TEST REPORT

KES Co., Ltd.
#3002, #3503, #3701, 40, Simin-daero365beon-gil, Dongan-gu, 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 : LED MODULE

Model/Type No. : SPI-BWN0

Variant Model : SPI-BWM0,SPI-BWM1,SPI-BWW0

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 Province, Vietnam
2. 173-25, Saneop-ro, Gwonseon-gu, Suwon-si, Gyeonggi- do, Korea (Suwon Industrial Complex)

3. Date of Receipt : Aug. 12, 2025

4. Test date : May. 18, 2025 ~ May. 21, 2025

5. Date of Issue : Aug. 18, 2025

6. Test Results : In Compliance

Tested by

[전은구]2025/08/18

Eun Gu, Jeon
EMC Test Engineer

Reviewed by

[장동훈]2025/08/18

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
Jun. 05, 2025	KES-EM251645	Issued
Aug. 18, 2025	KES-EM251645-R1	Reissuance of modifications due to addition of derivative model name

TABLE OF CONTENTS

1.0 General Product Description

Main Specifications of EUT are:

Division		Specificity
Internal highest operating frequency		120 Hz
Power	Rated Power	DC 24 V
	Test Power	AC 230 V, 50 Hz
Ports	I/O Port	LED DRIVER 1 EA
	Unused Port	N/A
Components		Main Body 1 EA

Electrical Input	24 VDC ± 10%
Max. Power Consumption	6.9 W
Color temperature	6,500 K ± 10%
LED Quantity	16EA
Angle	FWHM : 12° 10-% : 32°
Operation Temperature / Humidity	-40°C~+55°C / 0~95% RH
Storage Temperature / Humidity	-40°C ~ +60°C / Less than 95% RH
Dimension	W101.2 x D53.8 x H78.2
Weight	200g
Certification	FCC, UL, CE, KC, IEC 62471

1.1 Test Voltage & Frequency

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

☒ AC 230 V, 50 Hz

1.2 Variant Model Differences

Differences between base model and derivative: Only LED Lens with different light emission angle specifications differ / Same electronics/instruments
- Basic model: SPI-BWN0 / Light dissipation angle 12°
- Derivatives: SPI-BWM0 / Light divergence angle 25°, SPI-BWM1 / Light divergence angle 43°, SPI-BWW0 / Light divergence angle 60°

1.3 Device Modifications

Not applicable

1.4 Equipment Under Test

Description	Model Number	Serial Number	Manufacturer	Remarks
LED MODULE	SPI-BWN0	-	HANWHA VISION VIETNAM COMPANY LIMITED	EUT

1.5 System Configuration

Description	Model Number	Serial Number	Manufacturer	Remarks
-	-	-	-	-

1.6 Support Equipments

Description	Model Number	Serial Number	Manufacturer	Remarks
AC/DC Adapter	WTS-2405N(120W)	-	Sun Electronics Co., Ltd.	-
BARCODE READER	TNS-7000M		HANWHA VISION VIETNAM COMPANY LIMITED	-
Laptop	P95G001	9JM8HT2	DELL INC.	-
Laptop AC/DC Adapter	HA65NM130	-	Chicony Power Technology(Suzhou)Co., Ltd.	-
Micro SD Card	-	-	Sandisk	8 GB

1.7 External I/O Cabling

Start		END		Cable Spec.	
Description	**I/O Port**	**Description**	**I/O Port**	**Length**	**Shield**
LED MODULE (EUT)	LED DRIVER	BARCODE READER	LED DRIVER	-	-
BARCODE READER	8 Pin	AC/DC Adapter	Line	2.8	U
	Micro SD Slot	Micro SD Card	Micro SD Slot	-	-
	12 Pin	Laptop	RJ-45	5.0	S
Laptop	DC Jack	Laptop Adapter	Line	1.5	U

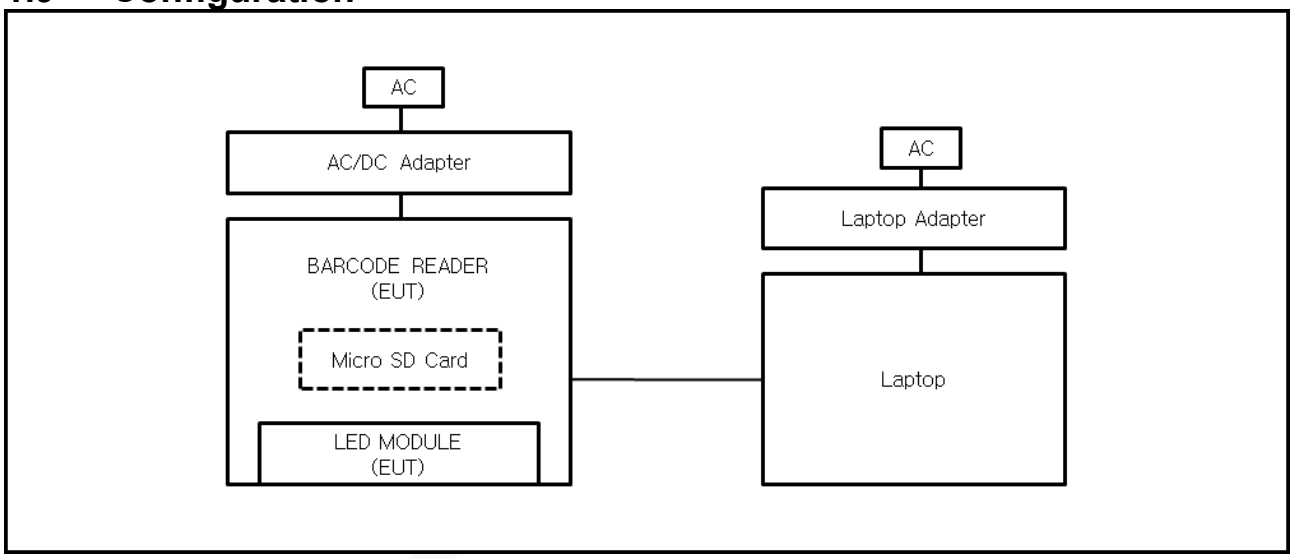
* Unshielded=U, Shielded=S

1.8 EUT Operating Mode(s)

Test mode	Normal operating	Test Voltages
Operating	- Check the operation of BARCODE READER through the laptop's web viewer and check the LED operation of EUT.	AC 230 V, 50 Hz

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

1.9 Configuration



1.10 Remarks when standards applied

N/A

1.11 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.

1.12 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

1.13 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/A1:2020 ☒ 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
May. 18, 2025

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, 09, 2026
☒	ARTIFICIAL MAINS NETWORK	ESH2-Z5	R & S	100450	11, 06, 2025
☒	PULSE LIMITER	ESH3-Z2	R & S	101915	11, 06, 2025

Test Conditions
Temperature: (23.1 ± 0,1) ℃
Relative Humidity: (46.4 ± 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.

2.2 Conducted Emissions at Telecommunication Ports

Test Date
N/A

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, 09, 2026
☐	ARTIFICIAL MAINS NETWORK	ESH2-Z5	R & S	100450	11, 06, 2025
☐	PULSE LIMITER	ESH3-Z2	R & S	101915	11, 06, 2025
☐	ISN	ISN S8	SCHWARZBECK	ISN-S8-0019	02, 27, 2026

Test Conditions
Temperature: ℃
Relative Humidity: % 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
Does not apply because no IP is assigned

2.3 Radiated Electric Field Emissions(Below 1 ㎓)

Test Date
May. 18, 2025

Test Location
☐ OPEN AREA TEST SITE #2 ☒ SEMI ANECHOIC CHAMBER #4

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	ESW8	R & S	101319	03, 24, 2026
☒	AMPLIFIER	SCU 01	R & S	100603	11, 06, 2025
☒	BILOG ANTENNA	VULB 9168	SCHWARZBECK	9168-461	05, 09, 2026
☒	ATTENUATOR	6806.17.A	HUBER+SUHNER	-	02, 13, 2026

Test Conditions
Temperature: (23,4 ± 0,1) ℃
Relative Humidity: (47,6 ± 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
N/A

Test Location
SEMI ANECHOIC CHAMBER #5

Test Equipment

Used	Description	Model Number	Manufacturer	Serial Number	Cal. Due
☐	EMI Test S/W	ES10/RE	TOYO Corporation	2022.01.000	-
☐	EMI TEST RECEIVER	ESU26	Rohde & Schwarz	100552	02, 13, 2026
☐	HORN ANTENNA	BBHA 9120D	SCHWARZBECK	9120D-1802	11, 04, 2025
☐	PREAMPLIFIER	8449B	HP	3008A00899	03, 05, 2026
☐	ATTENUATOR	8491B	HP	23094	02, 13, 2026

Test Conditions
Temperature: ℃
Relative Humidity: % 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
It does not apply because the frequency is less than 108 MHz.

2.5 Harmonic Current Emissions

Test Date
May. 21, 2025

Test Location
SHIELD ROOM #7

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, 31, 2026
☒	POWER SOURCE	ACS 500N6	EM TEST	V1024106760	-

Test Conditions

Temperature: (23,2 ± 0,1) ℃
Relative Humidity: (46,4 ± 0,1) % R.H.

Classification of Equipment for Harmonic Current Emissions

☒ Class A
☐ Class B
☐ Class C(Below 25 W)
☐ Class C(Above 25 W)
☐ Class D

Test Results

The requirements are:

☒ PASS
☐ NOT PASS
☐ NOT APPLICABLE

Remarks

See Appendix A for test data.

2.6 Voltage Fluctuations and Flicker

Test Date
May. 21, 2025

Test Location
SHIELD ROOM #7

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, 31, 2026
☒	POWER SOURCE	ACS 500N6	EM TEST	V1024106760	-

Test Conditions

Temperature: (23,2 ± 0,1) ℃
Relative Humidity: (46,4 ± 0,2) % R.H.

Test Results
The requirements are:

☒ PASS
☐ NOT PASS
☐ NOT APPLICABLE

Remarks
See Appendix A for test data.

3.0 Criteria for compliance

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
May. 18, 2025

Test Location
EMS-ESD: SHIELD ROOM #6

Test Equipment

Used	Description	Model Number	Manufacturer	Serial Number	Cal. Due
☒	ESD SIMULATOR	ESS-2000	Noise Ken	ESS01Z0454	01, 21, 2026
☒	HCP	-	KES	-	-
☒	VCP	-	Noise Ken	-	-

Test Conditions

Temperature: (23,2 ± 0,1) ℃
Relative Humidity: (46,3 ± 0,1) % R.H.
Atmospheric Pressure: (100,1 ± 0,1) kPa

Test Specifications

Discharge Factor: ≥ 1 s

Discharge Impedance: 330 ohm / 150 pF

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

Polarity: Positive and Negative

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

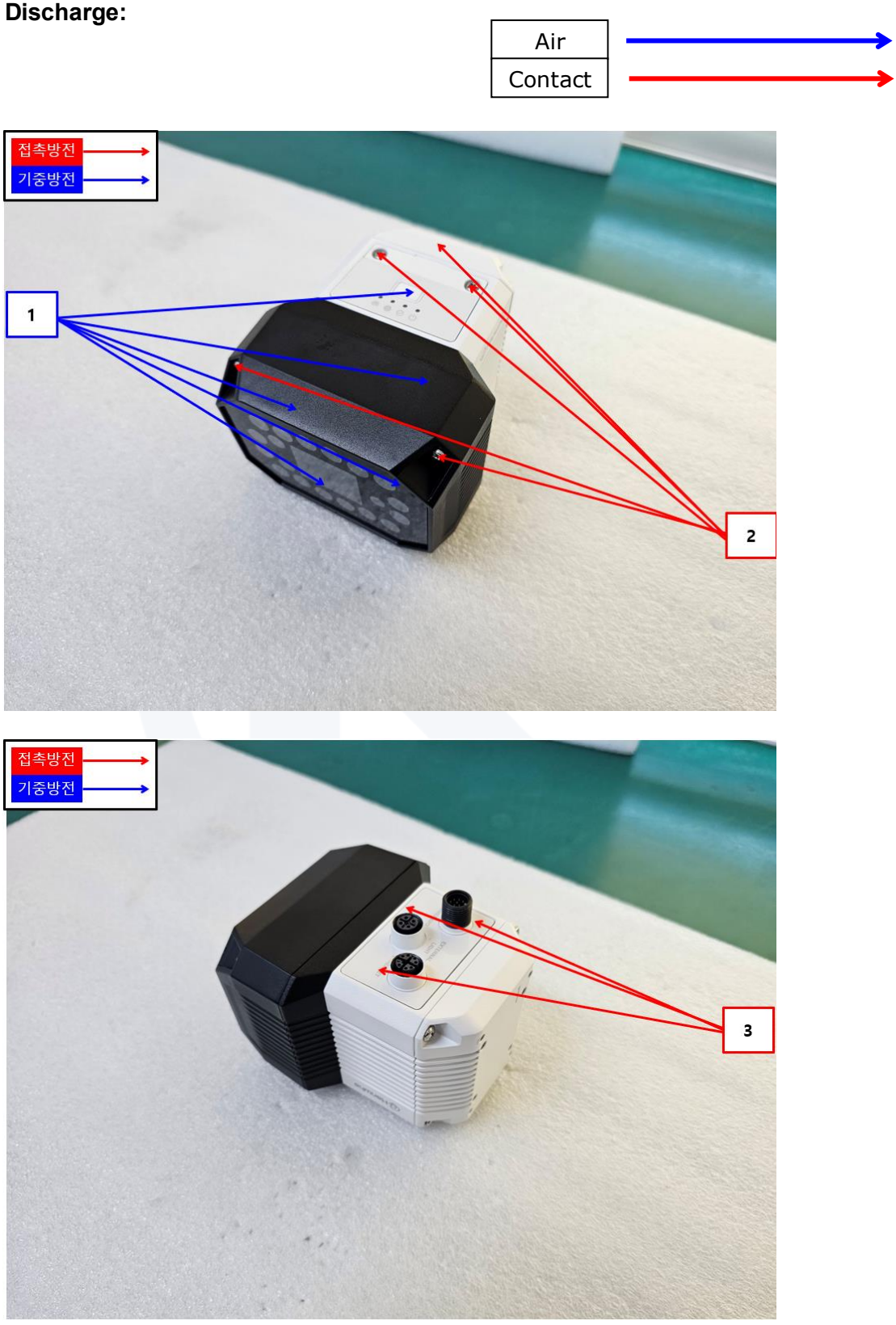
Discharge Voltage:

Contact	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	BARCODE READER Enclosure 1, Button	Air Discharge	B	A	-
2	Screw, BARCODE READER Enclosure 2	Contact Discharge	B	A	-
3	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
May. 19, 2025

Test Location
EMS-RS: ☒ SEMI ANECHOIC CHAMBER #4(10 m)

Test Equipment

Used	Description	Model Number	Manufacturer	Serial Number	Cal. Due
☒	EMS Test S/W	EMC32	R & S	10.10.02	-
☒	SIGNAL GENERATOR	SMB 100A	Rohde & Schwarz	108252	07, 29, 2025
☒	HIGH POWER DUAL AMP	SSA532	SUNGSAN	SSA532-001	-
☒	POWER METER	E4419B	Agilent	GB40203000	02, 13, 2026
☒	AVERAGE POWER SENSOR	E9301A	Agilent	MY52170007	02, 13, 2026
☒	AVERAGE POWER SENSOR	E9301A	Agilent	MY41498669	02, 13, 2026
☒	STACKED DOUBLE LOG-PER- ANTENNA	STPL9128 E	Schwarzbeck	9128ES-121	-
☒	DOUBLE RIDGED HORN ANTENNA	SAS-571	A.H.SYSTEM,INC	781	03, 05, 2026

Test Conditions

Temperature: (23,8 ± 0,1) ℃
Relative Humidity: (47,4 ± 0,1) % R.H.
Atmospheric Pressure: (100,0 ± 0,1) 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) ☒ 1.8 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	-	-

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
May. 19, 2025

Test Location
EMS-EFT: Electro wave Shieldroom #7

Test Equipment

Used	Description	Model Number	Manufacturer	Serial Number	Cal. Due
☒	EMS Test S/W	iec.control	EM TEST	5.4.8	-
☒	ULTRA COMPACT SIMULATOR	UCS 500N7	EM TEST	P1608172950	11, 06, 2025
☒	MOTOR VARIAC	MV2616	EM TEST	P1552169719	11, 07, 2025
☒	CAPACITIVE COUPLING CLAMP	HFK	EM TEST	P1633183115	11, 06, 2025

Test Conditions

Temperature: (23,2 ± 0,1) ℃
Relative Humidity: (46.2 ± 0,1) % R.H.
Atmospheric Pressure: (100,1 ± 0,1) 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)
12 Pin	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
May. 19, 2025

Test Location
EMS-Surge: Electro wave Shieldroom #7

Test Equipment

Used	Description	Model Number	Manufacturer	Serial Number	Cal. Due
☒	EMS Test S/W	iec.control	EM TEST	5.4.8	-
☒	ULTRA COMPACT SIMULATOR	UCS 500N7	EM TEST	P1608172950	11, 07, 2025
☒	MOTOR VARIAC	MV2616	EM TEST	P1552169719	11, 07, 2025

Test Conditions

Temperature: (23,2 ± 0,1) ℃
Relative Humidity: (46,2 ± 0,1) % R.H.
Atmospheric Pressure: (100,1 ± 0,1) 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 ☐ (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
May. 21, 2025

Test Location
EMS-CS: SHIELD ROOM #7

Test Equipment

Used	Description	Model Number	Manufacturer	Serial Number	Cal. Due
☒	EMS Test S/W	icd.control	EM TEST	8.0.0	-
☒	TEST SYSTEM FOR CONDUCTED AND RADIATED	NSG4070	TESEQ	65585	11, 18, 2025
☒	ATTENUATOR	ATT 6/80	EM TEST	P1614178148	11, 06, 2025
☒	CDN	CDN M016	TESEQ	43694	11, 07, 2025
☒	CDN	CDN M016	TESEQ	43697	11, 07, 2025
☒	EM CLAMP	KEMZ 801A	TESEQ	44099	11, 08, 2025

Test Conditions

Temperature: (23,2 ± 0,1) ℃
Relative Humidity: (46,4 ± 0,1) % R.H.
Atmospheric Pressure: (100,0 ± 0,1) kPa

Test Specifications

Frequency range: ☒ 150 ㎑ to 80 ㎒

Voltage Level: ☒ 3 Vrms (150 ㎑ to 10 ㎒)
☒ 3 Vrms to 1 Vrms (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
12 Pin	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	-	-
Y - axis	-	-
Z - axis	-	-

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
May. 19, 2025

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

Test Equipment

Used	Description	Model Number	Manufacturer	Serial Number	Cal. Due
☒	EMS Test S/W	iec.control	EM TEST	5.4.8	-
☒	ULTRA COMPACT SIMULATOR	UCS 500N7	EM TEST	P1608172950	11, 07, 2025
☒	MOTOR VARIAC	MV2616	EM TEST	P1552169719	11, 07, 2025

Test Conditions

Temperature: (23,2 ± 0,1) ℃
Relative Humidity: (46,2 ± 0,1) % R.H.
Atmospheric Pressure: (100,1 ± 0,1) 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

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

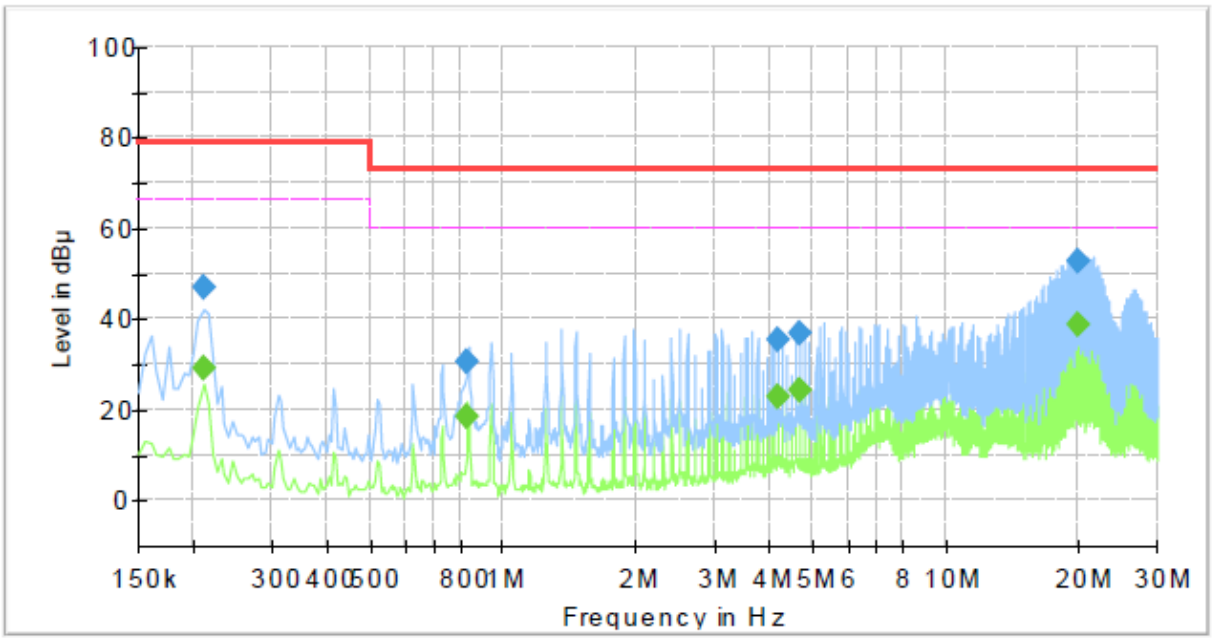
APPENDIX A – TEST DATA

Conducted Emissions at Mains Power Ports

[HOT]

Common Information

Test Description:	Conducted Emission
Job No.:	KES-EM251645
Phase:	L
Mode:	
Operator Name:	KES



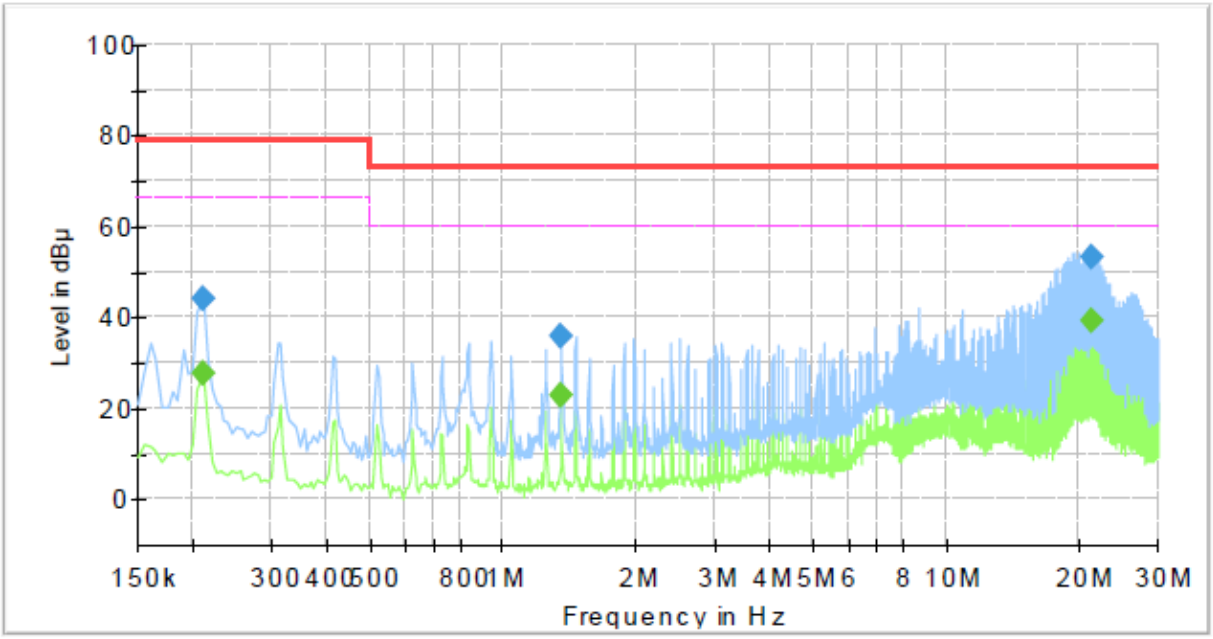
Final_Result

Frequency (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.210000	---	29.11	66.00	36.89	1000.0	9.000	L1	19.5
0.210000	46.89	---	79.00	32.11	1000.0	9.000	L1	19.5
0.830000	---	18.48	60.00	41.52	1000.0	9.000	L1	19.6
0.830000	30.61	---	73.00	42.39	1000.0	9.000	L1	19.6
4.165000	---	22.82	60.00	37.18	1000.0	9.000	L1	19.8
4.165000	35.25	---	73.00	37.75	1000.0	9.000	L1	19.8
4.690000	---	24.16	60.00	35.84	1000.0	9.000	L1	19.9
4.690000	36.90	---	73.00	36.10	1000.0	9.000	L1	19.9
19.900000	---	38.89	60.00	21.11	1000.0	9.000	L1	20.3
19.900000	52.88	---	73.00	20.12	1000.0	9.000	L1	20.3

[NEUTRAL]

Common Information

Test Description:	Conducted Emission
Job No.:	KES-EM251645
Phase:	N
Mode:	
Operator Name:	KES



Final_Result

Frequency (MHz)	QuasiPeak (dBuV)	CAverage (dBuV)	Limit (dBuV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.210000	---	27.44	66.00	38.56	1000.0	9.000	N	19.5
0.210000	43.83	---	79.00	35.17	1000.0	9.000	N	19.5
1.355000	---	22.75	60.00	37.25	1000.0	9.000	N	19.6
1.355000	35.74	---	73.00	37.26	1000.0	9.000	N	19.6
21.360000	---	39.28	60.00	20.72	1000.0	9.000	N	20.4
21.360000	53.14	---	73.00	19.86	1000.0	9.000	N	20.4

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

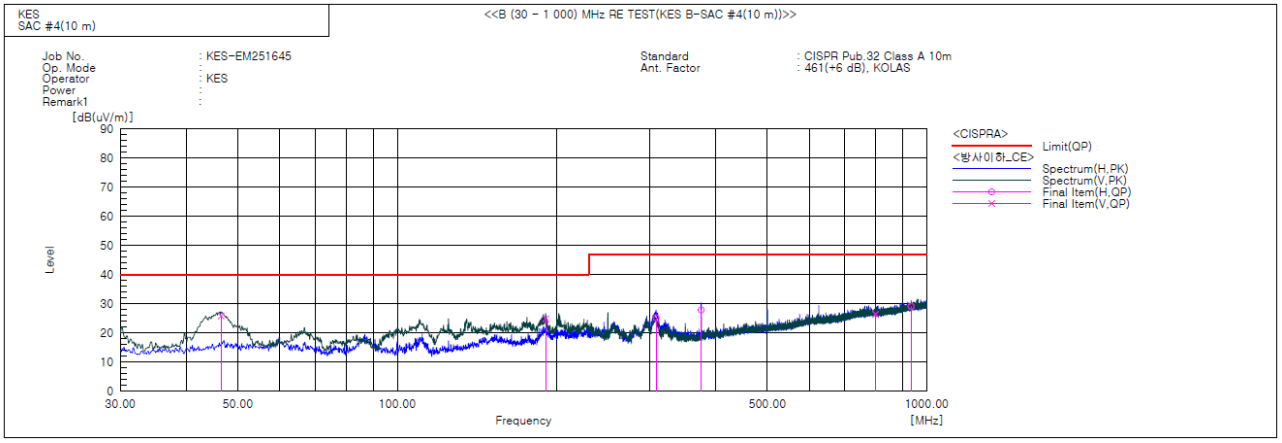
Conducted Emissions at Telecommunication Ports

[1000 Mbps]

N/A

♦ 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	46.490	V	46.9	-21.1	25.8	40.0	14.2	152.0	225.0	
2	190.656	V	46.5	-21.6	24.9	40.0	15.1	158.0	71.0	
3	308.148	H	41.9	-16.7	25.2	47.0	21.8	313.0	268.0	
4	374.956	H	42.5	-14.6	27.9	47.0	19.1	363.0	248.0	
5	800.059	V	30.1	-3.7	26.4	47.0	20.6	133.0	182.0	
6	934.283	H	30.0	-0.9	29.1	47.0	17.9	286.0	107.0	

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

Radiated Electric Field Emissions(Above 1 ㎓)

N/A

♦ Calculation
Result(PK/CAV) [㏈(㎶/m)] = (Reading(PK/CAV)[㏈(㎶)] + c.f[㏈(1/m)]
Margin(PK/CAV)[㏈] = Limit[㏈(㎶/m)] - Result(PK/CAV) [㏈(㎶/m)]
Reading(PK/CAV) : Reading value, Result(PK/CAV) : Reading value + Factor value
Limit(PK/CAV) : 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	0.048			
2	0.001	0.137	1.080	n/a
3	0.041	1.792	2.300	PASS
4	0.002	0.460	0.430	n/a
5	0.039	3.422	1.140	PASS
6	0.002	0.749	0.300	n/a
7	0.037	4.794	0.770	PASS
8	0.002	0.707	0.230	n/a
9	0.035	8.659	0.400	PASS
10	0.001	0.781	0.184	n/a
11	0.031	9.499	0.330	PASS
12	0.001	0.850	0.153	n/a
13	0.027	12.982	0.210	PASS
14	0.001	0.995	0.131	n/a
15	0.023	15.299	0.150	PASS
16	0.001	1.046	0.115	n/a
17	0.019	14.262	0.132	PASS
18	0.001	0.960	0.102	n/a
19	0.015	12.790	0.118	PASS
20	0.001	0.916	0.092	n/a
21	0.011	7.090	0.161	PASS
22	0.001	0.987	0.084	n/a
23	0.008	5.462	0.147	PASS
24	0.001	1.037	0.077	n/a
25	0.005	3.680	0.135	n/a
26	0.001	1.039	0.071	n/a
27	0.002	1.962	0.125	n/a
28	0.001	1.113	0.066	n/a
29	0.001	0.889	0.116	n/a
30	0.001	1.182	0.061	n/a
31	0.002	1.542	0.109	n/a
32	0.001	1.232	0.058	n/a
33	0.003	2.577	0.102	n/a
34	0.001	1.273	0.054	n/a
35	0.003	3.218	0.096	n/a
36	0.001	1.262	0.051	n/a
37	0.003	3.663	0.091	n/a
38	0.001	1.306	0.048	n/a
39	0.003	3.597	0.087	n/a
40	0.001	1.367	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	0.049			
2	0.002	0.106	1.620	n/a
3	0.041	1.199	3.450	PASS
4	0.002	0.349	0.645	n/a
5	0.039	2.298	1.710	PASS
6	0.003	0.643	0.450	n/a
7	0.037	3.210	1.155	PASS
8	0.002	0.535	0.345	n/a
9	0.035	5.812	0.600	PASS
10	0.002	0.611	0.276	n/a
11	0.032	6.385	0.495	PASS
12	0.001	0.637	0.230	n/a
13	0.028	8.733	0.315	PASS
14	0.002	0.778	0.197	n/a
15	0.023	10.308	0.225	PASS
16	0.001	0.825	0.173	n/a
17	0.019	9.639	0.199	PASS
18	0.001	0.733	0.153	n/a
19	0.015	8.685	0.178	PASS
20	0.001	0.710	0.138	n/a
21	0.012	7.271	0.161	PASS
22	0.001	0.747	0.125	n/a
23	0.008	5.651	0.147	PASS
24	0.001	0.786	0.115	n/a
25	0.005	3.871	0.135	PASS
26	0.001	0.796	0.106	n/a
27	0.003	2.125	0.125	n/a
28	0.001	0.883	0.099	n/a
29	0.001	0.965	0.116	n/a
30	0.001	0.874	0.092	n/a
31	0.002	1.690	0.109	n/a
32	0.001	0.916	0.086	n/a
33	0.003	2.752	0.102	n/a
34	0.001	0.955	0.081	n/a
35	0.003	3.300	0.096	n/a
36	0.001	0.968	0.077	n/a
37	0.004	3.851	0.091	n/a
38	0.001	0.976	0.073	n/a
39	0.003	3.737	0.087	n/a
40	0.001	1.039	0.069	n/a

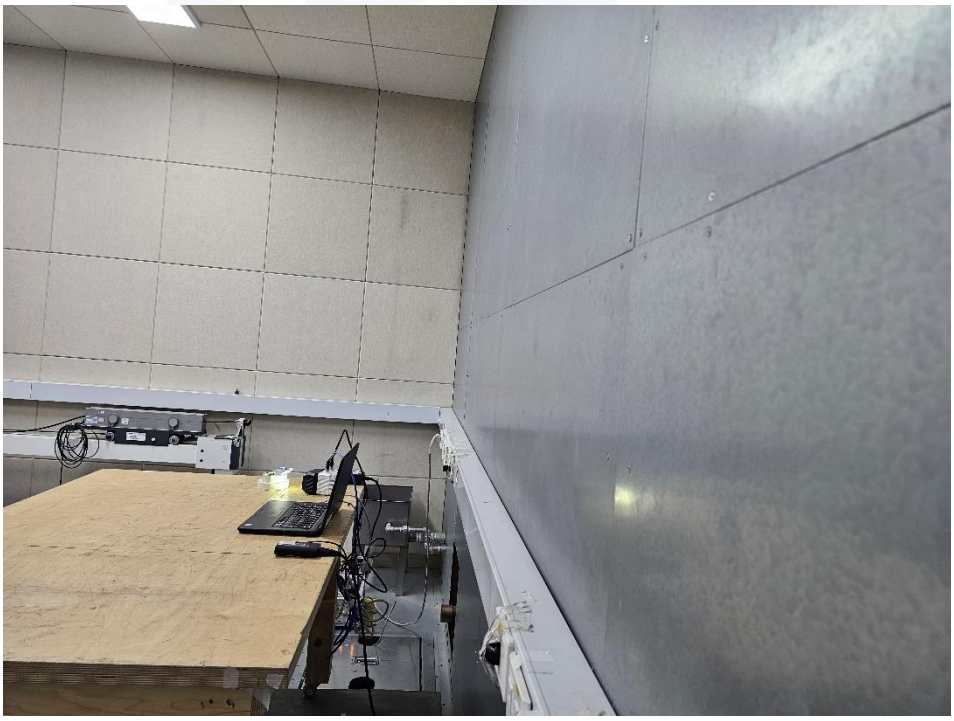
Note: Harmonic currents less than 0.6 % of the input current measured under the test conditions, or less than 5 mA, whichever is greater, are disregarded.
* Application of limits for average is 100% except for odd harmonics from 21 to 39, where 150% applies.

Test Data - Voltage Fluctuations

Flicker Measurements					
	P_{lt}	**Max P_{st}**	**Max D_c**	**Max D_{max}**	**Max T_{max}**
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

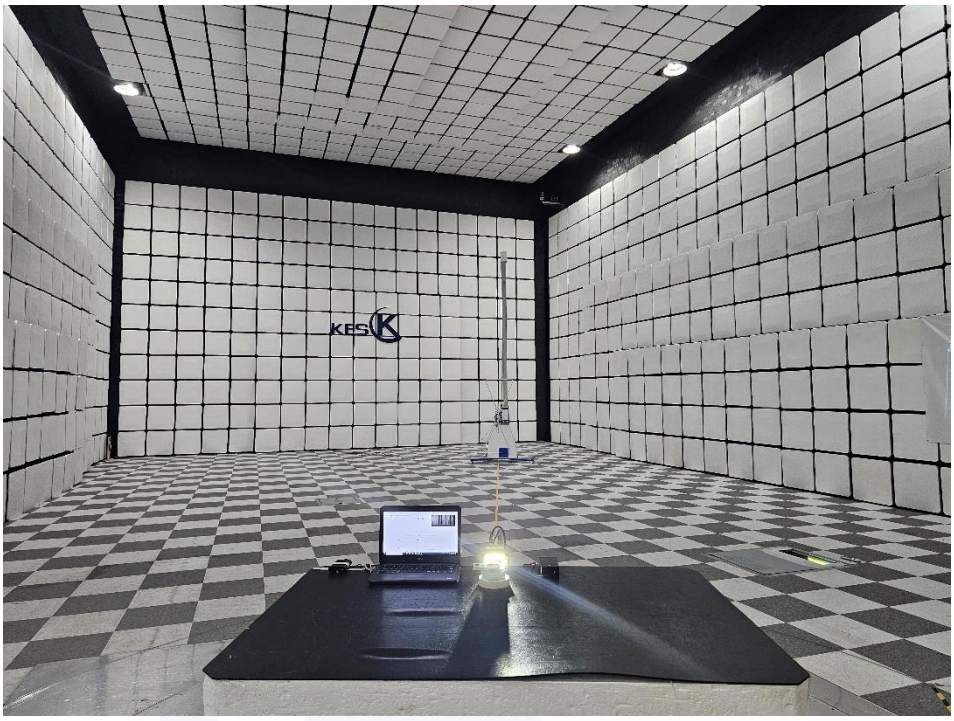
Conducted Emissions at Mains Power Ports

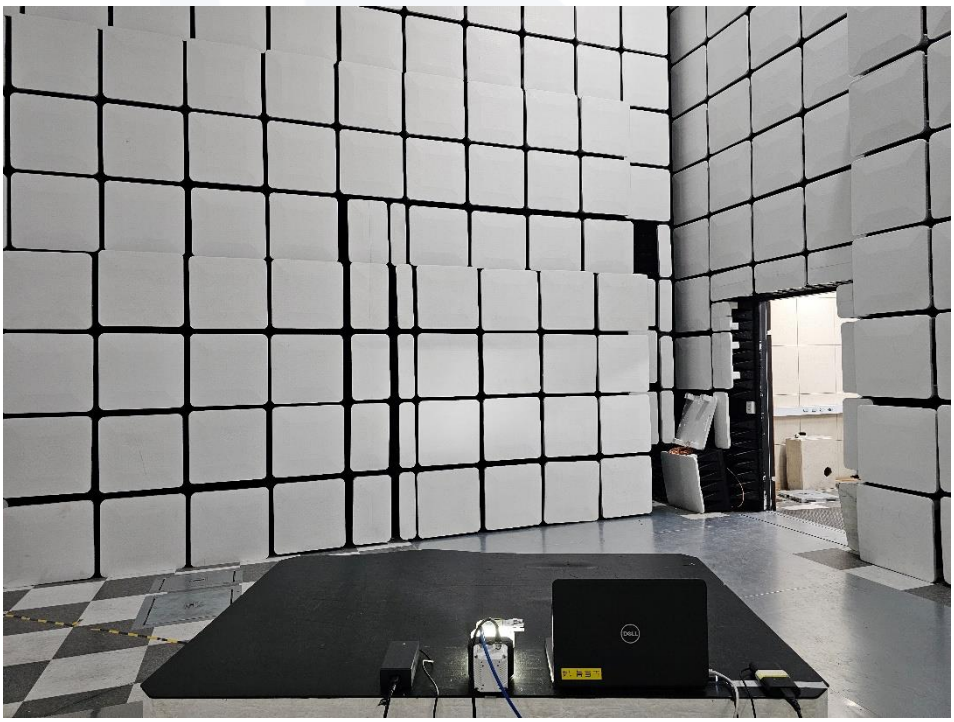


Conducted Telecommunication Emissions

N/A

Radiated Electric Field Emissions(Below 1 ㎓)





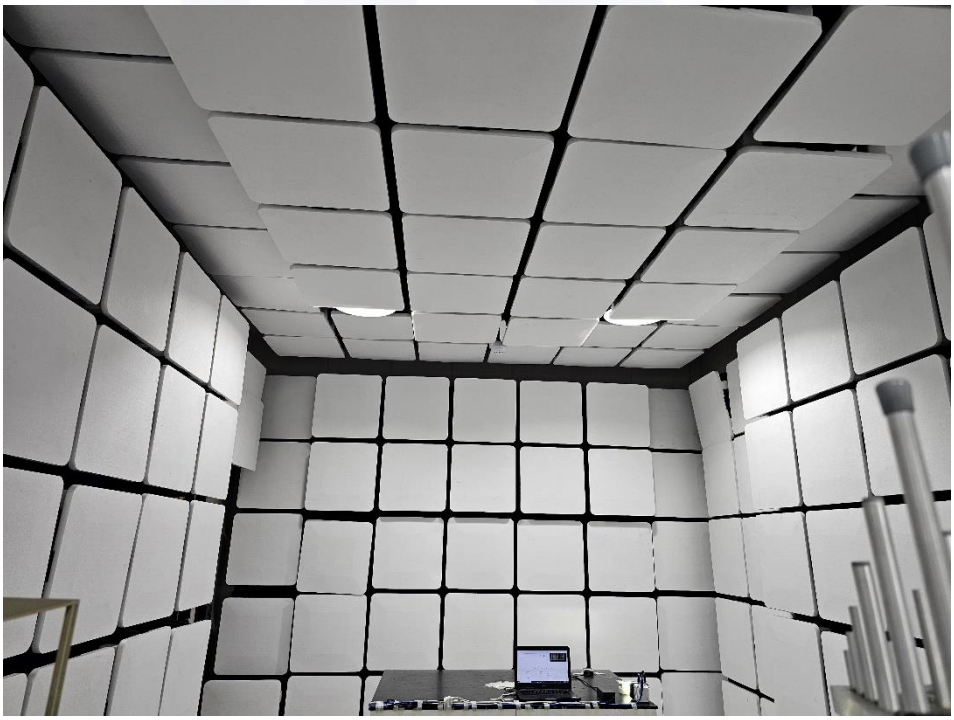
Radiated Electric Field Emissions(Above 1 ㎓)

N/A

Harmonic Current Emissions and Voltage Fluctuations and Flicker

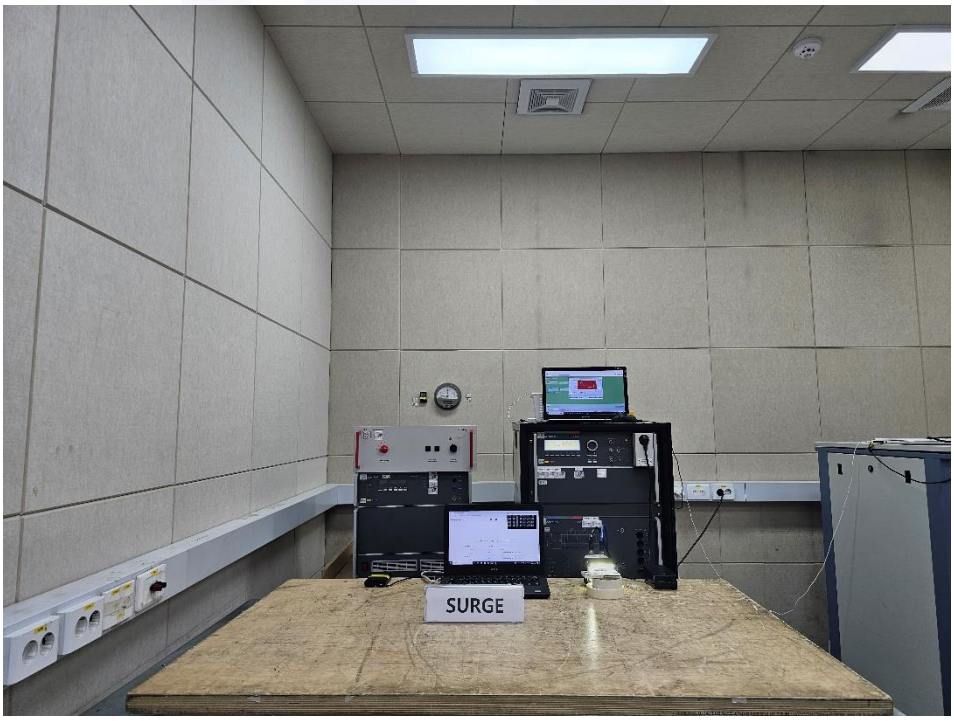
Electrostatic Discharge

Radiated Electric Field Immunity

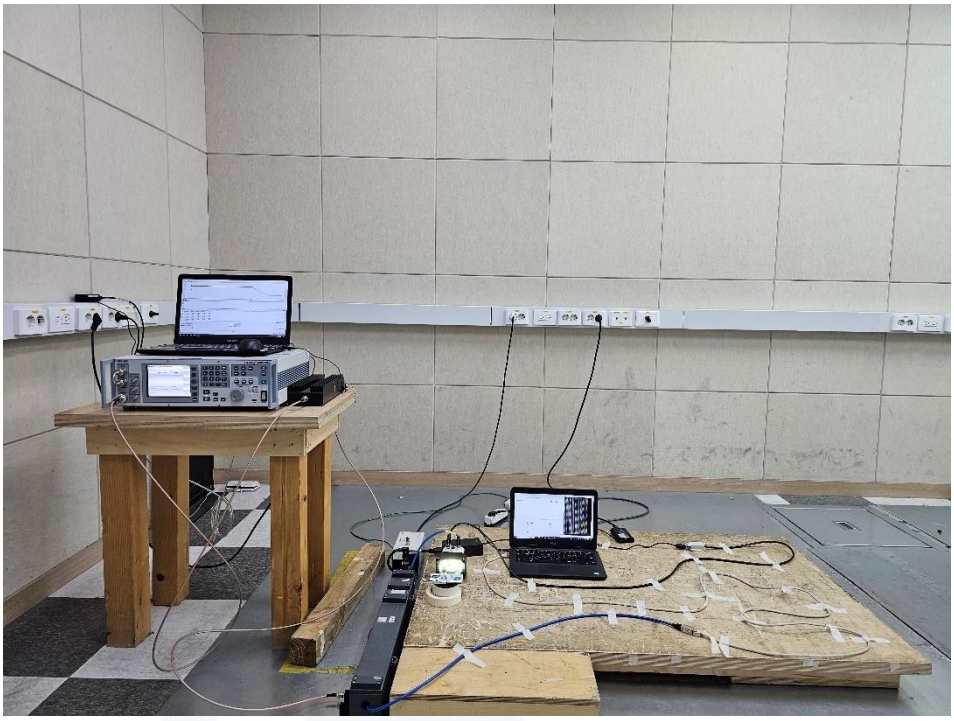


Electrical Fast Transients/Bursts

Surge Transients



Conducted Disturbance



Power Frequency Magnetic Field Immunity

N/A

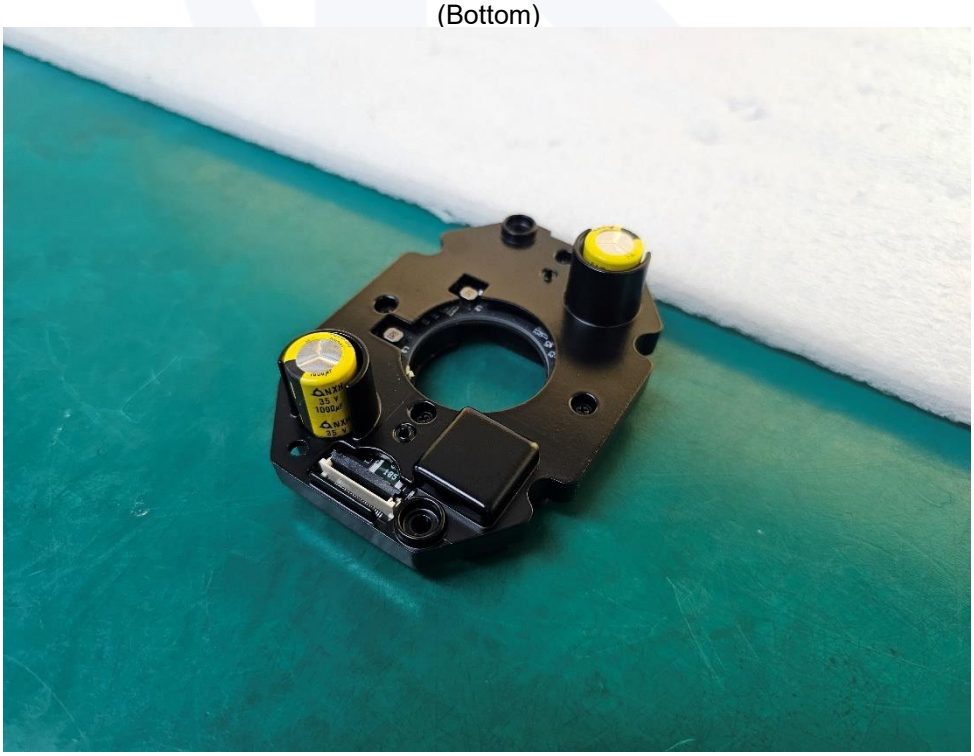
Voltage Dips and Short Interruptions

APPENDIX C – EUT Photographs

EUT External Photographs

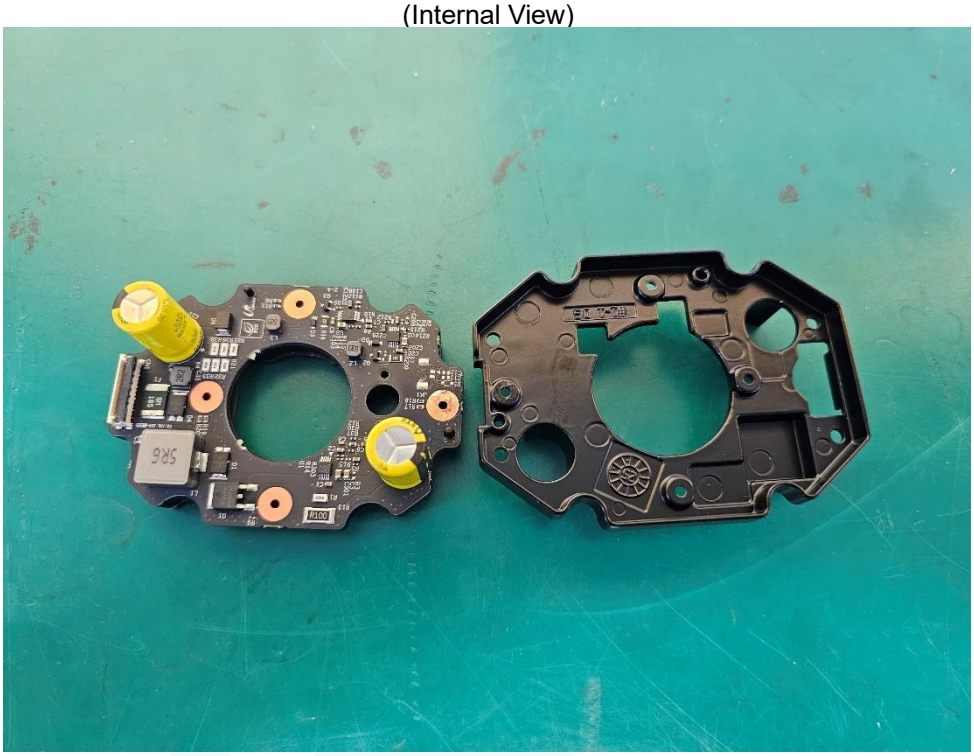
(Top)

(Bottom)



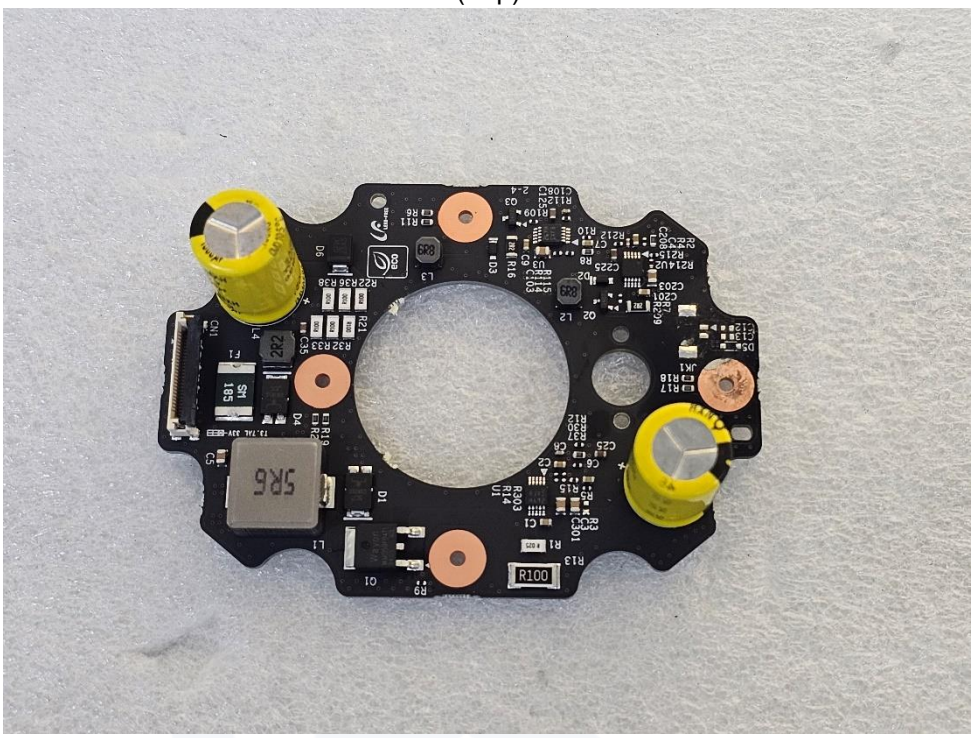
EUT Internal Photographs

(Internal View)

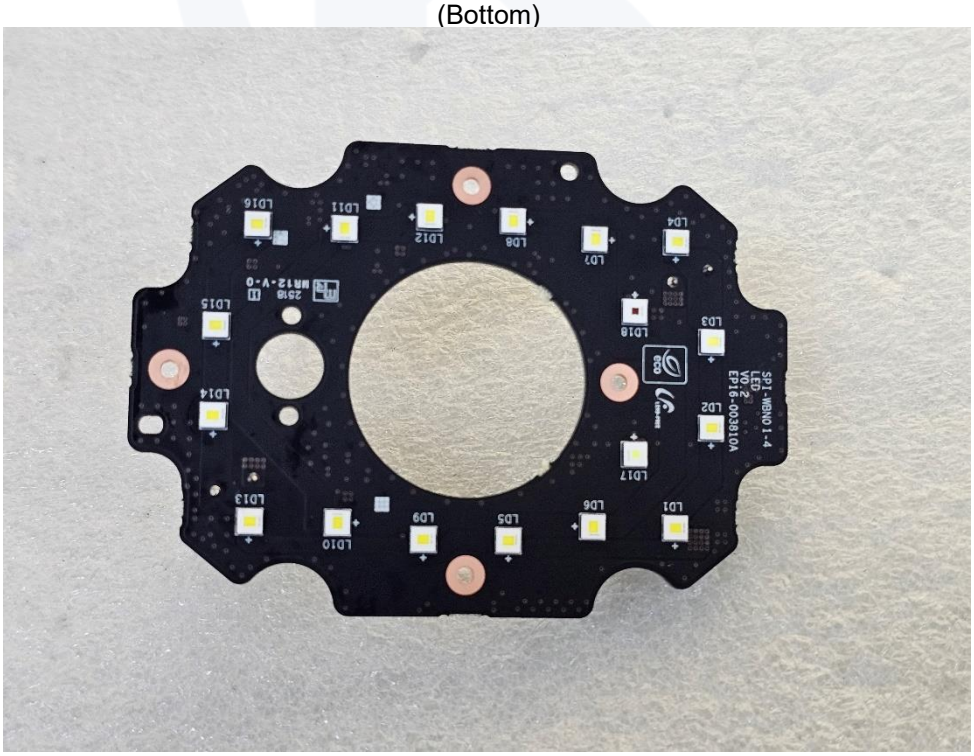


EUT Internal View – Board

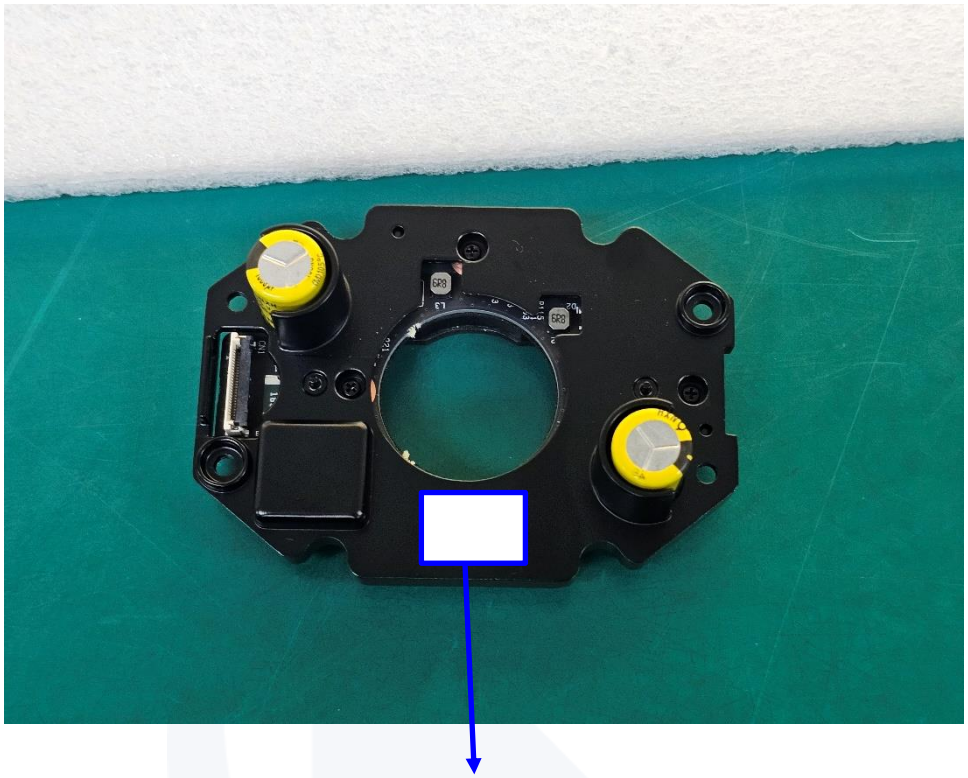
(Top)



(Bottom)



Label and Location



LED MODULE

Model No : SPI-BWN0

Manufacturer : HANWHA VISION VIETNAM COMPANY LIMITED

Made in VIETNAM

The End.