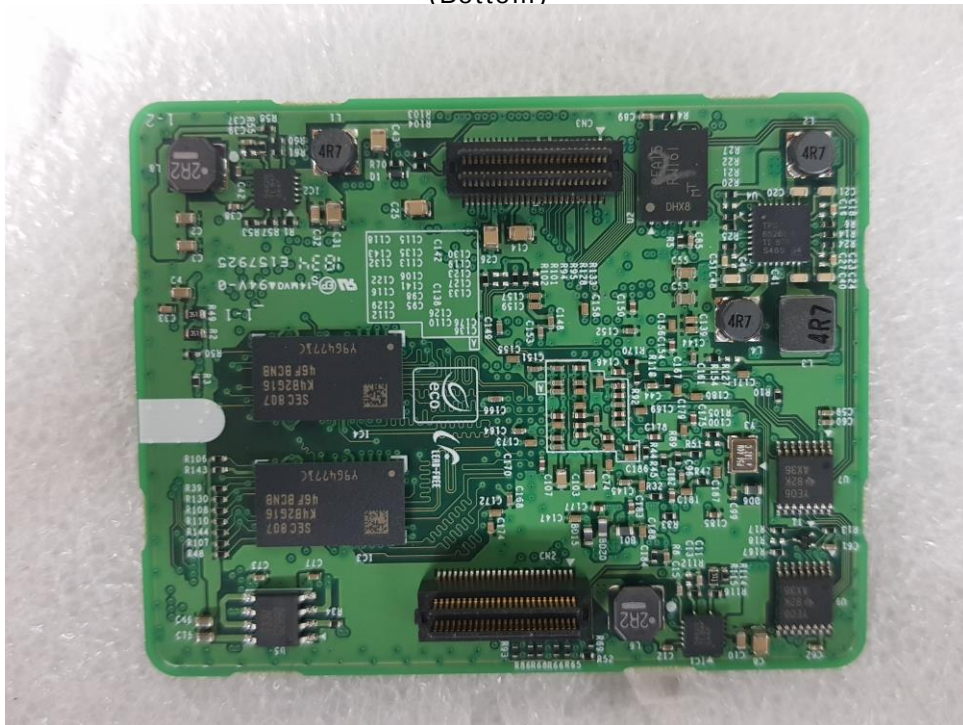
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EUT Internal View – NUC Board

(Top)



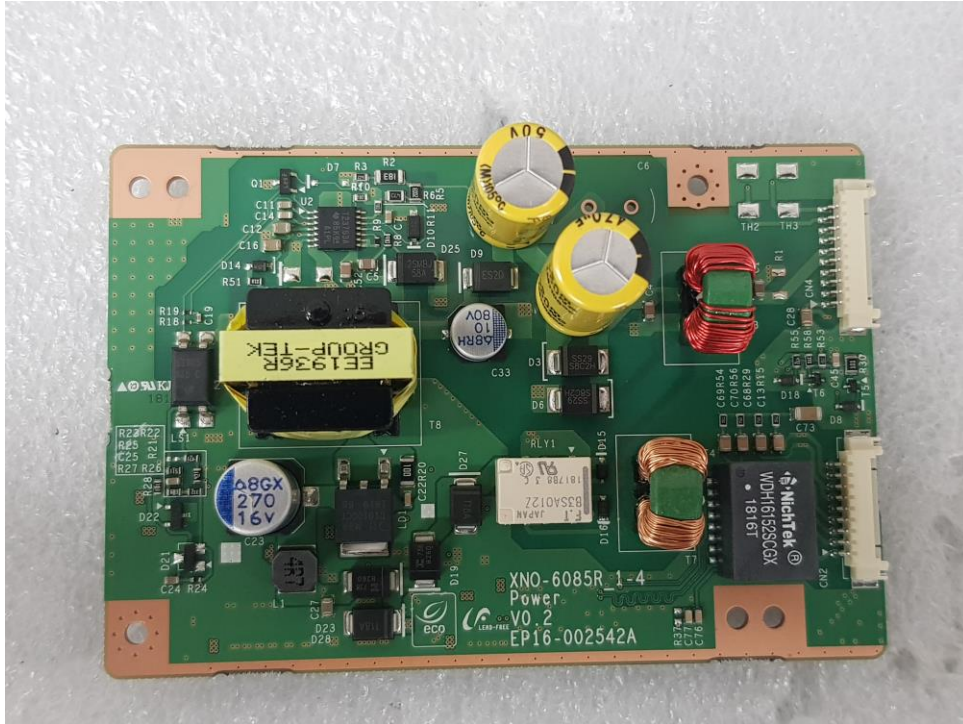
(Bottom)



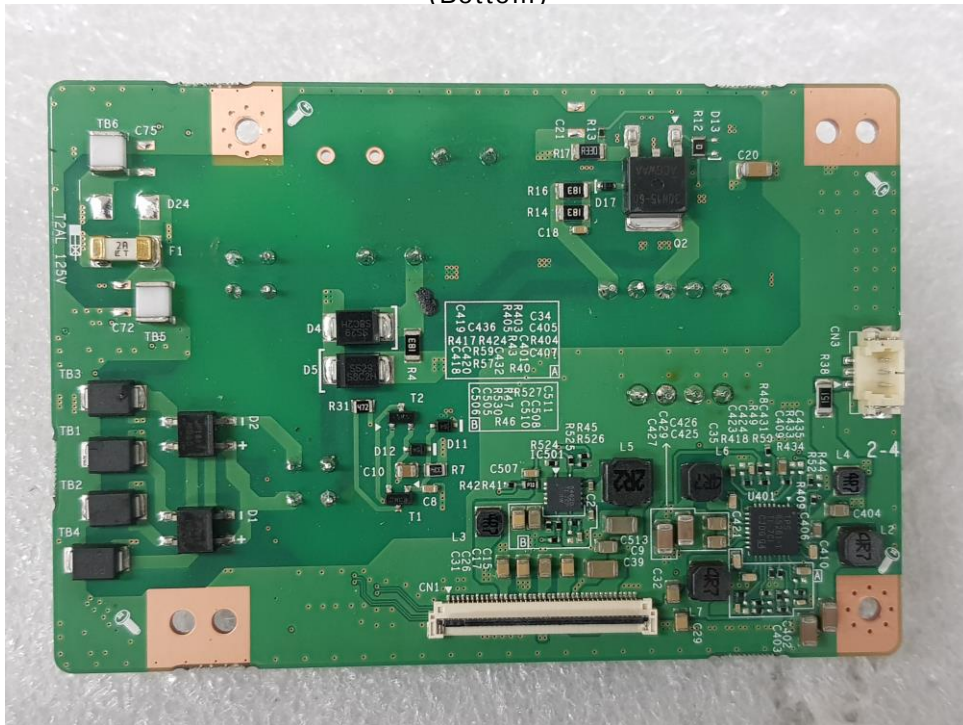
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EUT Internal View – Power Board

(Top)



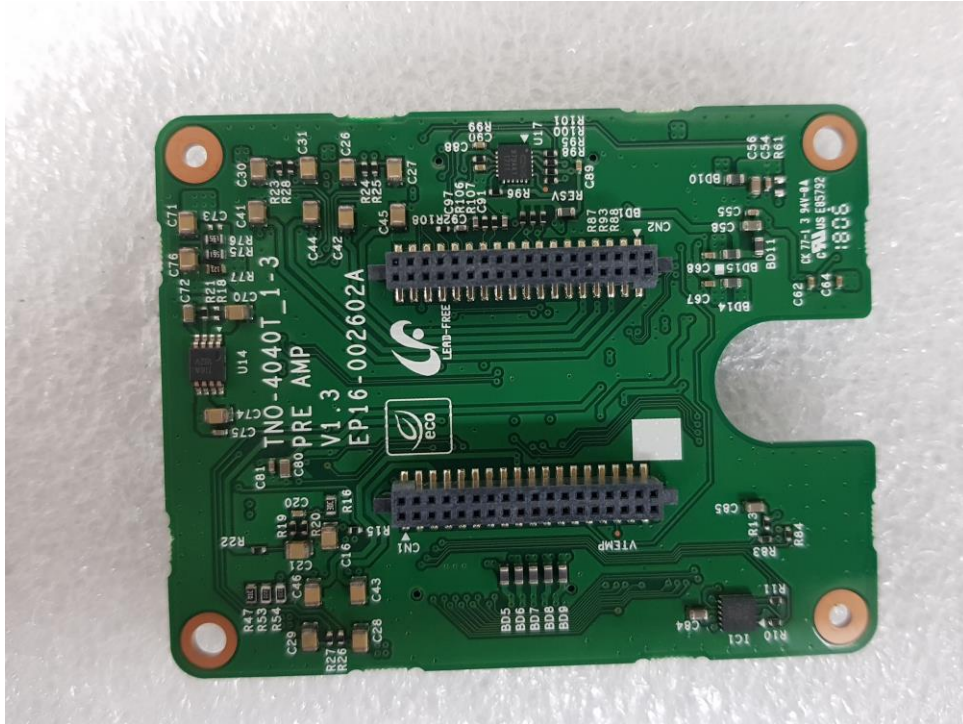
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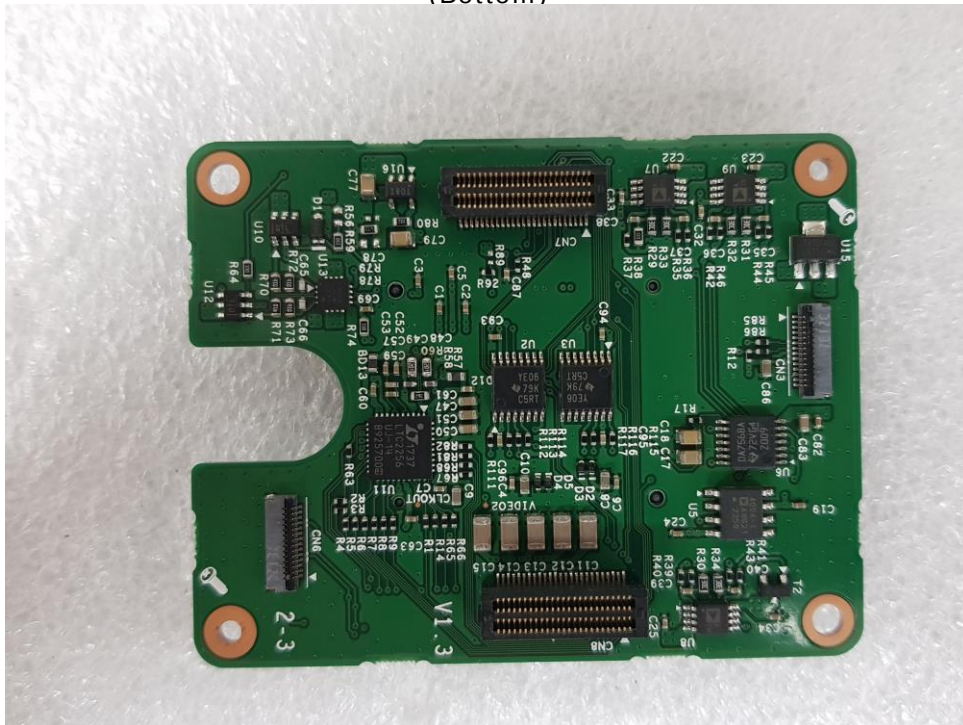
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EUT Internal View – PRE AMP Board

(Top)



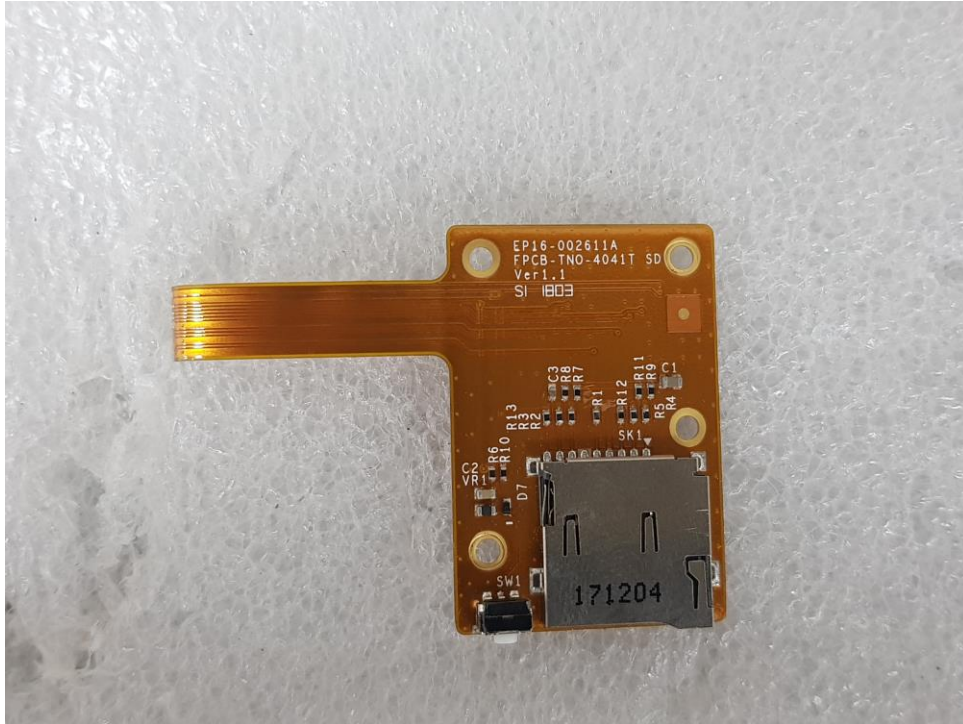
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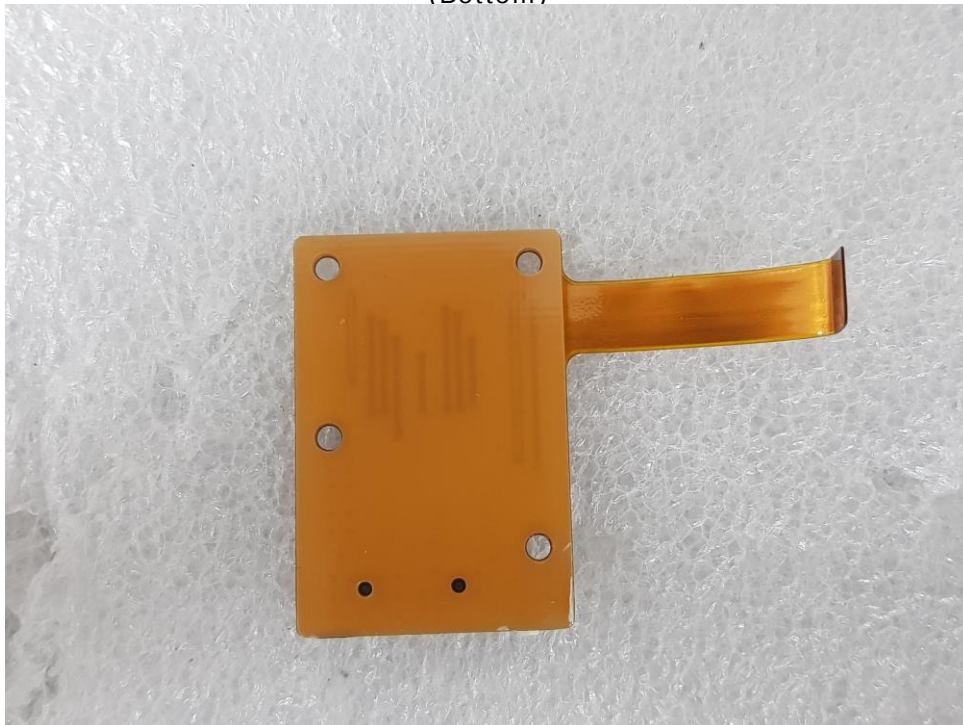
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EUT Internal View – SD Card Board

(Top)



(Bottom)



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Label and Location



Thermal Camera

Model No : TNO-4041TR

Manufacturer : Hanwha Techwin (Tianjin) Co.,Ltd.

Made in China

