TEST REPORT

KES Co., Ltd.
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Anyang-si, Gyeonggi-do, 14057, Republic of Korea
Tel : +82-31-425-6200, Fax : +82-31-341-3838

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 : Barcode Reader

Model/Type No. : TNS-9050IBC

Variant Model : TNS-9040IBC, TNS-9060IBC

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 Ward, 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 : Oct. 10, 2024

4. Test date : Nov. 07, 2024 ~ Nov. 11, 2024

5. Date of Issue : Nov. 15, 2024

6. Test Results : In Compliance

Tested by

[김동인]2024/11/15

Dong In, Kim
EMC Test Engineer

Reviewed by

[장동훈]2024/11/15

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
Nov. 15, 2024	KES-EM243479	Issued

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1.0 General Product Description

Main Specifications of EUT are:

영상	**Video**	
촬상 소자	Imaging Device	Global Shutter Mono 1" CMOS Global Shutter Color 1" CMOS
해상도	Resolution	Mono: Max 4096x2160 Color: Max 4096x2160
최대 프레임레이트	Max. Framerate	Mono : Max 15fps Color : Max 15fps
픽셀 사이즈	Pixel Size	3.45μm(H)×3.45μm(V)
렌즈	**Lens**	
초점거리	Focal Length (Zoom Ratio)	25mm
최대 구경비	Max. Aperture Ratio	MONO : F2.8 ~ F16.0 COLOR : F2.8 ~ F16.0
화각	Angular Field of View	Mono: H30.4° / V16.6° / D34.2° Color: H30.4° / V16.6° / D34.2°
최소 지근 거리	Min. Object Distance	0.15m (0.492126ft)
포커스 제어	Focus Control	Manual
렌즈 타입	Lens Type	Manual
마운트 타입	Mount Type	C Mount
카메라 기능	**Operational**	
카메라 타이틀	Camera Title	Displayed up to 85 characters
노이즈 제거	Digital Noise Reduction	SSNR V
Gain Control	Gain Control	- Manual - 0~48dB
화이트발란스	White Balance	AWC / Manual
전자셔터	Electronic Shutter Speed	- Manual - 1/10,000~1/30s (100us ~ 33.33ms)
영상 회전	Video Rotation	Flip, Mirror
지능형 분석	Analytics	Barcode recognition - Barcode type: 1D Code, Code128 / Codabar / ITF(Interleaved 2 of 5)
조명 타입	Light Type	White LED 32ea (4ea expandable) Support Anti-blinking mode
네트워크	**Network**	
이더넷	Ethernet	M12 8pin connector (10/100/1000BASE-T)
비디오 압축	Video Compression	H.265/H.264: Main/High, MJPEG
화질 제어	Video Quality Adjustment	H.264/H.265: Target bitrate level control MJPEG: Quality Level control
비트레이트 제어	Bitrate Control	H.264/H.265: CBR or VBR MJPEG: VBR
스트리밍	Streaming	Unicast(6 users) / Multicast Mono (1) 4096x2160 @ 15fps all codec Color (1) 4096x2160 @ 15fps all codec (2) 1920x1080 @ 15fps all codec (3) 640x360 @ 15fps all codec
프로토콜	Protocol	IPv4, IPv6, TCP/IP, UDP/IP, RTP(UDP), RTP(TCP), RTCP,RTSP, NTP, HTTP, HTTPS, SSL/TLS, DHCP, FTP, SMTP, ICMP, IGMP, SNMPv1/v2c/v3(MIB-2), ARP, DNS, DDNS, QoS, UPnP, Bonjour, SRTP (TCP, UDP Unicast)
응용 인터페이스	Application Programming Interface	SUNAPI(HTTP API) Wisenet Open Platform
보안	**Security**	
OS / 펌웨어 보호	OS / Firmware Protect	Secure boot, Signed firmware, Firmware encryption
사용자 인증	User authentication	Digest Authentication, Privent brute-force attack
네트워크 인증	Network authentication	802.1X Authentication(EAP-TLS, EAP-LEAP, EAP-PEAP MSCHAPv2)
암호통신	Secure Communication	HTTPS, SRTP, WSS(Websocket secure)
접근제어	Access Control	IP address filtering
데이터 보호	Data Protect	Authentication information encryption, ZIP compression encryption
감사(audit)	Audit	User Access/System/Event log
Device ID	Device ID	Device Certificate(Hanwha Techwin Root CA, pre-installed)
Secure Storage	Secure Storage	HTPM (Hanwha Trusted Platform Module)
보안 인증	Security Certificate	Secure by default
일반	**General**	
웹페이지 언어	Webpage Language	English, Korean
웹뷰어	Web Viewer	Support
메모리	Memory	4GB RAM, 512MB Flash
동작 환경 및 전원	**Environmental & Electrical**	
동작 온도 / 습도	Operating Temperature / Humidity	-40°C~+55°C(-40°F ~ +131°F) / 0~95% RH * Start up should be done at above -30°C NEMA TS-2: 74°C - / 0~95% RH
보관 온도 / 습도	Storage Temperature / Humidity	-40°C ~ +60°C(-40°F ~ +140°F) / Less than 95% RH
규격 인증	Certification	IP67, IK10, NAME 4X
전원	Input Voltage	24VDC
소비 전력	Power Consumption	Max 28.6W, typical 13.7W * Typical: LED Off * Max: LED On
외관	**Mechanical**	
색상 / 재질	Color / Material	Black / Aluminum
RAL 코드	RAL Code	RAL9005
제품 사이즈 / 무게	Product Dimensions / Weight	Camera : 218 x 123.8 x 101.3 mm, 1900 g LED : 256 x 73.8 x 50 mm, 750 g Total : 256 x 180 x 123.8 mm, 2900 g (with install bracket)
Certifications & Standards	**Certifications & Standards**	
EMC (전자파)	EMC	FCC 47 CFR 15 Subpart B Class A ICES-3(A)/NMB-3(A) CE/UKCA - EN 55032 Class A, EN 50130-4, EN 61000-3-2, EN 61000-3-3 KS C 9832 Class A, KS C 9835
안전	Safety	UL 62368-1, CAN/CSA C22.2 NO. 62368-1 IEC/EN 62471
환경	Environment	EN 60068-2-6 (variation resistance) EN 60068-2-27 (shock resistance) IEC/EN 60529 IP67 IEC/EN 62262 IK10

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 ㎐

1.2 Variant Model Differences

- TNS-9040IBC : 16 ㎜ Fixed Lens
- TNS-9060IBC: 35 ㎜ Fixed Lens

(Added derivative model due to difference in fixed lens built into the camera / No electronics in the lens)

1.3 Device Modifications

Not applicable

1.4 Equipment Under Test

Description	Model Number	Serial Number	Manufacturer	Remarks
Barcode Reader	TNS-9050IBC	-	HANWHA VISION VIETNAM COMPANY LIMITED.	EUT

1.5 Support Equipments

Description	Model Number	Serial Number	Manufacturer	Remarks
AC/DC Adapter	XLG-320-V-A	-	MEAN WELL ENTERPRISEES CO.,LTD.	-
Notebook	LG15N54	509NZSJ043910	LG	-
Notebook Adapter	PA-1650-43(65W)	OF8DS63849302K347(1.2)	LITE-ON TECHNOLOGY (CHANGZHOU) CO.,LTD.	-

1.6 External I/O Cabling

Start		END		Cable Spec.	
Description	**I/O Port**	**Description**	**I/O Port**	**Length**	**Shield**
Barcode Reader (EUT)	12 Pin	AC/DC Adapter	2 Pin	0.6	U
	8 Pin	Notebook	RJ-45	5.0	U
Notebook	DC Jack	Notebook Adapter	DC Jack	1.4	U

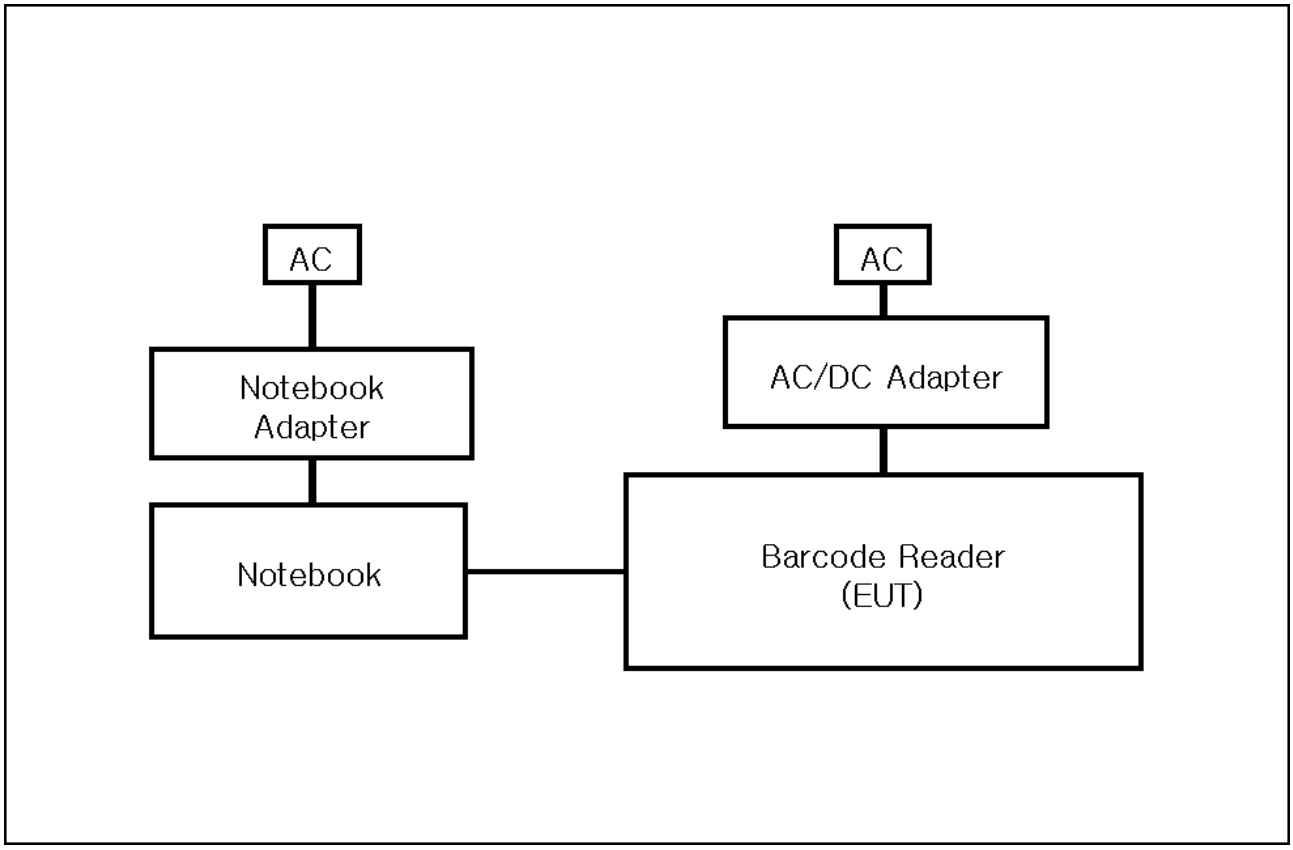
* Unshielded=U, Shielded=S

1.7 EUT Operating Mode(s)

1. Connect the EUT to the laptop and check the operation status of the EUT with the Web Viewer.
2. Scan barcodes continuously with EUT and check barcodes information with Web Viewer.
3. Check network communication status with Ping Test

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

1.8 Configuration



1.9 Remarks when standards applied

N/A

1.10 Calibration Details of Equipment Used for Measurement

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

1.11 Test Facility

The measurement facility is located at 473-21, Gayeo-ro, Yeoju-si, Gyeonggi-do, 12658, Korea, Republic of. The sites are constructed in conformance with the requirements of ANSI C63.4a-2017 and CISPR 16-1-4:2019

1.12 Laboratory Accreditations and Listings

Country	Agency	Scope of Accreditation	Logo
KOREA	**RRA**	EMI (3 m & 10 m Semi-Anechoic Chamber and conducted test site) EMS (ESD, RS, EFT/Burst, Surge, CS, Magnetic, Dips and interruptions)	KR0100
International	**KOLAS**	EMI (3 m & 10 m Semi-Anechoic Chamber and conducted test site) EMS (ESD, RS, EFT/Burst, Surge, CS, Magnetic, Dips and interruptions)	KT489
USA	**FCC**	3 m & 10 m Semi-Anechoic Chamber Conducted test site to perform FCC Part 15/18 measurements.	KR0100
Canada	**ISED**	3 m & 10 m Semi-Anechoic Chamber and Conducted test site	23298
JAPAN	**VCCI**	EMI (3 m & 10 m Semi-Anechoic Chamber and conducted test site)	C-20136, T-20137, R-20181, G-20176
Europe	**TÜV SÜD**	EMI (3 m & 10 m Semi-Anechoic Chamber and conducted test site) EMS (ESD, RS, EFT/Burst, Surge, CS, Magnetic, Dips and interruptions)	CARAT 001633 0008

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 55035:2017/A11:2020

☒ EN IEC 61000-3-2:2019

☒ EN 61000-3-3:2013/A2:2021

☒ **EMC – Regulations 2016**

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

☒ EN 55035:2017/A11:2020

☒ EN IEC 61000-3-2:2019

☒ EN 61000-3-3:2013/A2:2021

2.1 Conducted Emissions at Mains Power Ports

Test Date
Nov. 07, 2024

Test Location
Electro wave Shieldroom #6

Test Equipment

Used	Description	Model Number	Manufacturer	Serial Number	Cal. Due
☒	EMI Test S/W	EMC32	R & S	9.12.00	-
☒	EMI TEST RECEIVER	ESR3	R & S	101783	11, 06, 2025
☒	LISN	ENV216	R & S	101786	01, 10, 2025
☒	LISN	ESH2-Z5	R & S	100450	11, 06, 2025
☒	PULSE LIMITER	ESH3-Z2	R & S	101915	11, 06, 2025

Test Conditions
Temperature: (22,7 ± 0,0) ℃
Relative Humidity: (45,9 ± 0,0) % R.H.

Frequency Range of Measurement
150 ㎑ to 30 ㎒

Instrument Settings
IF Band Width: 9 ㎑

Test Results
The requirements are:

☒ PASS
☐ NOT PASS
☐ NOT APPLICABLE

Remarks
See Appendix A for test data.

2.2 Conducted Emissions at Telecommunication Ports

Test Date
Nov. 07, 2024

Test Location
Electro wave Shieldroom #6

Test Equipment

Used	Description	Model Number	Manufacturer	Serial Number	Cal. Due
☒	EMI Test S/W	EMC32	R & S	9.12.00	-
☒	EMI TEST RECEIVER	ESR3	R & S	101783	11, 06, 2025
☒	LISN	ENV216	R & S	101786	01, 10, 2025
☒	LISN	ESH2-Z5	R & S	100450	11, 06, 2025
☒	PULSE LIMITER	ESH3-Z2	R & S	101915	11, 06, 2025
☒	8-WIRE ISN CAT6	ENY81-CAT6	R & S	101666	03, 06, 2025

Test Conditions
Temperature: (22,7 ± 0,0) ℃
Relative Humidity: (45,9 ± 0,1) % R.H.

Frequency Range of Measurement
150 ㎑ to 30 ㎒

Instrument Settings
IF Band Width: 9 ㎑

Test Results
The requirements are:

☒ PASS
☐ NOT PASS
☐ NOT APPLICABLE

Remarks
See Appendix A for test data.

2.3 Radiated Electric Field Emissions(Below 1 ㎓)

Test Date
Nov. 07, 2024

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

Test Equipment

Used	Description	Model Number	Manufacturer	Serial Number	Cal. Due
☒	EMI Test S/W	EP5/RE	TOYO Corporation	6.0.0	-
☒	EMI TEST RECEIVER	ESU26	R & S	100551	02, 13, 2025
☒	AMPLIFIER	SCU 01	R & S	100603	11, 06, 2025
☒	TRILOG-BROADBAND ANTENNA	VULB9163	Schwarzbeck	715	05, 09, 2026
☒	ATTENUATOR	8491A	HP	32173	02, 13, 2025

Test Conditions
Temperature: (23,1 ± 0,0) ℃
Relative Humidity: (46,0 ± 0,1) % R.H.

Frequency Range of Measurement
30 ㎒ to 1 ㎓

Measurement distance
10 m

Instrument Settings
IF Band Width: 120 ㎑

Test Results
The requirements are:

☒ PASS
☐ NOT PASS
☐ NOT APPLICABLE

Remarks
See Appendix A for test data.

2.4 Radiated Electric Field Emissions(Above 1 ㎓)

Test Date
Nov. 07, 2024

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	07, 29, 2025
☒	PREAMPLIFIER	8449B	AGILENT	3008A01967	03, 05, 2025
☒	ATTENUATOR	8491A	HP	35496	02, 13, 2025
☒	DOUBLE RIDGED HORN ANTENNA	SAS-571	A.H.SYSTEM,INC	781	03, 05, 2025

Test Conditions
Temperature: (22,7 ± 0,0) ℃
Relative Humidity: (46,2 ± 0,0) % R.H.

Frequency Range of Measurement
1 ㎓ to 6 ㎓

Instrument Settings
IF Band Width: 1 ㎒

Test Results
The requirements are:

☒ PASS
☐ NOT PASS
☐ NOT APPLICABLE

Remarks
See Appendix A for test data.

2.5 Harmonic Current Emissions

Test Date
Nov. 11, 2024

Test Location
Electro wave Shieldroom #6

Test Equipment

Used	Description	Model Number	Manufacturer	Serial Number	Cal. Due
☒	EMI Test S/W	net.control	EM TEST	2.1.4	-
☒	DIGITAL POWER ANALYZER	DPA 500N	EM TEST	V1024106759	03, 28, 2025
☒	POWER SOURCE	ACS 500N6	EM TEST	V1024106760	-

Test Conditions

Temperature: (22,4 ± 0,0) ℃
Relative Humidity: (46,3 ± 0,0) % 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
Nov. 11, 2024

Test Location
Electro wave Shieldroom #6

Test Equipment

Used	Description	Model Number	Manufacturer	Serial Number	Cal. Due
☒	EMI Test S/W	net.control	EM TEST	2.1.4	-
☒	DIGITAL POWER ANALYZER	DPA 500N	EM TEST	V1024106759	03, 28, 2025
☒	POWER SOURCE	ACS 500N6	EM TEST	V1024106760	-

Test Conditions

Temperature: (22,4 ± 0,1) ℃
Relative Humidity: (46,3 ± 0,1) % R.H.

Test Results
The requirements are:

☒ PASS
☐ NOT PASS
☐ NOT APPLICABLE

Remarks
See Appendix A for test data.

3.0 Criteria for compliance

General performance criteria

General performance criteria are defined in 8.2, 8.3 and 8.4. These criteria shall be used during the testing of primary functions where no relevant annex is applicable.

When assessing the impact of a disturbance on a function, the assessment should take into consideration the function's performance prior to the application of the disturbance and
only identify as failures those changes in performance that are a result of the disturbance.

Performance criterion A

The equipment shall continue to operate as intended without operator intervention. No degradation of performance, loss of function or change of operating state is allowed
below a performance level specified by the manufacturer when the equipment is used as intended.
The performance level may be replaced by a permissible loss of performance. If the minimum performance level or the permissible performance loss is not specified by the manufacturer,
then either of these may be derived from the product description and documentation, and by what the user may reasonably expect from the equipment if used as intended.

Performance criterion B

During the application of the disturbance, degradation of performance is allowed. However, no unintended change of actual operating state or stored data is allowed to persist after the test.
After the test, the equipment shall continue to operate as intended without operator intervention; no degradation of performance or loss of function is allowed,
below a performance level specified by the manufacturer, when the equipment is used as intended. The performance level may be replaced by a permissible loss of performance.
If the minimum performance level (or the permissible performance loss), or recovery time, is not specified by the manufacturer, then either of these may be derived from the product description and documentation,
and by what the user may reasonably expect from the equipment if used as intended.

Performance criterion C

Loss of function is allowed, provided the function is self-recoverable, or can be restored by the operation of the controls by the user in accordance with the manufacturer's instructions. A reboot or re-start operation is allowed.
Information stored in non-volatile memory, or protected by a battery backup, shall not be lost.

3.1 Electrostatic Discharge

Reference Standard
EN 61000-4-2

Test Date
Nov. 07, 2024

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	01, 30, 2025
☒	HCP	-	KES	-	-
☒	VCP	-	Noise Ken	-	-

Test Conditions

Temperature: (22,7 ± 0,0) ℃
Relative Humidity: (45,9 ± 0,0) % R.H.
Atmospheric Pressure: (100,0 ± 0,0) kPa

Test Specifications

Discharge Factor: ≥ 1 s

Discharge Impedance: 330 ohm / 150 pF

Kind of Discharge: Air, Contact (direct and indirect)

Polarity: Positive and Negative

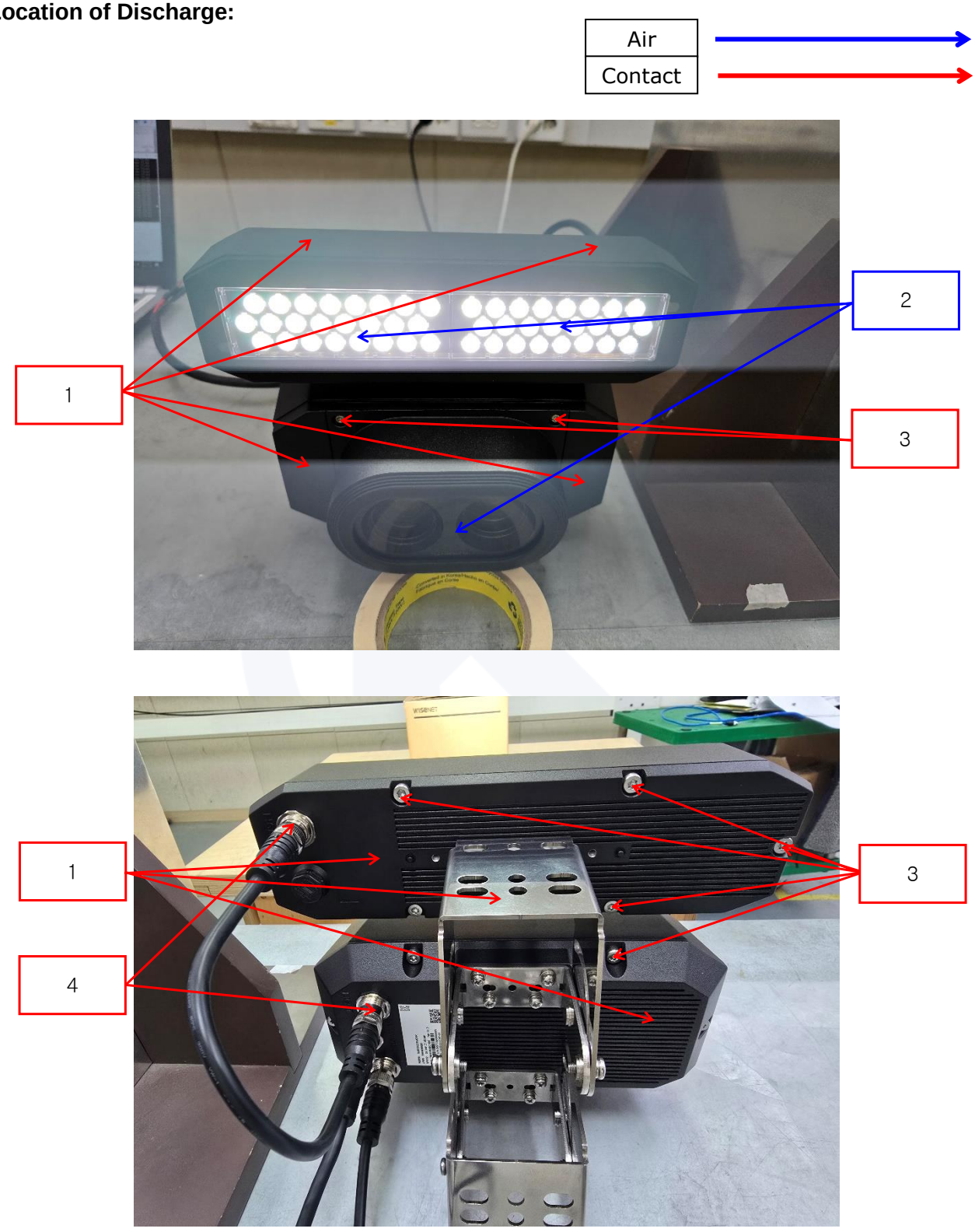
Number of Discharge: 10 at all locations for Air discharge
10 at all locations for Contact discharge

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

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

Required Performance Criteria: ☒ B

Location of Discharge:



Test Data

No.	Test Point	Discharge Method	Performance		Remarks
			Criteria	Results	
1	HCP Contact	Contact Discharge	B	A	-
2	VCP Contact	Contact Discharge	B	A	-

Direct Discharge

No.	Test Point	Discharge Method	Performance		Remarks
			Criteria	Results	
1	Enclosure	Contact Discharge	B	A	-
2	Lens and LED	Air Discharge	B	A	-
3	Screw	Contact Discharge	B	A	-
4	Around port	Contact Discharge	B	A	-

Note: “Blank” = Not performed

Results:
A – No degradation of function
B – Distortion/Error of function (self-recoverable)
C – Loss of function

Test Results

☒ PASS Required Performance Criteria
☐ NOT PASS Required Performance Criteria

Remarks

Any degradations of performance was not observed during in the test.

3.2 Radiated Electric Field Immunity

Reference Standard
EN IEC 61000-4-3

Test Date
Nov. 11, 2024

Test Location
EMS-RS: ☐ SEMI ANECHOIC CHAMBER #1 ☒ SEMI ANECHOIC CHAMBER #2

Test Equipment

Used	Description	Model Number	Manufacturer	Serial Number	Cal. Due
☒	EMS Test S/W	KTI_RS2012	KTI	2.1.1	-
☒	POWER METER	E4419B	Agilent	GB40201439	01, 23, 2025
☒	AVERAGE POWER SENSOR	E9301A	Agilent	MY41495698	01, 23, 2025
☒	CW POWER SENSOR	E4412A	Agilent	MY41501662	01, 23, 2025
☒	AMPLIFIER	ITA0300-200	Infinitech	-	-
☒	AMPLIFIER	ITA0750-200	Infinitech	-	-
☒	AMPLIFIER	ITA1500-100	Infinitech	-	-
☒	AMPLIFIER	ITA2500-100	Infinitech	-	-
☒	GPIB INTERFACE CONTROL	SYSTEM CONTROL UNIT	Infinitech	-	-
☒	POWER SUPPLY	SYSTEM POWER SUPPLY	Infinitech	-	-
☒	SIGNAL GENERATOR	SMIQ06B	Rohde & Schwarz	100236	01, 23, 2025
☒	HIGH POWER AMPLIFIER	ITA-4500KL-50	Infinitech	4500KL-2203 0002	-
☒	HYBRID LOG-PERIODIC ANTENNA	HLP-2603	TDK	100400	-
☒	LOG-PERIODIC ANTENNA	STLP 9149	SCHWARZBECK	9149-255	-

Test Conditions

Temperature: (22,6 ± 0,1) ℃
Relative Humidity: (46,0 ± 0,1) % R.H.
Atmospheric Pressure: (100,4 ± 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(swept test) ☐ 1,4 GHz to 2,7 GHz ☒ 1.8 GHz , 2.6 GHz , 3.5 GHz , 5 GHz (± 1 %)(spot test)
Modulation:	☒ AM, 80 %, 1 kHz sine wave
Frequency step:	☒ 1 % step
Dwell Time:	☒ 1 s ☒ 3 s (spot test)
# of Sides Radiated:	☒ 4
Required Performance Criteria:	☒ A

Test Data

Side Exposed	Performance Criteria	Results	
		Horizontal	Vertical
Front	A	A	A
Right	A	A	A
Back	A	A	A
Left	A	A	A

[Audio output function]
☐ Electrical Measurements / ☐ Acoustic Measurements

Measured parts	Test method	Level (dB)		Performance criteria	Observations	
		Criteria	Measured		Horizontal	Vertical
-	-	-	-	A	-	-

***** The SOUND ACOUSTIC TESTER mark characteristics indicate low if less than 50 dB.

Note: "Blank" = Not performed

Results:
A – No degradation of function
B – Distortion/Error of function (self-recoverable)
C – Loss of function

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

Remarks
Any degradations of performance was not observed during in the test.

3.3 Electrical Fast Transients/Bursts

Reference Standard
EN 61000-4-4

Test Date
Nov. 08, 2024

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	02, 14, 2025
☒	MOTOR VARIAC	MV2616	EM TEST	V0936105123	02, 16, 2025
☒	CAPACITIVE COUPLING CLAMP	HFK	EM TEST	070925	02, 14, 2025

Test Conditions

Temperature: (22,6 ± 0,0) ℃
Relative Humidity: (46,0 ± 0,0) % R.H.
Atmospheric Pressure: (100,0 ± 0,0) kPa

Test Specifications

Pulse Amplitude & Polarity: (Power Lines)	☒ ± 1.0 kV ☐ ± 4.0 kV	☐ ± 2.0 kV
Pulse Amplitude & Polarity: (Signal Lines)	☒ ± 0.5 kV ☐ ± 2.0 kV	☐ ± 1.0 kV
Burst Period:	☒ 300 ms	☐ 2 s
Repetition Rate:	☒ 5 kHz	☐ 100 kHz
Duration of Test Voltage:	☒ ≥ 1 min	
Required Performance Criteria:	☒ B	

Test Data

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

Mode of Application	Performance Criteria	Results	
		(+) Burst (kV)	(-) Burst (kV)
L	B	A	A
N	B	A	A
PE	B	A	A
L – N	B	A	A
L – PE	B	A	A
N – PE	B	A	A
L – N – PE	B	A	A

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

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

☒ Signal ports and telecommunication ports – Coupling Clamp used

Mode of Application	Performance Criteria	Results	
		(+) Burst (kV)	(-) Burst (kV)
RJ-45	B	A	A

Note: "Blank" = Not performed

Results:
A – No degradation of function
B – Distortion/Error of function (self-recoverable)
C – Loss of function

Test Results

☒ PASS Required Performance Criteria
☐ NOT PASS Required Performance Criteria

Remarks

Any degradations of performance was not observed during in the test.

3.4 Surge

Reference Standard
EN 61000-4-5

Test Date
Nov. 08, 2024

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	02, 13, 2025
☒	MOTOR VARIAC	MV2616	EM TEST	V0936105123	02, 16, 2025

Test Conditions

Temperature: (22,6 ± 0,0) ℃
Relative Humidity: (46,0 ± 0,0) % R.H.
Atmospheric Pressure: (100,0 ± 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) kV Differential Mode ☒ (0,5 / 1,0) kV
Number of Surges:	☒ 5 surges per angle
Angle:	☒ 90°, 270° (input a.c. power port)
Polarity:	☒ Positive & Negative
Repetition Rate:	☒ 1 surge per min ☐ 1 surge per 30 sec.
Required Performance Criteria:	☒ B

Signal Lines

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

Test Data

☒ Line to Line – Differential Mode

Mode of Application	Performance Criteria	Results	
		(+) Surge (kV)	(-) Surge (kV)
L – N	B	A	A

☒ Line to Earth – Common Mode

Mode of Application	Performance Criteria	Results	
		(+) Surge (kV)	(-) Surge (kV)
L – PE	B	A	A
N – PE	B	A	A

Signal Lines

☐ Line to Earth – Common Mode

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

Note: "Blank" = Not performed

Results:
A – No degradation of function
B – Distortion/Error of function (self-recoverable)
C – Loss of function

Test Results

☒ PASS Required Performance Criteria
☐ NOT PASS Required Performance Criteria

Remarks

Any degradations of performance was not observed during in the test.

3.5 Conducted Disturbance

Reference Standard
EN 61000-4-6

Test Date
Nov. 08, 2024

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	07, 29, 2025
☒	ATTENUATOR	ATT6	EM TEST	1208-34	07, 29, 2025
☒	CDN	CDN-M2/M3N	EM TEST	0909-06	07, 29, 2025
☐	CDN	CDN T8RJ45	EM TEST	0909-09	07, 29, 2025
☒	EM INJECTION CLAMP	EM 101	Liithi	35943	07, 30, 2025

Test Conditions

Temperature: (22,8 ± 0,0) ℃
Relative Humidity: (46,3 ± 0,1) % R.H.
Atmospheric Pressure: (100,1 ± 0,0) kPa

Test Specifications

Frequency range:	☒ 150 ㎑ to 80 ㎒	
Voltage Level:	☒ 3 Vrms	(150 ㎑ to 10 ㎒)
	☒ 3 Vrms to 1Vms	(10 ㎒ to 30 ㎒)
	☒ 1 Vrms	(30 ㎒ to 80 ㎒)
Modulation:	☒ AM, 80 %, 1 ㎑ sine wave	
Frequency step:	☒ 1 % step	
Dwell Time:	☒ 1 s	☐ 3 s
Required Performance Criteria:	☒ A	

Test Data

☒ Input a.c. power ports

Coupling Location (Line Stressed)	Coupling Method	Performance Criteria	Results
L – N – PE	CDN	A	A

☐ Input d.c. power ports

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

☒ Signal ports and telecommunication ports

Coupling Location (Line Stressed)	Coupling Method	Performance Criteria	Results
RJ-45	Clamp	A	A

[Audio output function]

☐ Electrical Measurements / ☐ Acoustic Measurements

Measured parts	Test method	Level (dB)		Performance criteria	Results
		Criteria	Measured		
-	-	-	-	A	-

***** The SOUND ACOUSTIC TESTER mark characteristics indicate low if less than 50 dB.

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

Results:
A – No degradation of function
B – Distortion/Error of function (self-recoverable)
C – Loss of function

Test Results

☒ PASS Required Performance Criteria
☐ NOT PASS Required Performance Criteria

Remarks

Any degradations of performance was not observed during in the test.

3.6 Power Frequency Magnetic Field Immunity

Reference Standard
EN 61000-4-8

Test Date
N/A

Test Location
EMS-Magnetic: Electro wave Shieldroom #7

Test Equipment

Used	Description	Model Number	Manufacturer	Serial Number	Cal. Due
☐	EMS Test S/W	iec.control	EM TEST	5.4.8	-
☐	ULTRA COMPACT SIMULATOR	UCS 500N7	EM TEST	P1608172950	11, 08, 2025
☐	MOTOR VARIAC	MV2616	EM TEST	P1552169719	11, 08, 2025
☐	MAGNETIC FIELD COIL	MS 100N	EM TEST	P1536163691	11, 08, 2025
☐	CURRENT TRANSFORMER	MC 2630	EM TEST	P1629182219	11, 08, 2025

Test Conditions

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

Test Specifications

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

Frequency: ☐ 50 Hz ☐ 60 Hz

Required Performance Criteria: ☐ A

Test Data

☐ Immersion method

Coil orientation	Performance Criteria	Results
X - axis	A	-
Y - axis	A	-
Z - axis	A	-

Note: “blank” = Not performed

Results:
A – No degradation of function
B – Distortion/Error of function (self-recoverable)
C – Loss of function

Test Results

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

Remarks

Not affected by magnetic fields.

3.7 Voltage Dips and Short Interruptions

Reference Standard
EN IEC 61000-4-11

Test Date
Nov. 08, 2024

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	02, 16, 2025
☒	MOTOR VARIAC	MV2616	EM TEST	V0936105123	02, 16, 2025

Test Conditions

Temperature: (22,6 ± 0,0) ℃
Relative Humidity: (46,0 ± 0,0) % R.H.
Atmospheric Pressure: (100,0 ± 0,0) kPa

Test Data

NO	Depth	Duration	Performance		Remarks
			Criteria	Results	
1	95 %	0.5	B	A	-
2	30 %	25	C	A	-
3	95 %	250	C	C	-

Results:
A – No response observed from EUT
B – Unit shuts down then automatically restarts when full voltage is restored.
C – Unit shuts down then manually restarts when full voltage is restored or Loss of function.

Test Results

☒ PASS Required Performance Criteria
☐ NOT PASS Required Performance Criteria

Remarks

C : During the interruption (95 %, 250 cycle), EUT was turned off but after the test, it was recovered by operator's intervention.

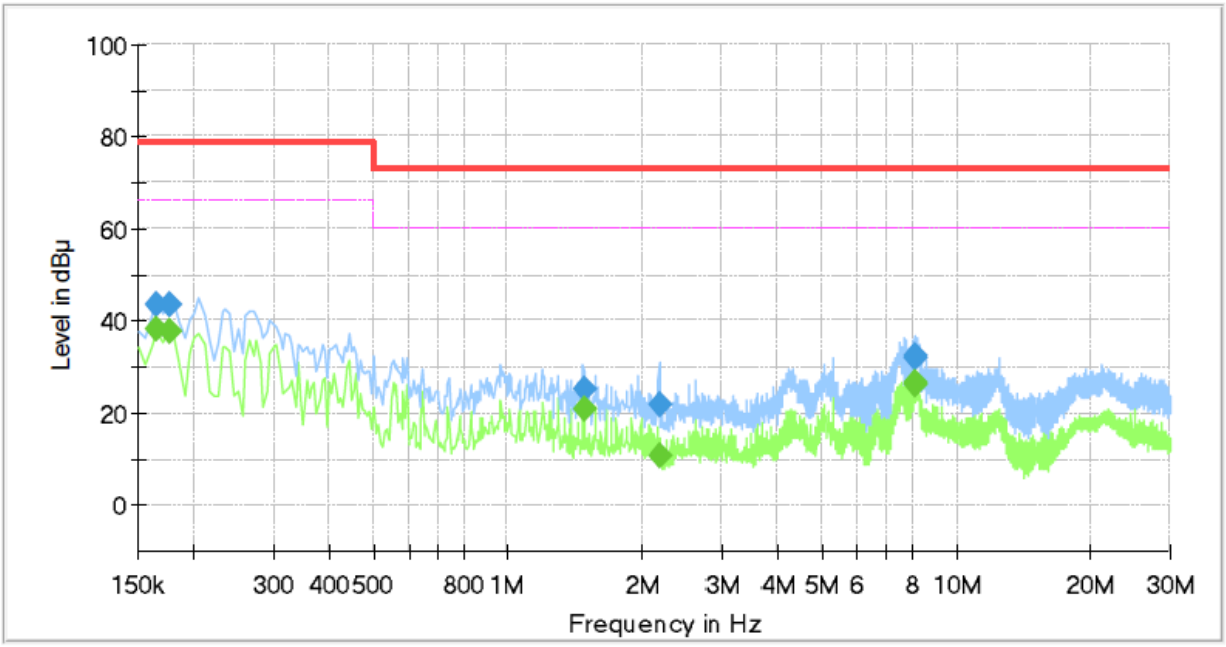
APPENDIX A – TEST DATA

Conducted Emissions at Mains Power Ports

[HOT]

Common Information

Test Description:	Conducted Emission
Job No.:	KES-EM243479
Phase:	L
Mode:	
Operator Name:	KES



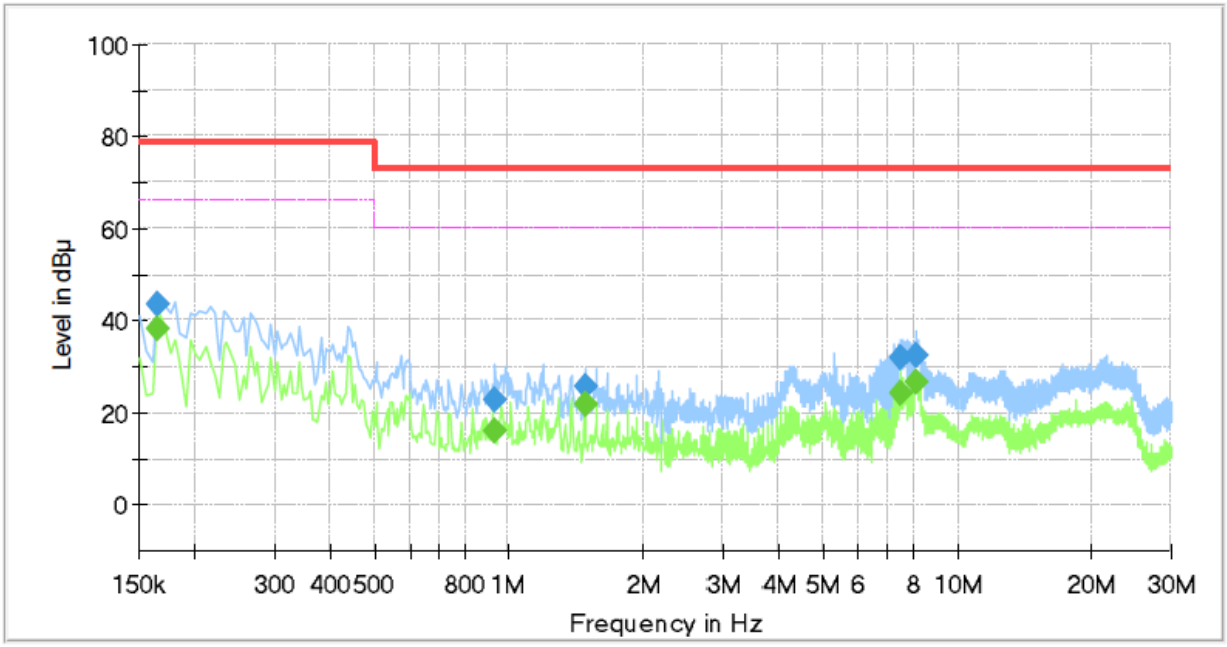
Final_Result

Frequency (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.165000	---	38.14	66.00	27.86	1000.0	9.000	L1	19.6
0.165000	43.36	---	79.00	35.64	1000.0	9.000	L1	19.6
0.175000	---	37.85	66.00	28.15	1000.0	9.000	L1	19.6
0.175000	43.79	---	79.00	35.21	1000.0	9.000	L1	19.6
1.475000	---	20.99	60.00	39.01	1000.0	9.000	L1	19.7
1.475000	25.18	---	73.00	47.82	1000.0	9.000	L1	19.7
2.175000	---	10.69	60.00	49.31	1000.0	9.000	L1	19.7
2.175000	21.84	---	73.00	51.16	1000.0	9.000	L1	19.7
8.050000	---	26.01	60.00	33.99	1000.0	9.000	L1	20.1
8.050000	32.13	---	73.00	40.87	1000.0	9.000	L1	20.1
8.090000	---	26.49	60.00	33.51	1000.0	9.000	L1	20.1
8.090000	32.37	---	73.00	40.63	1000.0	9.000	L1	20.1

[NEUTRAL]

Common Information

Test Description:	Conducted Emission
Job No.:	KES-EM243479
Phase:	N
Mode:	
Operator Name:	KES



Final_Result

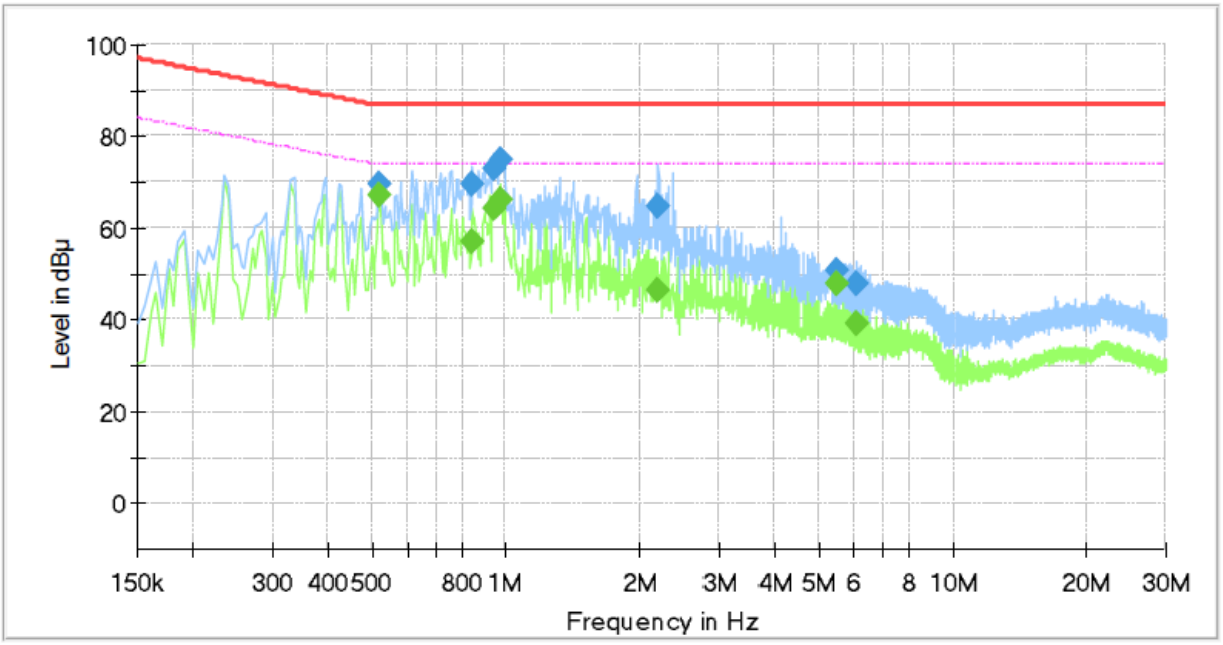
Frequency (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.165000	---	38.24	66.00	27.76	1000.0	9.000	N	19.5
0.165000	43.63	---	79.00	35.37	1000.0	9.000	N	19.5
0.930000	---	15.87	60.00	44.13	1000.0	9.000	N	19.6
0.930000	22.66	---	73.00	50.34	1000.0	9.000	N	19.6
1.475000	---	21.84	60.00	38.16	1000.0	9.000	N	19.6
1.475000	25.87	---	73.00	47.13	1000.0	9.000	N	19.6
7.480000	---	24.16	60.00	35.84	1000.0	9.000	N	20.0
7.480000	32.02	---	73.00	40.98	1000.0	9.000	N	20.0
8.075000	---	26.48	60.00	33.52	1000.0	9.000	N	20.0
8.075000	32.31	---	73.00	40.69	1000.0	9.000	N	20.0

Conducted Emissions at Telecommunication Ports

[1 000 Mbps]

Common Information

Test Description:	Telecommunication Emission
Job No.:	KES-EM243479
Mode :	
Speed :	1 000 Mbps
Operator Name:	KES

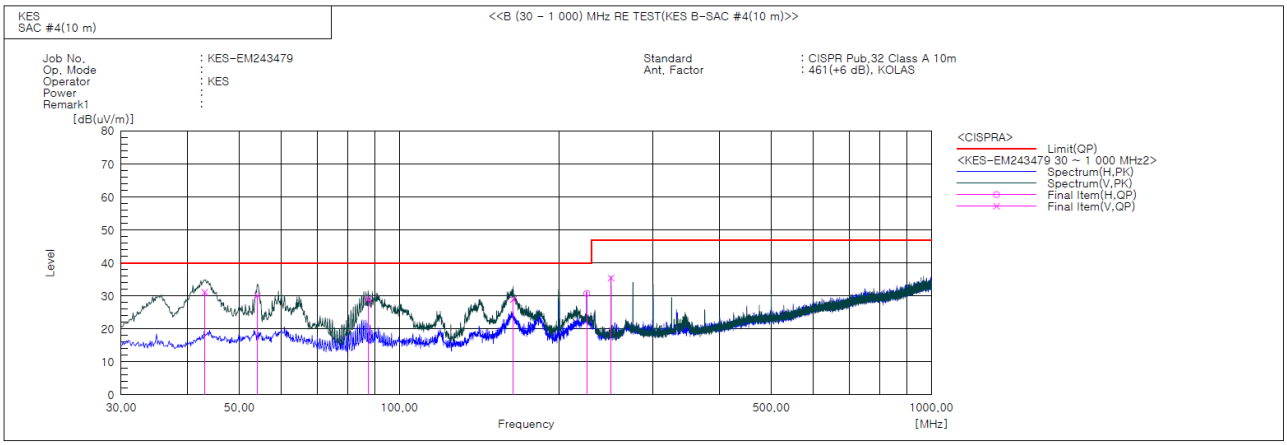


Final_Result

Frequency (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.520000	69.53	---	87.00	17.47	1000.0	9.000	Single Line	19.5
0.520000	---	67.09	74.00	6.91	1000.0	9.000	Single Line	19.5
0.840000	69.68	---	87.00	17.32	1000.0	9.000	Single Line	19.4
0.840000	---	57.17	74.00	16.83	1000.0	9.000	Single Line	19.4
0.940000	72.76	---	87.00	14.24	1000.0	9.000	Single Line	19.4
0.940000	---	64.18	74.00	9.82	1000.0	9.000	Single Line	19.4
0.970000	74.80	---	87.00	12.20	1000.0	9.000	Single Line	19.4
0.970000	---	66.32	74.00	7.68	1000.0	9.000	Single Line	19.4
2.195000	---	46.58	74.00	27.42	1000.0	9.000	Single Line	19.4
2.195000	64.96	---	87.00	22.04	1000.0	9.000	Single Line	19.4
5.485000	---	48.06	74.00	25.94	1000.0	9.000	Single Line	19.6
5.485000	50.89	---	87.00	36.11	1000.0	9.000	Single Line	19.6
6.115000	---	38.98	74.00	35.02	1000.0	9.000	Single Line	19.6
6.115000	48.02	---	87.00	38.98	1000.0	9.000	Single Line	19.6

♦ 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))

Radiated Electric Field Emissions(Below 1 ㎓)

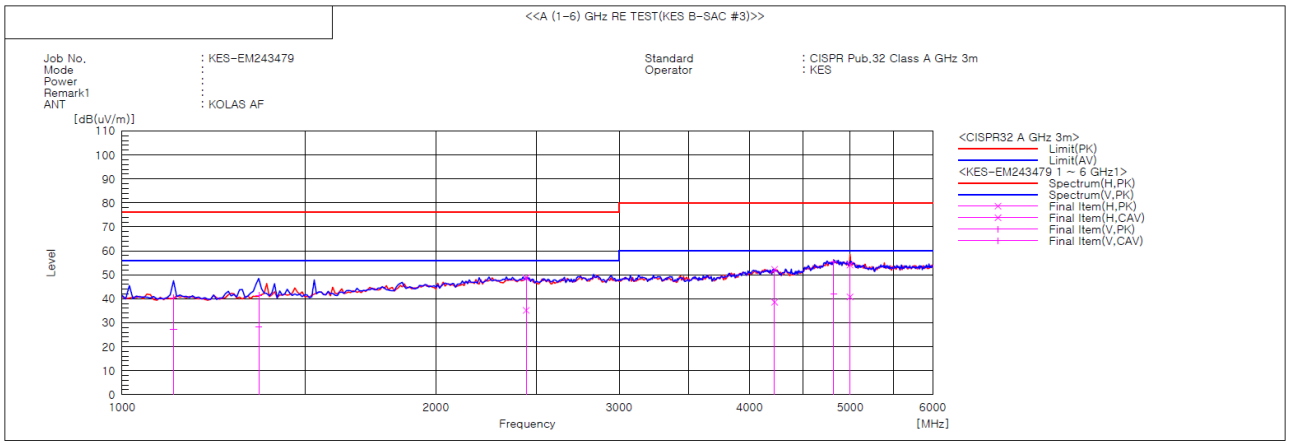


Final Result

No.	Frequency [MHz]	(P)	Reading QP [dB(uV)]	c.f [dB(1/m)]	Result QP [dB(uV/m)]	Limit QP [dB(uV/m)]	Margin QP [dB]	Height [cm]	Angle [deg]	Remark
1	43.056	V	52.7	-21.6	31.1	40.0	8.9	100.0	109.0	
2	54.062	V	51.2	-21.1	30.1	40.0	9.9	102.0	83.0	
3	87.370	V	55.4	-26.3	29.1	40.0	10.9	105.0	31.0	
4	163.730	V	48.7	-19.8	28.9	40.0	11.1	111.0	185.0	
5	225.003	H	51.8	-21.1	30.7	40.0	9.3	383.0	33.0	
6	250.002	V	55.0	-19.6	35.4	47.0	11.6	119.0	241.0	

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

Radiated Electric Field Emissions(Above 1 ㎓)



Final Result

No.	Frequency [MHz]	(P)	Reading PK [dB(uV)]	Reading CAV [dB(uV)]	c.f [dB(1/m)]	Result PK [dB(uV/m)]	Result CAV [dB(uV/m)]	Limit PK [dB(uV/m)]	Limit AV [dB(uV/m)]	Margin PK [dB]	Margin CAV [dB]	Height [cm]	Angle [deg]	Remark
1	1120.470	V	43.6	30.3	-3.2	40.4	27.1	76.0	56.0	35.6	28.9	100.0	52.9	
2	1352.397	V	43.3	29.9	-1.8	41.5	28.1	76.0	56.0	34.5	27.9	100.0	306.2	
3	2442.229	H	42.4	28.8	6.4	48.8	35.2	76.0	56.0	27.2	20.8	100.0	143.6	
4	4228.730	H	40.3	26.6	12.0	52.3	38.6	80.0	60.0	27.7	21.4	100.0	106.5	
5	4821.788	V	39.3	26.1	15.9	55.2	42.0	80.0	60.0	24.8	18.0	100.0	76.8	
6	4997.898	H	38.2	24.9	15.9	54.1	40.8	80.0	60.0	25.9	19.2	100.0	68.0	

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

Harmonic Current Emissions and Voltage Fluctuations and Flicker

Average harmonic current results

Hn	Ieff [A]	% of Limit	Limit [A]	Result
1	0.204			
2	0.002	0.141	1.080	n/a
3	0.048	2.077	2.300	PASS
4	0.001	0.271	0.430	n/a
5	0.017	1.516	1.140	PASS
6	0.001	0.461	0.300	n/a
7	0.011	1.477	0.770	PASS
8	0.001	0.461	0.230	n/a
9	0.010	2.456	0.400	PASS
10	0.001	0.584	0.184	n/a
11	0.007	2.145	0.330	PASS
12	0.001	0.772	0.153	n/a
13	0.007	3.216	0.210	PASS
14	0.001	0.867	0.131	n/a
15	0.006	3.967	0.150	PASS
16	0.001	1.027	0.115	n/a
17	0.005	3.481	0.132	n/a
18	0.001	1.139	0.102	n/a
19	0.003	2.947	0.118	n/a
20	0.001	1.282	0.092	n/a
21	0.003	1.997	0.161	n/a
22	0.001	1.474	0.084	n/a
23	0.003	2.261	0.147	n/a
24	0.001	1.599	0.077	n/a
25	0.004	2.743	0.135	n/a
26	0.001	1.675	0.071	n/a
27	0.003	2.686	0.125	n/a
28	0.001	1.981	0.066	n/a
29	0.003	2.566	0.116	n/a
30	0.001	2.069	0.061	n/a
31	0.003	2.952	0.109	n/a
32	0.001	2.321	0.058	n/a
33	0.003	2.792	0.102	n/a
34	0.001	2.354	0.054	n/a
35	0.002	2.205	0.096	n/a
36	0.001	2.604	0.051	n/a
37	0.002	2.401	0.091	n/a
38	0.001	2.783	0.048	n/a
39	0.002	2.303	0.087	n/a
40	0.001	2.892	0.046	n/a

Note: Harmonic currents less than 0.6 % of the input current measured under the test conditions, or less than 5 mA, whichever is greater, are disregarded.
* Application of limits for average is 100% except for odd harmonics from 21 to 39, where 150% applies.

Test Data - Harmonics (continued)

Maximum harmonic current results

Hn	Ieff [A]	% of Limit	Limit [A]	Result
1	0.205			
2	0.002	0.109	1.620	n/a
3	0.048	1.392	3.450	PASS
4	0.001	0.204	0.645	n/a
5	0.017	1.022	1.710	PASS
6	0.002	0.370	0.450	n/a
7	0.012	0.996	1.155	PASS
8	0.001	0.350	0.345	n/a
9	0.010	1.660	0.600	PASS
10	0.001	0.449	0.276	n/a
11	0.007	1.493	0.495	PASS
12	0.001	0.594	0.230	n/a
13	0.007	2.191	0.315	PASS
14	0.001	0.682	0.197	n/a
15	0.006	2.721	0.225	PASS
16	0.001	0.765	0.173	n/a
17	0.005	2.375	0.199	n/a
18	0.001	0.875	0.153	n/a
19	0.004	2.070	0.178	n/a
20	0.001	0.965	0.138	n/a
21	0.003	2.061	0.161	n/a
22	0.001	1.116	0.125	n/a
23	0.003	2.357	0.147	n/a
24	0.001	1.177	0.115	n/a
25	0.004	2.833	0.135	n/a
26	0.001	1.285	0.106	n/a
27	0.004	2.812	0.125	n/a
28	0.001	1.490	0.099	n/a
29	0.003	2.732	0.116	n/a
30	0.001	1.520	0.092	n/a
31	0.003	3.037	0.109	n/a
32	0.002	1.772	0.086	n/a
33	0.003	2.901	0.102	n/a
34	0.001	1.706	0.081	n/a
35	0.002	2.333	0.096	n/a
36	0.001	1.919	0.077	n/a
37	0.002	2.531	0.091	n/a
38	0.002	2.161	0.073	n/a
39	0.002	2.510	0.087	n/a
40	0.001	2.108	0.069	n/a

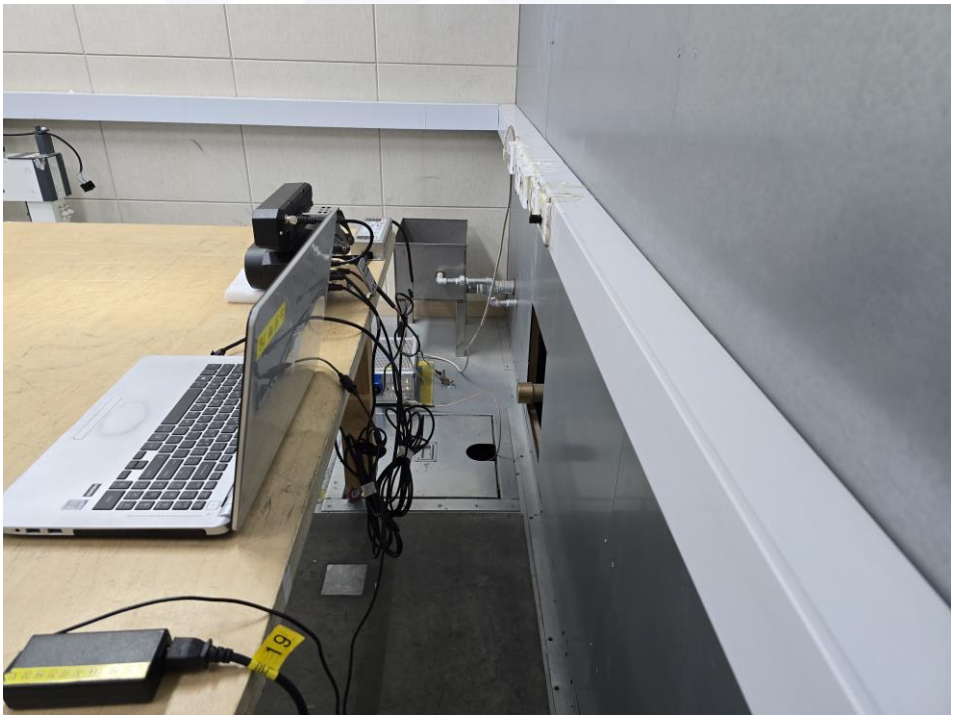
Note: Harmonic currents less than 0.6 % of the input current measured under the test conditions, or less than 5 mA, whichever is greater, are disregarded.
* Application of limits for average is 100% except for odd harmonics from 21 to 39, where 150% applies.

Test Data - Voltage Fluctuations

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

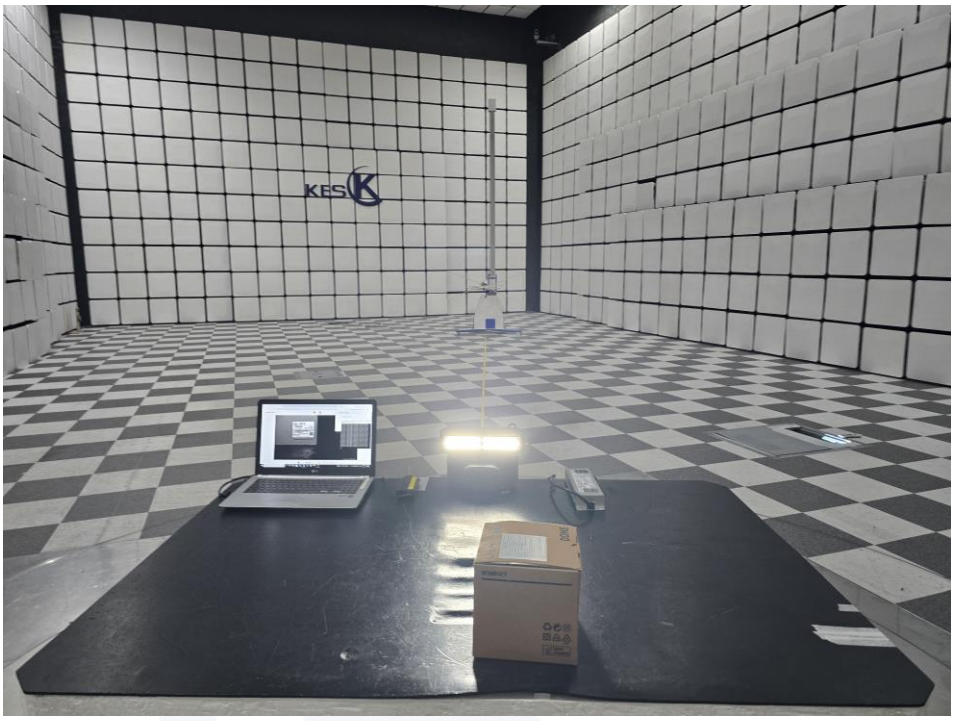
APPENDIX B – Test Setup Photos and Configuration

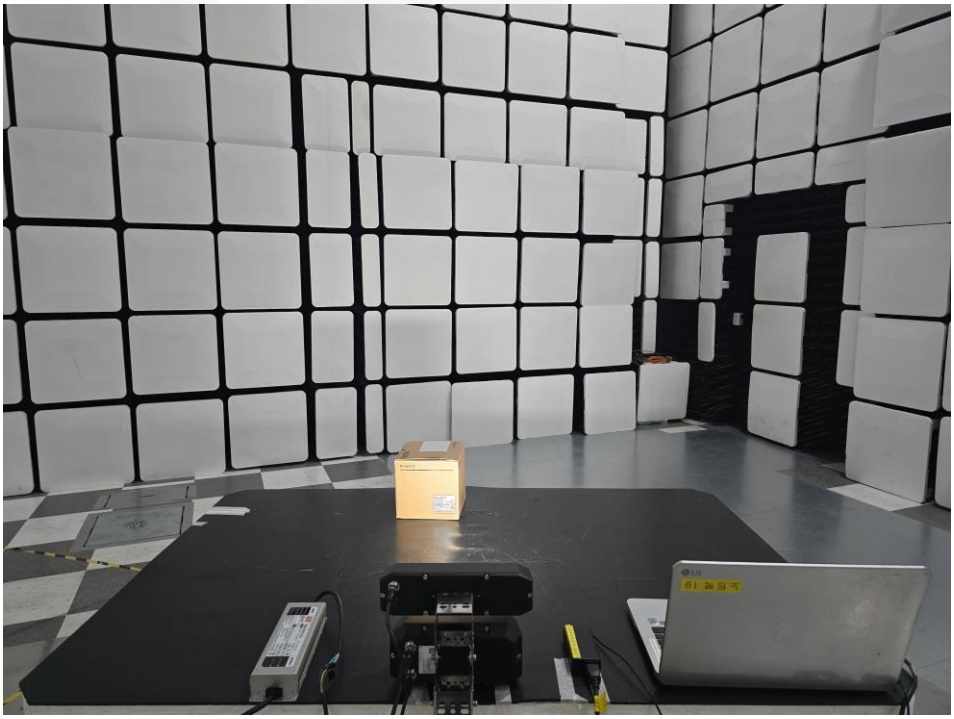
Conducted Emissions at Mains Power Ports



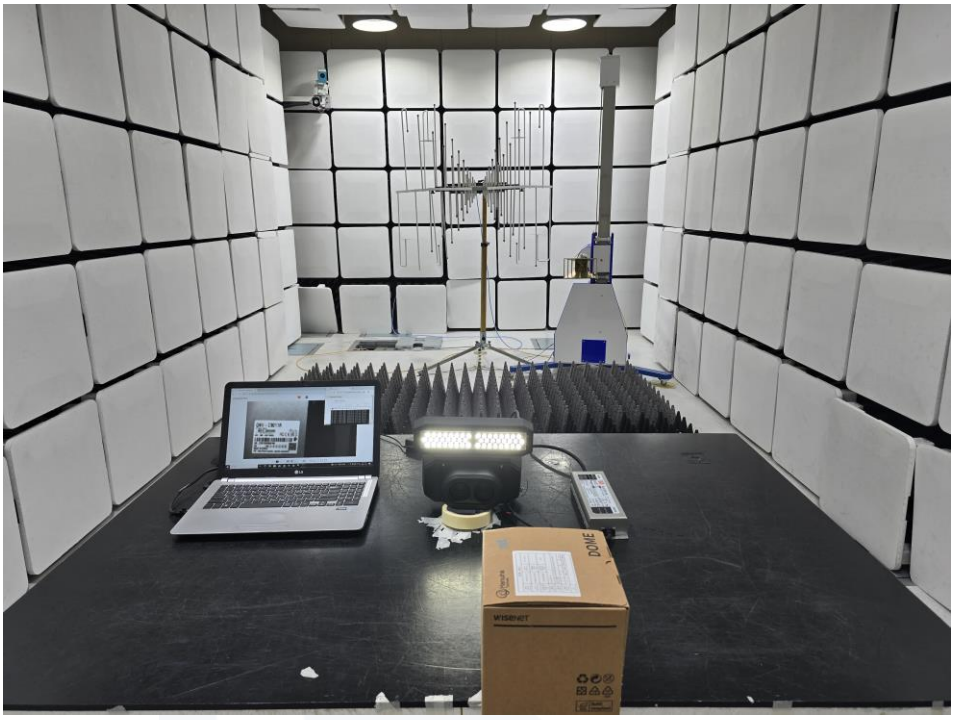
Conducted Telecommunication Emissions

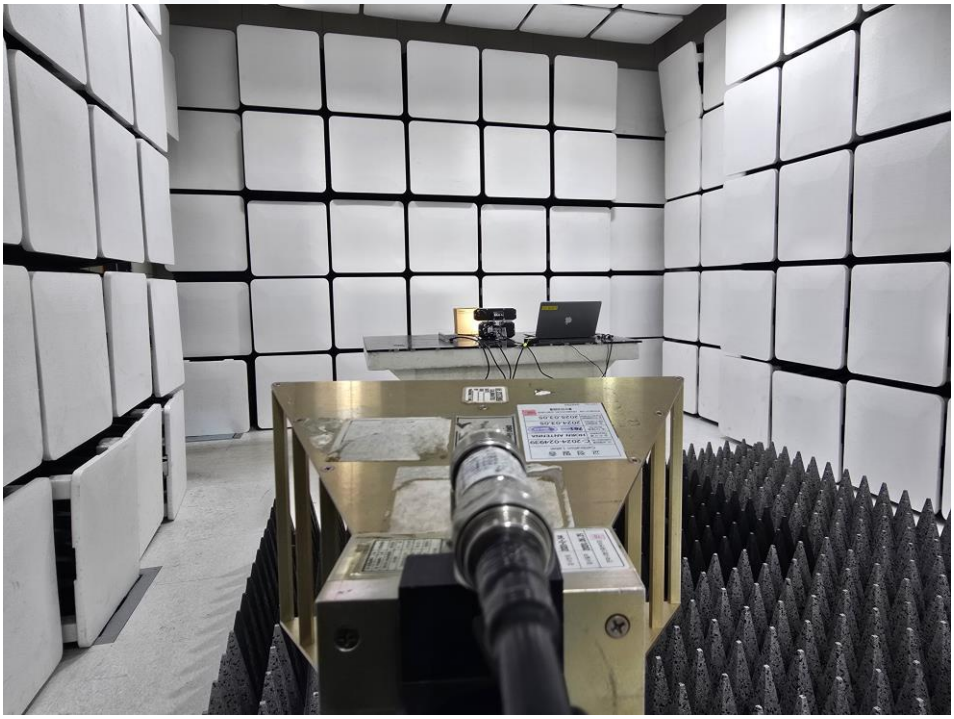
Radiated Electric Field Emissions(Below 1 ㎓)





Radiated Electric Field Emissions(Above 1 ㎓)



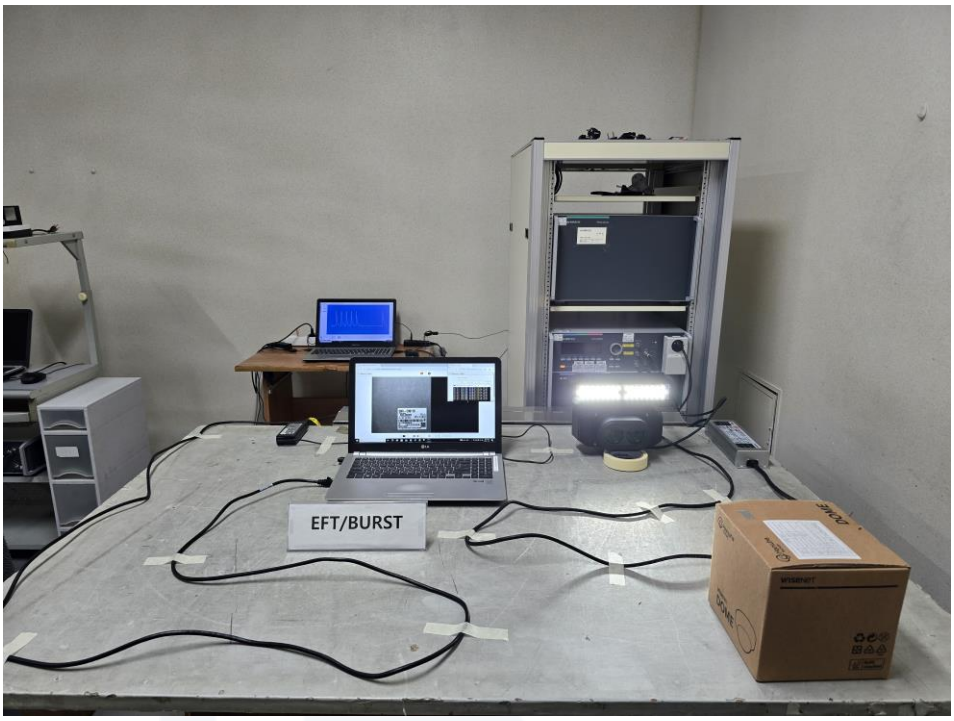


Harmonic Current Emissions and Voltage Fluctuations and Flicker

Electrostatic Discharge

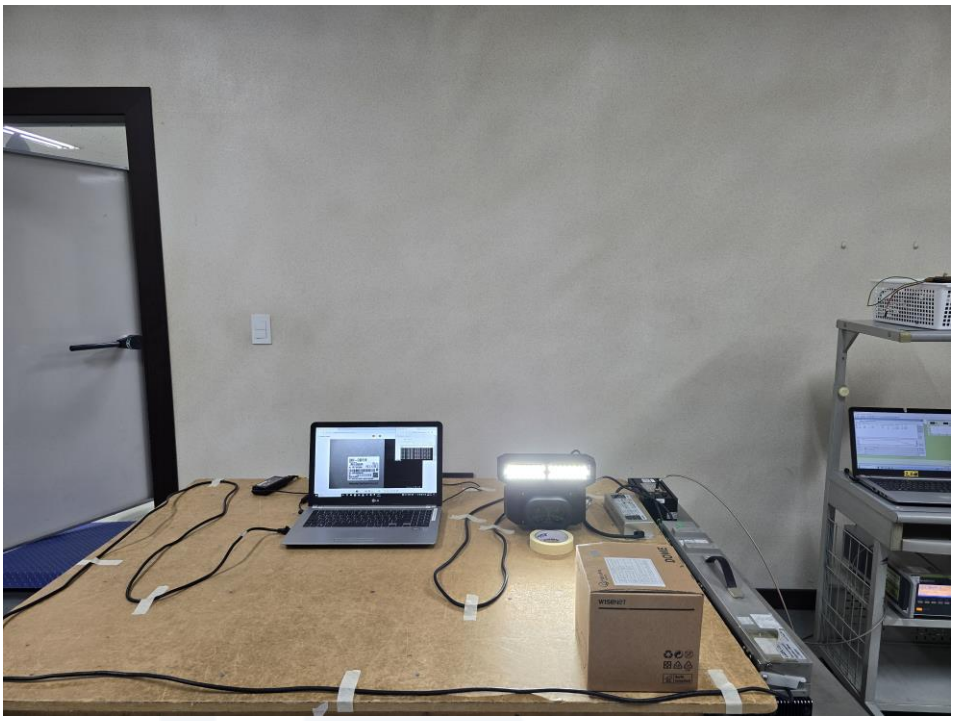
Radiated Electric Field Immunity

Electrical Fast Transients/Bursts



Surge Transients

Conducted Disturbance



Power Frequency Magnetic Field Immunity

N/A

Voltage Dips and Short Interruptions

APPENDIX C – EUT Photographs

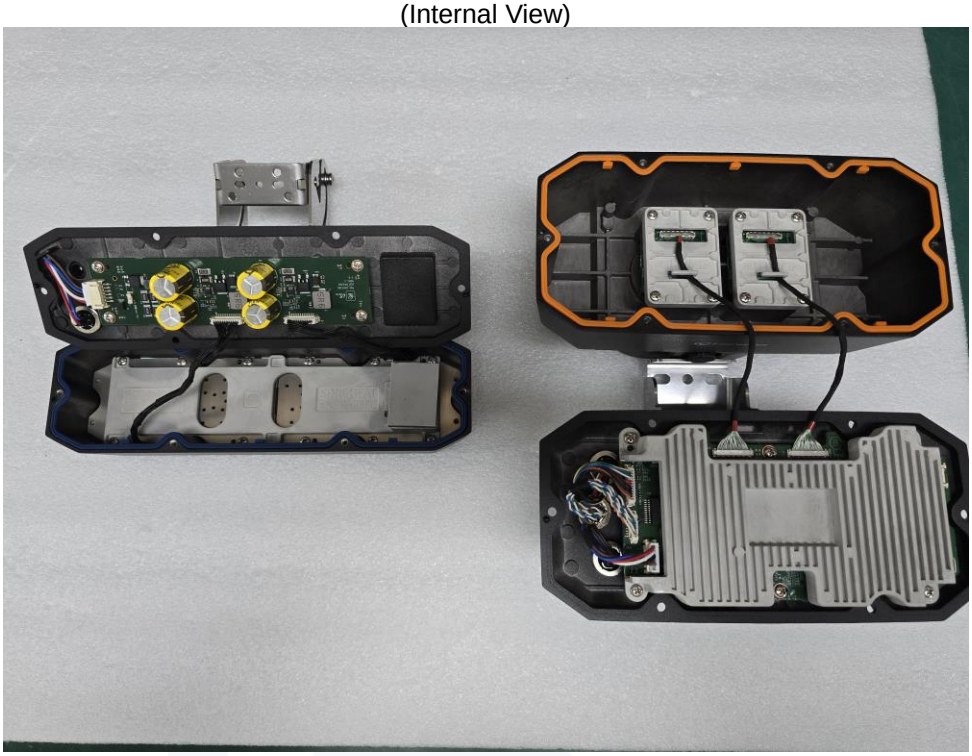
EUT External Photographs

(Top)

(Bottom)

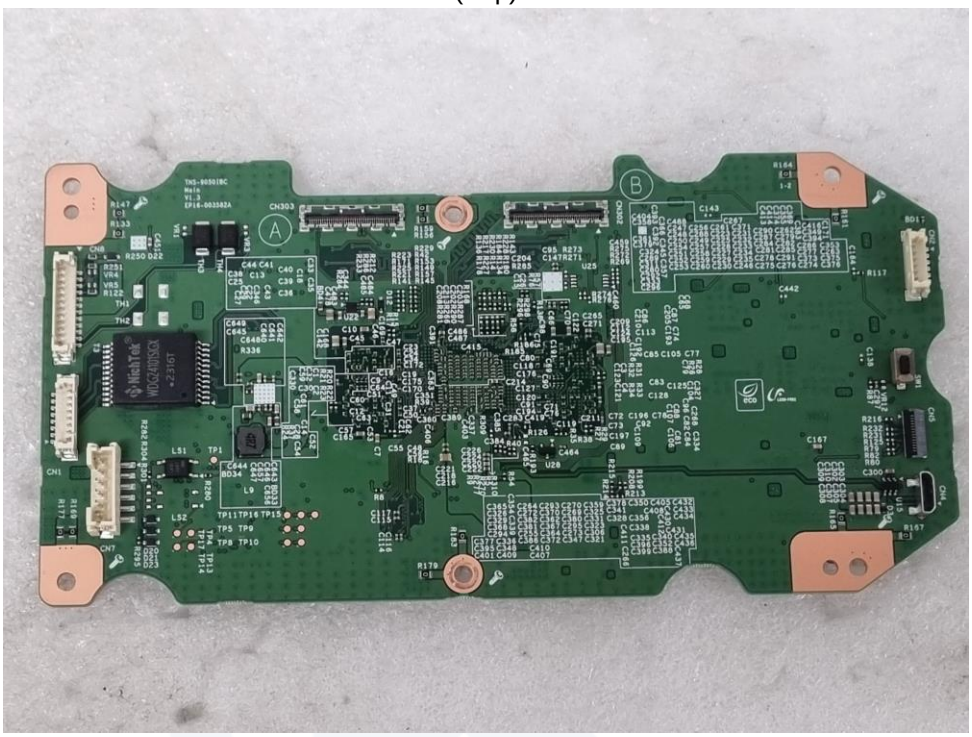
EUT Internal Photographs

(Internal View)

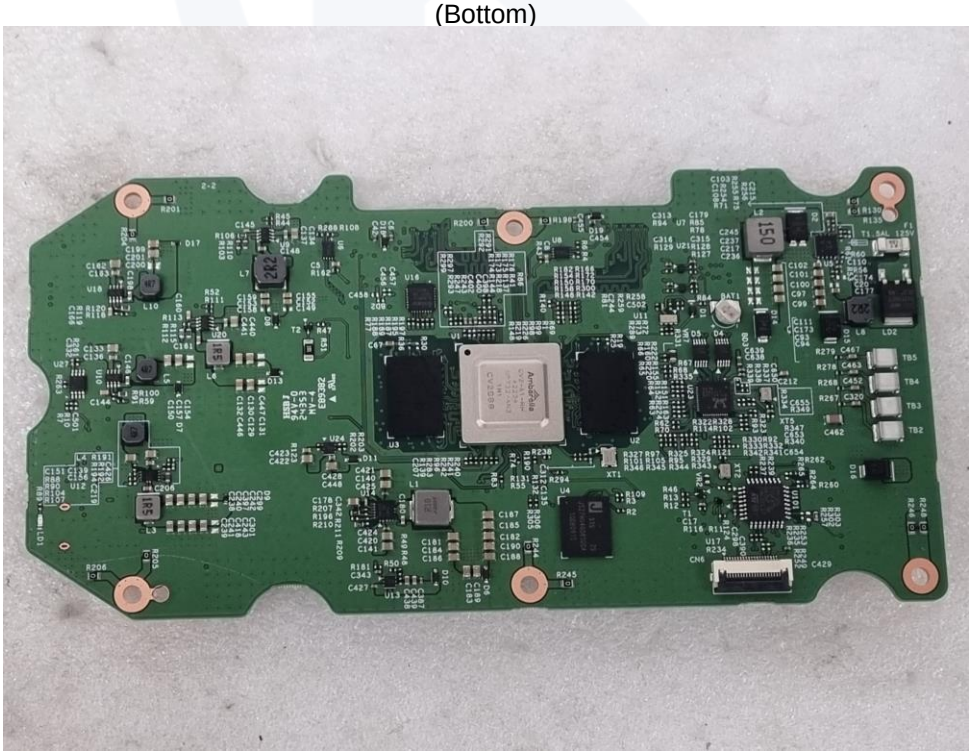


EUT Internal View – Main Board

(Top)

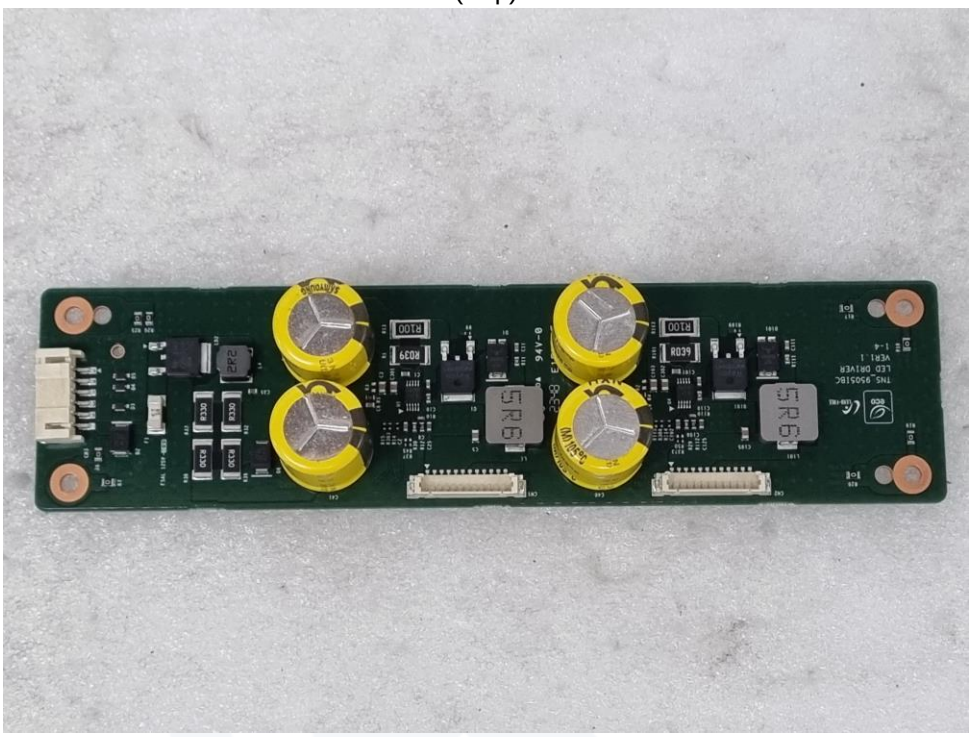


(Bottom)

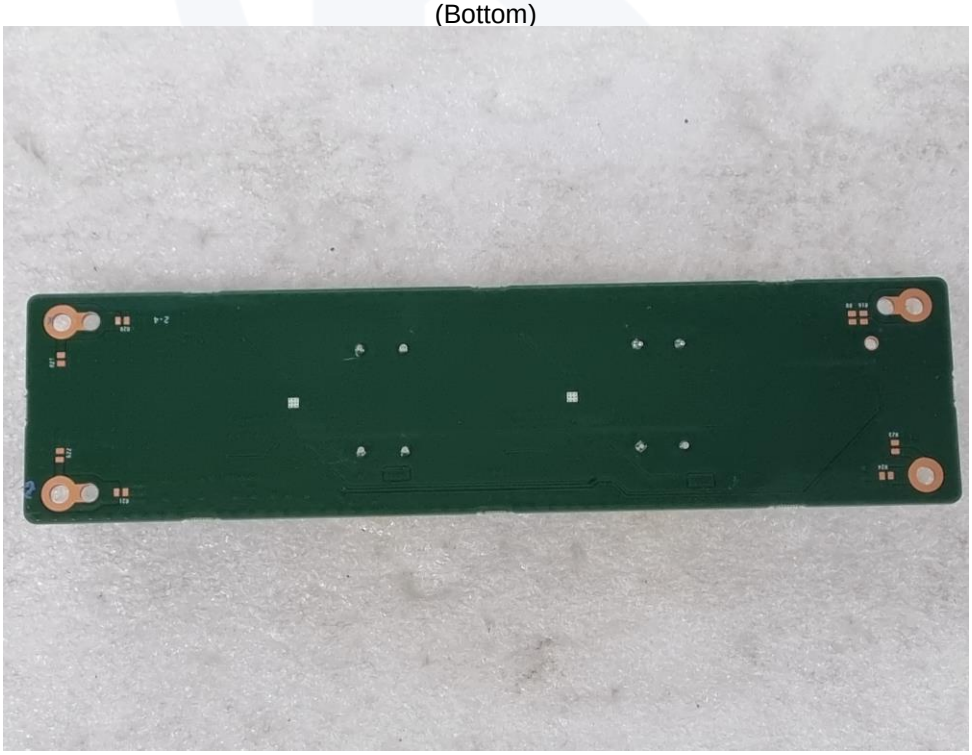


EUT Internal View – Sub Board

(Top)



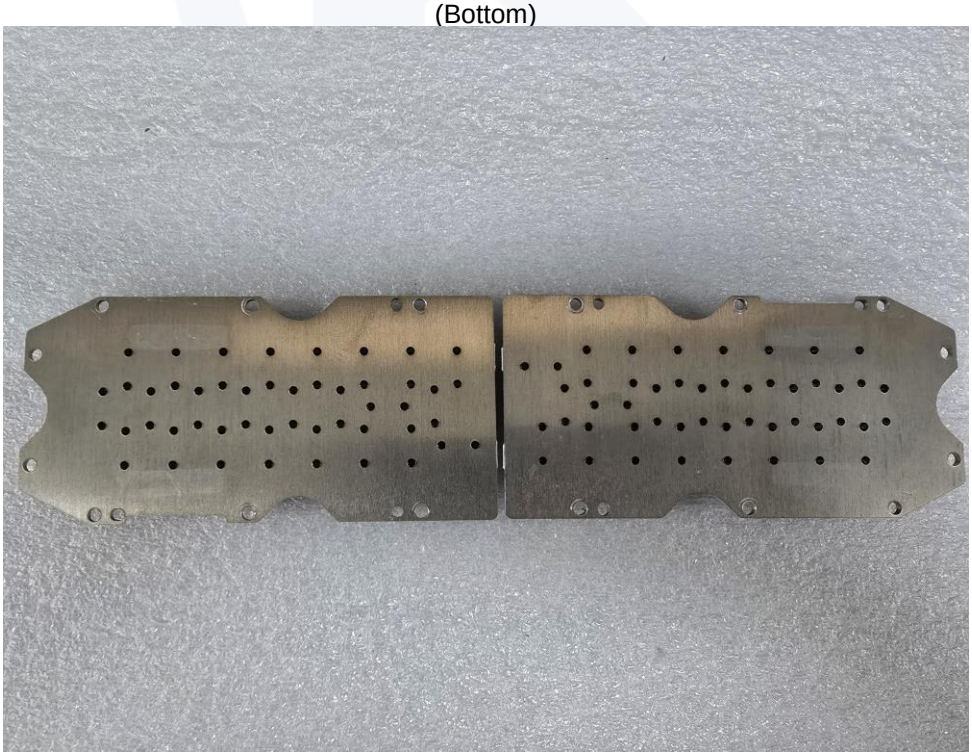
(Bottom)



EUT Internal View – LED Board

(Top)

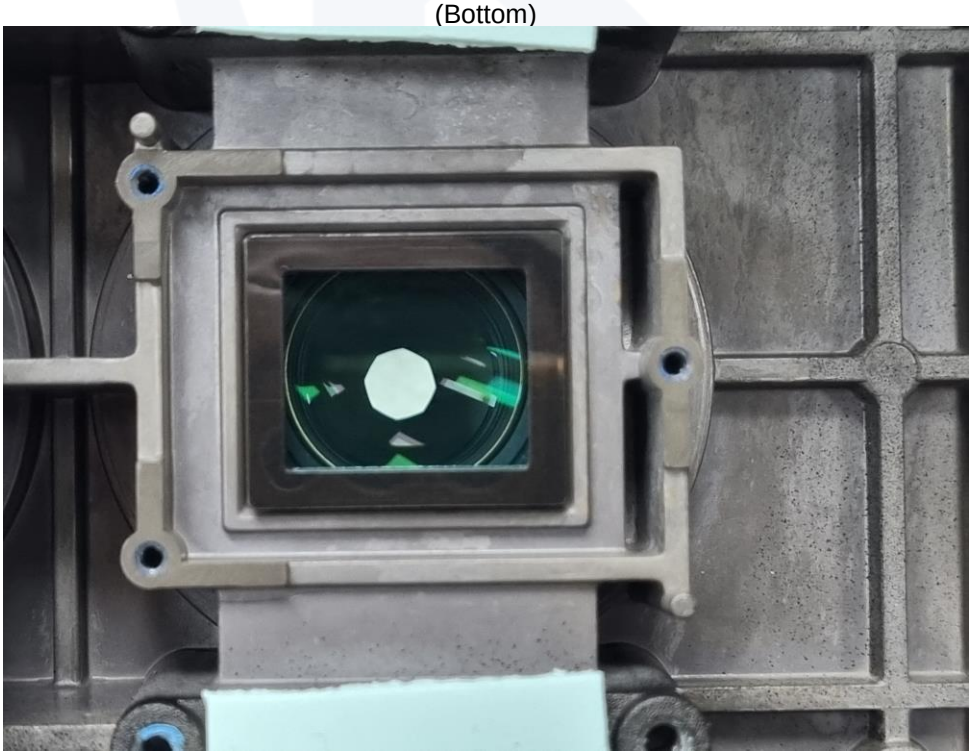
(Bottom)



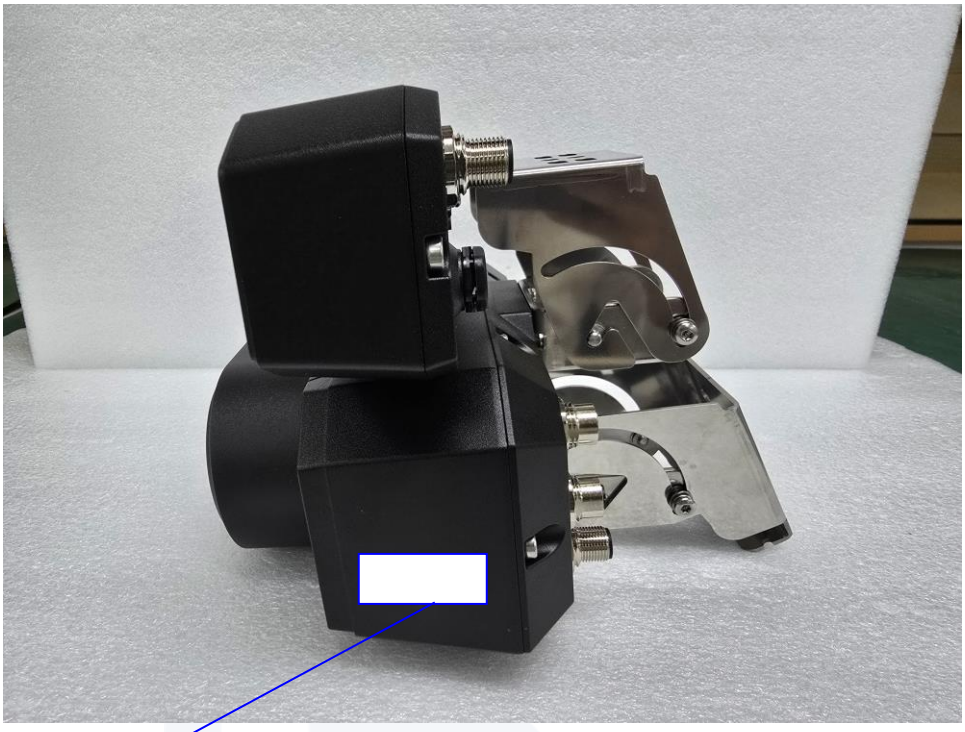
EUT Internal View – Lens

(Top)

(Bottom)



Label and Location



Barcode Reader

Model No : TNS-9050IBC

Manufacturer : HANWHA VISION VIETNAM COMPANY LIMITED

Made in Vietnam

The End.