



TEST REPORT



Report No. : KES-EM240345

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KES Co., Ltd.

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1. Client

Applicant : Hanwha Vision Co., Ltd

Applicant Address : 6, Pangyo-ro 319beon-gil, Bundang-gu, Seongnam-si, Gyeonggi-do,
Republic of Korea

2. Sample Description

Product name : SIP MIC

Model/Type No. : SPA-M2000

Variant Model : -

Manufacturer : Inter-M Corporation

Manufacturer Address : 73, Hwahap-ro 1402beon-gil, Yangju-si, Gyeonggi-do, Republic of
Korea

3. Date of Receipt : Jan. 25, 2024

4. Test date : Feb. 03, 2024 ~ Feb. 04, 2024

5. Date of Issue : Mar. 20, 2024

6. Test Results : In Compliance

Tested by

Reviewed by

Seon Ho, Choi
EMC Test Engineer

Dong Hun, Jang
EMC Technical Manager

This test report is not related to KS Q ISO/IEC 17025 and KOLAS.



REPORT REVISION HISTORY

Date	Test Report No.	Revision History
Mar. 20, 2024	KES-EM240345	Issued

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1.0 General Product Description

Main Specifications of EUT are:

Product	
Type	SIP Microphone
Line Output	
Output Level	None
Frequency Response	None
THD + N Ratio (AES17 LPF)	None
S/N Ratio (20kHz LPF, A-WTD)	None
Line Input	
Maximum Input Level	-7dBV, Aux Input Volume Max
Amplifier	
Description	1W/ 8Ω, Monitor Amp
Network	
Ethernet	10/100 Base-T
Memory	
Internal Memory	None
External Memory (Micro SD)	None
Contact	
Contact Input. Dry contact	None
Contact Output. Dry contact (NO)	None
General	
Operating Temperature	-10 ~ +40°C (+14°F ~ +104°F)
Operating Humidity	10~95% RH (Non-Condensing)
IP code	None
Weight	1.3 Kg
Size	200(W) x 73(H) x 206(D)mm
Color	Black
Certificate	EMC : KS C 9832/9835, EN 55032/55035, FCC Part 15 Subpart B, ICES-003 Safety : UL 62368-1, CAN/CSA 62368-1
Power	
PoE	PoE (IEEE 802.3 af type 1 Class 3)
PoE+	Max.12W, DC24V
Embedded MIC	
Input Sensitivity	-50dBV ± 3dB (Mic Volume Max)
Frequency Response	100Hz ~ 6kHz
Audio	
Supported Audio Format	None
Speaker	
Speaker Component	None
Max. Sound Pressure Level (PoE)	None
Max. Sound Pressure Level (PoE+)	None
Frequency Range (-10dB)	None
Sensitivity (1Watt)	None
Coverage Pattern	None
Network Protocol	
Security	Password protection : admin,setup,user,guest (sha-2, Digest authentication, User access log) Digest authentication, User access log
Supported Protocols	IPv4, HTTP, SIP, mDNS, DNS, NTP, TCP, UDP, DHCP, ARP, ICMP
System Integration	
API (Application Programming Interface)	SUNAPI
Multi-source Dynamic PA control	None
VoIP	Tested with SIP clients such as Grandstream, Yealink, Cisco, MicroSIP softphone and PBX supplier such as Asterisk Tested with SIP client such as Grandstream and PBX supplier such as Grandstream Supported SIP features: DTMF (RFC2833) Supported codecs: PCMU, PCMA, speex/8000, speex/16000
TTS	None
Audio Monitoring	None
Event & Preset	None
Functional Monitoring	Connection verification, Built-in system logging



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 100 V, 60 Hz

☒ PoE

1.2 Variant Model Differences

Not applicable

1.3 Device Modifications

Not applicable

1.4 Equipment Under Test

Description	Model Number	Serial Number	Manufacturer	Remarks
SIP MIC	SPA-M2000	-	Inter-M Corporation	EUT
AC / DC Adapter	KPL-060M-VI	-	Channel Well Technology (Guangzhou) Co.,Ltd.	-

1.5 Support Equipments

Description	Model Number	Serial Number	Manufacturer	Remarks
Speaker	-	-	-	-
Notebook	LG15U590	-	LG Electronics Co., Ltd.	-
Notebook Adapter	A13-040N3A	-	CHICONY POWER TECHNOLOGY (Chongqing) CO., LTD.	-
PoE Switch	GS728TPP	3AR3595700005	NETGEAR®	-
Smart Phone	SM-G991N	-	SAMSUNG	-
switching hub	H508	-	IpTIME	-
switching hub Adapter	DWA05200K	-	Dongguan City Rongrun Industry Co.,Ltd	-



1.6 External I/O Cabling

■ DC 24 V Mode

Start		END		Cable Spec.	
Description	I/O Port	Description	I/O Port	Length	Shield
SIP MIC (EUT)	DC Jack	AC / DC Adapter (EUT)	Line out	1.5	U
	AUX IN	Notebook	3.5 mm	1.0	U
	-	Smart Phone	-	-	-
	RJ-45(LAN)	switching hub	RJ-45(LAN)	3.5	U
Poe Switch	RJ-45(LAN)	switching hub	RJ-45(LAN)	1.5	U
	RJ-45(PoE)	Speaker	RJ-45(PoE)	1.6	U
	RJ-45(LAN)	Notebook	RJ-45(LAN)	1.2	U
Notebook	DC Jack	Notebook Adapter	DC Jack	1.4	U
switching hub	DC Jack	switching hub Adapter	DC Jack	1.2	U

* Unshielded=U, Shielded=S

■ PoE Mode

Start		END		Cable Spec.	
Description	I/O Port	Description	I/O Port	Length	Shield
SIP MIC (EUT)	AUX IN	Notebook	3.5 mm	1.0	U
	-	Smart Phone	-	-	-
	RJ-45(PoE)	PoE Switch	RJ-45(PoE)	3.5	U
Poe Switch	RJ-45(PoE)	Speaker	RJ-45(PoE)	1.6	U
	RJ-45(LAN)	Notebook	RJ-45(LAN)	1.2	U
Notebook	DC Jack	Notebook Adapter	DC Jack	1.4	U

* Unshielded=U, Shielded=S



1.7 EUT Operating Mode(s)

■ DC 24 V Mode, PoE Mode

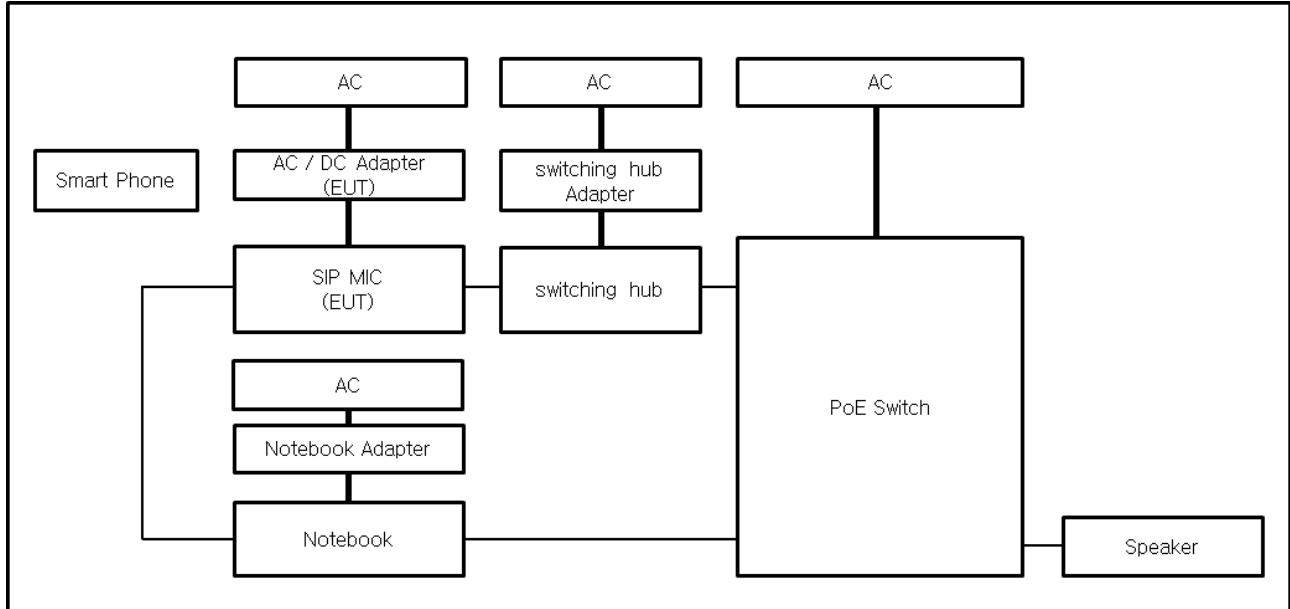
Test mode	operating
Operating	The test was performed by running Pingtest on a laptop to check whether the test equipment was connected properly and whether 1 kHz tone was output to the speaker through the test equipment.

EUT Test operating S/W		
Name	Version	Manufacture Company
-	-	-

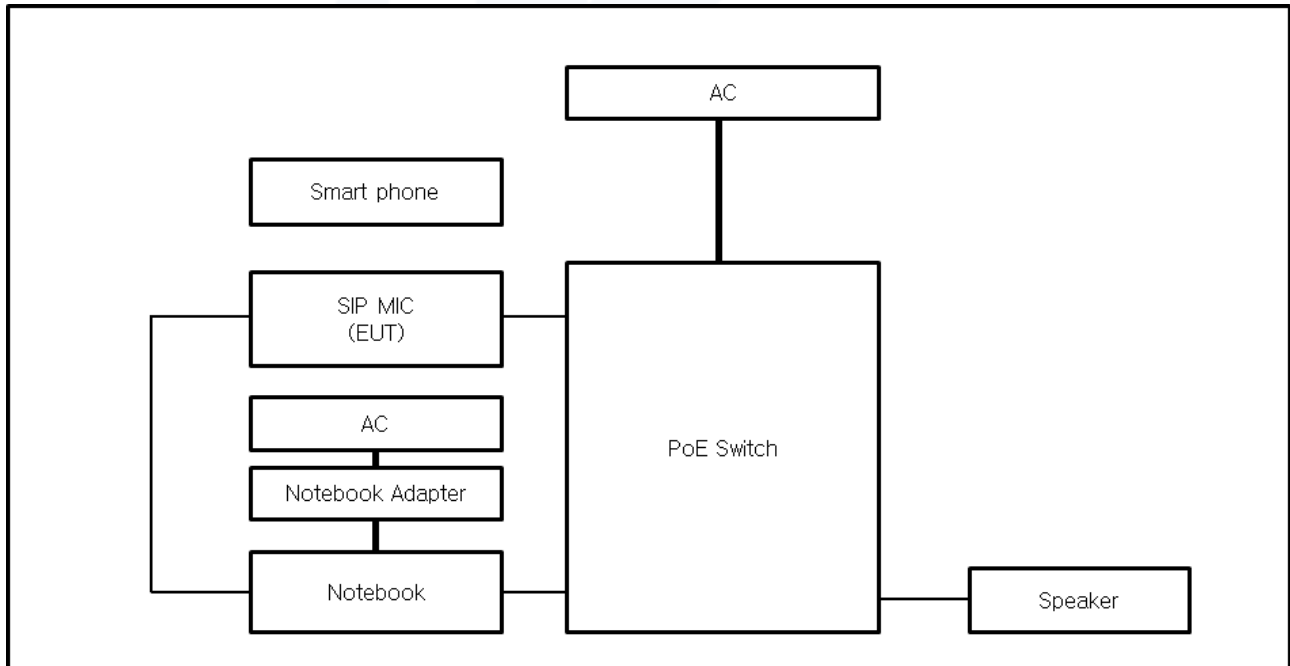


1.8 Configuration

■ DC 24 V Mode



■ PoE Mode



**1.9 Remarks when standards applied**

In PoE mode, the LAN port is regarded as a wired communication network port and power-related ports are not tested.

1.10 Calibration Details of Equipment Used for Measurement

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

1.11 Test Facility

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

1.12 Laboratory Accreditations and Listings

Country	Agency	Scope of Accreditation	Logo
KOREA	RRA	EMI (3 m & 10 m Semi-Anechoic Chamber and conducted test site) EMS (ESD, RS, EFT/Burst, Surge, CS, Magnetic, Dips and interruptions)	 KR0100
International	KOLAS	EMI (3 m & 10 m Semi-Anechoic Chamber and conducted test site) EMS (ESD, RS, EFT/Burst, Surge, CS, Magnetic, Dips and interruptions)	 KT489
USA	FCC	3 m & 10 m Semi-Anechoic Chamber Conducted test site to perform FCC Part 15/18 measurements.	 KR0100
Canada	ISED	3 m & 10 m Semi-Anechoic Chamber and Conducted test site	 23298
JAPAN	VCCI	EMI (3 m & 10 m Semi-Anechoic Chamber and conducted test site)	 C-20136, T-20137, R-20181, G-20176
Europe	TÜV SÜD	EMI (3 m & 10 m Semi-Anechoic Chamber and conducted test site) EMS (ESD, RS, EFT/Burst, Surge, CS, Magnetic, Dips and interruptions)	 CARAT 001633 0004



2.0 Test Regulations

The emissions tests were performed according to following regulations:

☒ VCCI-CISPR 32:2016

☒ Class A

☐ Class B





2.1 Conducted Emissions Mains Power Ports

Test Date

Feb. 03, 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, 08, 2024
☒	LISN	ENV216	R & S	101787	11, 08, 2024
☒	LISN	ESH2-Z5	R & S	100450	11, 08, 2024
☒	PULSE LIMITER	ESH3-Z2	R & S	101915	11, 08, 2024

Test Conditions

Temperature: (21,8 ± 0,2) °C

Relative Humidity: (45,9 ± 0,2) % R.H.

Frequency Range of Measurement

150 kHz to 30 MHz

Instrument Settings

IF Band Width: 9 kHz

Test Results

The requirements are:

- ☒ PASS
☐ NOT PASS
☐ NOT APPLICABLE

RemarksSee Appendix A for test data.



2.2 Conducted Emissions at Telecommunication Ports

Test Date

Feb. 03, 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, 08, 2024
☒	LISN	ENV216	R & S	101787	11, 08, 2024
☒	LISN	ESH2-Z5	R & S	100450	11, 08, 2024
☒	PULSE LIMITER	ESH3-Z2	R & S	101915	11, 08, 2024
☐	8-WIRE ISN CAT3,5	ENY81	R & S	100174	11, 09, 2024
☒	8-WIRE ISN CAT6	ENY81-CAT6	R & S	101665	11, 09, 2024

Test Conditions

Temperature: (21,8 ± 0,2) °C

Relative Humidity: (45,9 ± 0,2) % R.H.

Frequency Range of Measurement

150 kHz to 30 MHz

Instrument Settings

IF Band Width: 9 kHz

Test Results

The requirements are:

- ☒ PASS
☐ NOT PASS
☐ NOT APPLICABLE

RemarksSee Appendix A for test data.



2.3 Radiated Electric Field Emissions(Below 1 GHz)

Test Date

Feb. 04, 2024

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	03, 21, 2024
☒	AMPLIFIER	SCU 01	R & S	100603	11, 08, 2024
☒	TRILOG-BROADBAND ANTENNA	VULB9163	Schwarzbeck	715	11, 17, 2024
☒	ATTENUATOR	8491A	HP	32173	03, 03, 2024

Test Conditions

Temperature: (22,4 ± 0,3) °C

Relative Humidity: (46,2 ± 0,5) % R.H.

Frequency Range of Measurement

30 MHz to 1 GHz

Instrument Settings

IF Band Width: 120 kHz

Test Results

The requirements are:

- ☒ PASS
☐ NOT PASS
☐ NOT APPLICABLE

RemarksSee Appendix A for test data.



2.4 Radiated Electric Field Emissions(Above 1 GHz)

Test Date

Feb. 05, 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, 31, 2024
☒	PREAMPLIFIER	8449B	AGILENT	3008A01967	03, 06, 2024
☒	ATTENUATOR	8491A	HP	35496	03, 03, 2024
☒	DOUBLE RIDGED HORN ANTENNA	SAS-571	A.H.SYSTEM,INC	781	03, 06, 2024

Test Conditions

Temperature: (22,2 ± 0,2) °C

Relative Humidity: (45,7 ± 0,4) % R.H.

Frequency Range of Measurement

1 GHz to 6 GHz

Instrument Settings

IF Band Width: 1 MHz

Test Results

The requirements are:

- ☒ PASS
☐ NOT PASS
☐ NOT APPLICABLE

RemarksSee Appendix A for test data.



APPENDIX A – TEST DATA

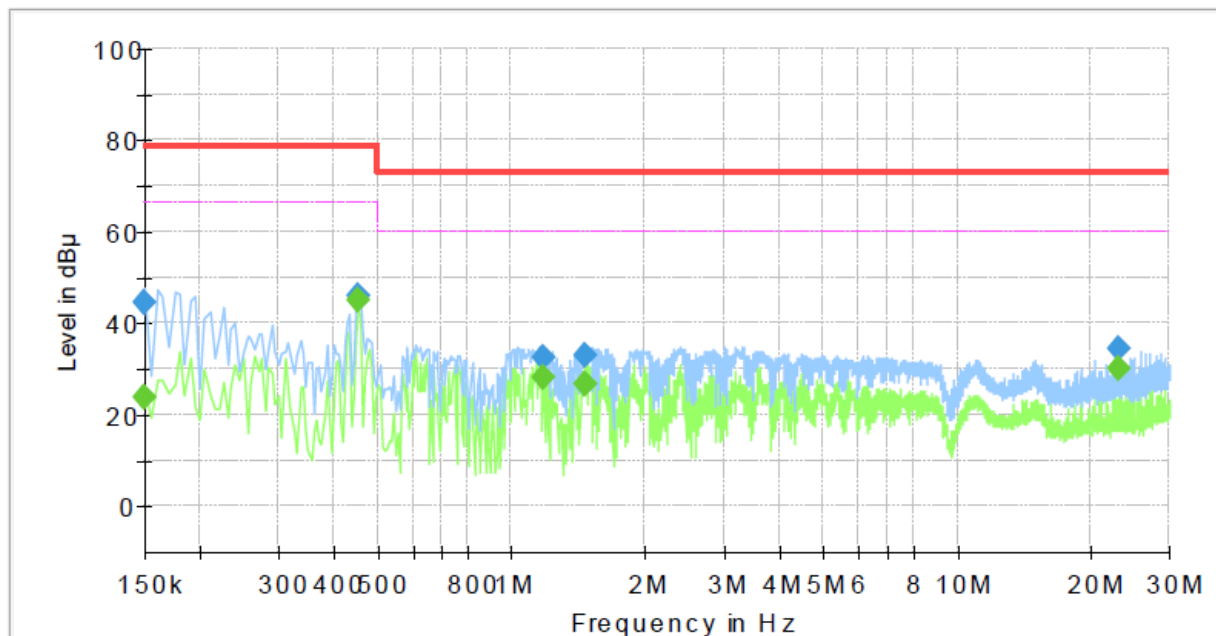
Conducted Emissions at Mains Power Ports

■ DC 24 V Mode

HOT LINE

Common Information

Test Description: Conducted Emission
Model No.: SPA-M2000
Phase: DC 24 V
Mode: H
Operator Name: KES



Final Result

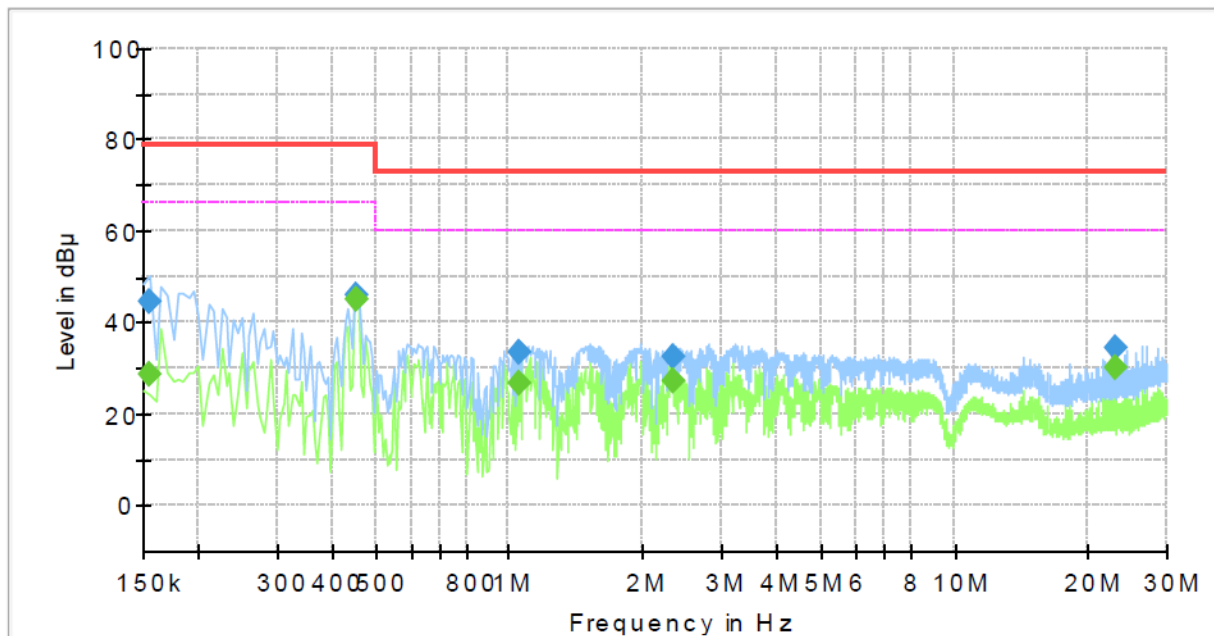
Frequency (MHz)	QuasiPeak (dBμV)	CAverage (dBμV)	Limit (dBμV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.150000	---	23.96	66.00	42.04	1000.0	9.000	L1	19.4
0.150000	44.28	---	79.00	34.72	1000.0	9.000	L1	19.4
0.455000	---	44.89	66.00	21.11	1000.0	9.000	L1	19.5
0.455000	45.93	---	79.00	33.07	1000.0	9.000	L1	19.5
1.175000	---	28.29	60.00	31.71	1000.0	9.000	L1	19.5
1.175000	32.42	---	73.00	40.58	1000.0	9.000	L1	19.5
1.470000	---	26.70	60.00	33.30	1000.0	9.000	L1	19.5
1.470000	32.88	---	73.00	40.12	1000.0	9.000	L1	19.5
23.130000	---	30.13	60.00	29.87	1000.0	9.000	L1	20.3
23.130000	34.17	---	73.00	38.83	1000.0	9.000	L1	20.3



NEUTRAL LINE

Common Information

Test Description: Conducted Emission
Model No.: SPA-M2000
Phase: DC 24 V
Mode: N
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	---	28.55	66.00	37.45	1000.0	9.000	N	19.3
0.155000	44.35	---	79.00	34.65	1000.0	9.000	N	19.3
0.455000	---	45.07	66.00	20.93	1000.0	9.000	N	19.4
0.455000	46.12	---	79.00	32.88	1000.0	9.000	N	19.4
1.050000	---	26.82	60.00	33.18	1000.0	9.000	N	19.5
1.050000	33.18	---	73.00	39.82	1000.0	9.000	N	19.5
2.345000	---	27.15	60.00	32.85	1000.0	9.000	N	19.6
2.345000	32.57	---	73.00	40.43	1000.0	9.000	N	19.6
23.130000	---	30.04	60.00	29.96	1000.0	9.000	N	20.3
23.130000	34.23	---	73.00	38.77	1000.0	9.000	N	20.3

◆ 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))

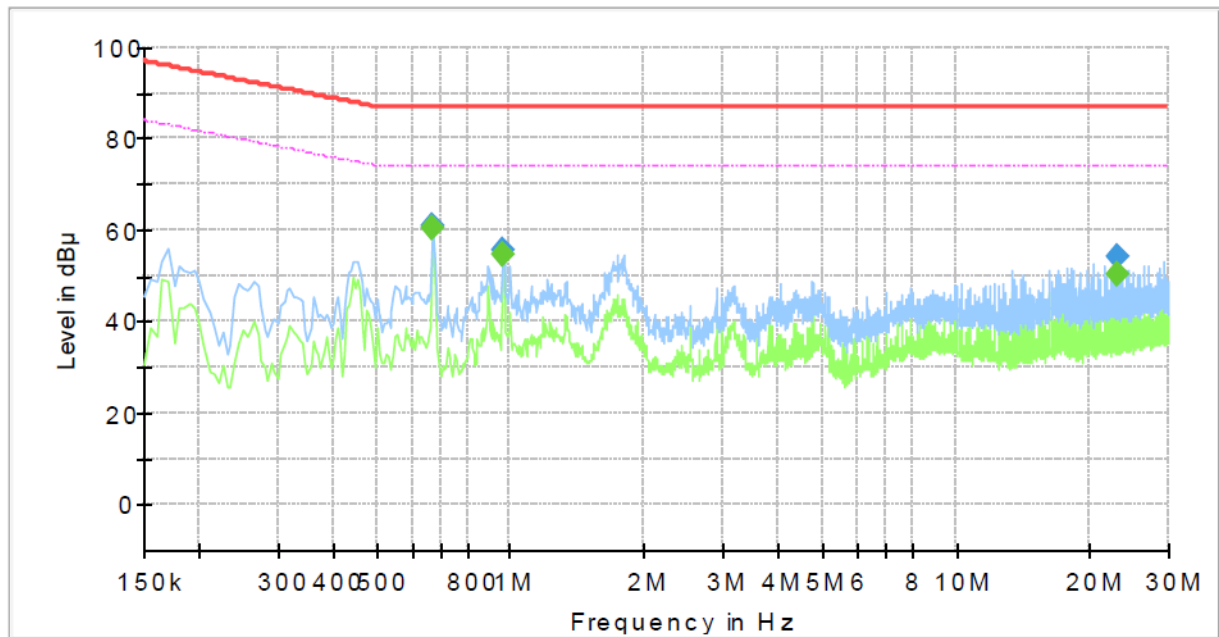
**Conducted Emissions at Telecommunication Ports**

■ DC 24 V Mode

[1 000 Mbps]

Common Information

Test Description: Telecommunication Emission
Model No.: SPA-M2000
Mode : DC 24 V
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)
0.670000	---	60.38	74.00	13.62	1000.0	9.000	Single Line	19.3
0.670000	60.80	---	87.00	26.20	1000.0	9.000	Single Line	19.3
0.965000	---	54.69	74.00	19.31	1000.0	9.000	Single Line	19.3
0.965000	55.56	---	87.00	31.44	1000.0	9.000	Single Line	19.3
23.130000	---	50.46	74.00	23.54	1000.0	9.000	Single Line	19.9
23.130000	53.93	---	87.00	33.07	1000.0	9.000	Single Line	19.9

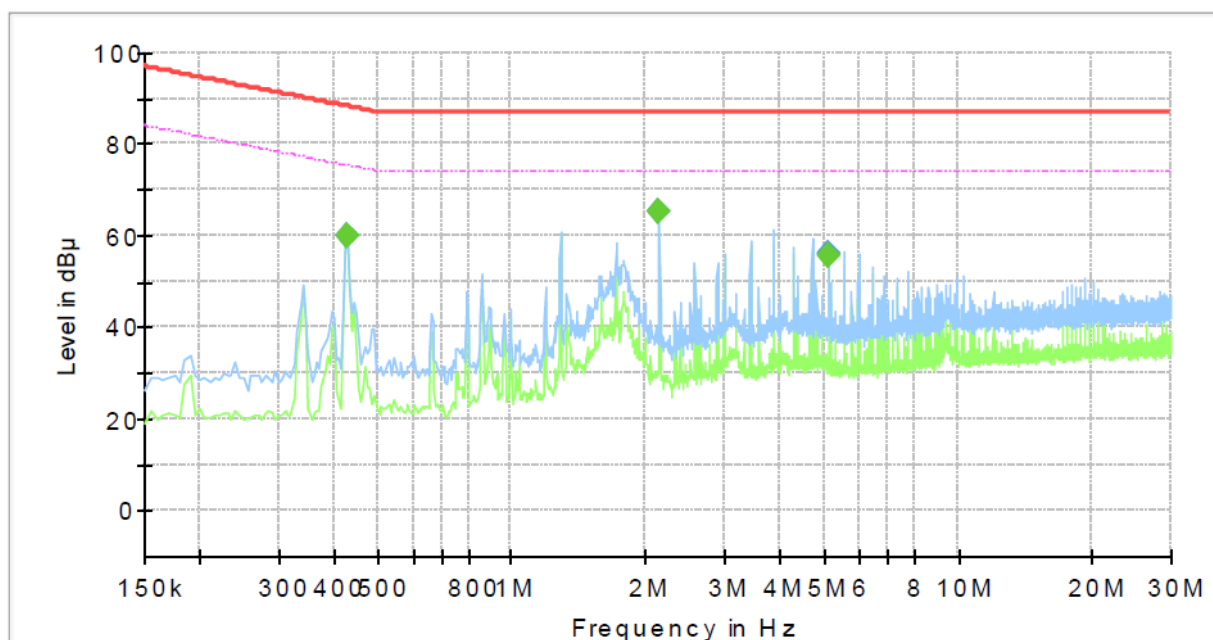


■ PoE Mode

[1 000 Mbps]

Common Information

Test Description: Telecommunication Emission
Model No.: SPA-M2000
Mode : PoE
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)
0.430000	---	60.00	75.25	15.25	1000.0	9.000	Single Line	19.4
0.430000	60.01	---	88.25	28.24	1000.0	9.000	Single Line	19.4
2.140000	---	65.48	74.00	8.52	1000.0	9.000	Single Line	19.3
2.140000	65.50	---	87.00	21.50	1000.0	9.000	Single Line	19.3
5.140000	---	55.42	74.00	18.58	1000.0	9.000	Single Line	19.4
5.140000	55.88	---	87.00	31.12	1000.0	9.000	Single Line	19.4

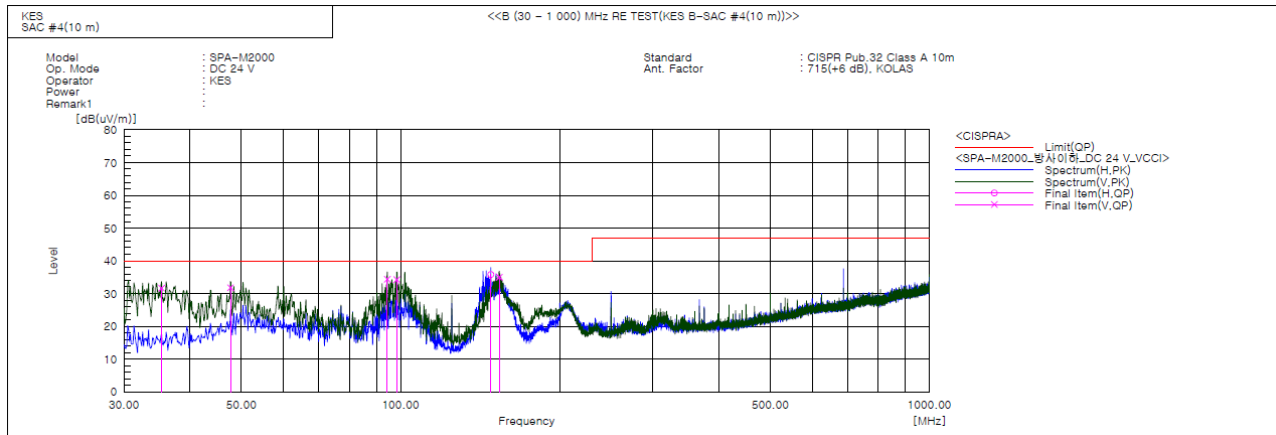
◆ Calculation

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

QuasiPeak / CAverage : The Final Value

Reading Value : Not shown in the table.

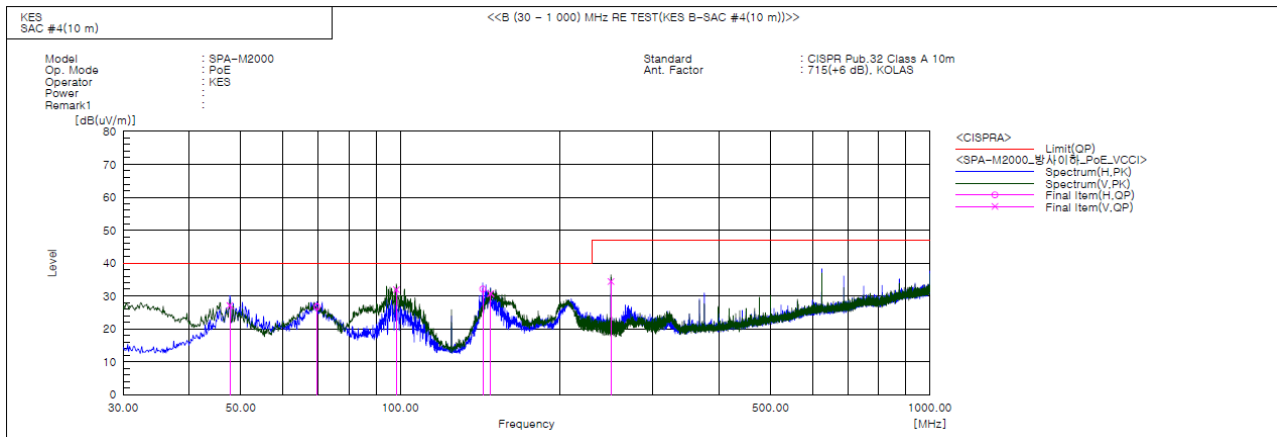
Corr. : Correction values (ISN FACTOR + (Cable Loss + Pulse Limiter FACTOR))

**Radiated Electric Field Emissions(Below 1 GHz)****■ DC 24 V 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	35.335	V	56.4	-24.7	31.7	40.0	8.3	100.0	111.0	
2	47.703	V	53.0	-21.2	31.8	40.0	8.2	107.0	296.0	
3	94.384	V	57.3	-22.9	34.4	40.0	5.6	100.0	303.0	
4	98.385	V	56.7	-22.4	34.3	40.0	5.7	106.0	176.0	
5	148.098	H	61.0	-25.2	35.8	40.0	4.2	400.0	185.0	
6	153.675	V	60.1	-25.1	35.0	40.0	5.0	100.0	198.0	



■ PoE Mode



Final Result

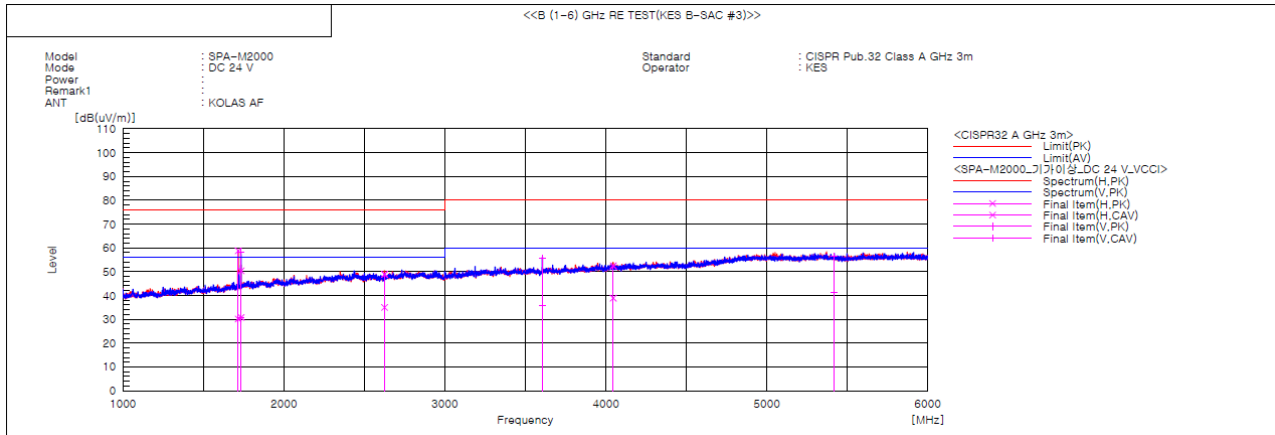
No.	Frequency [MHz]	(P)	Reading QP [dB(uV)]	c.f [dB(1/m)]	Result QP [dB(uV/m)]	Limit QP [dB(uV/m)]	Margin QP [dB]	Height [cm]	Angle [deg]	Remark
1	47.703	V	48.3	-21.2	27.1	40.0	12.9	109.0	253.0	
2	69.649	H	51.6	-24.9	26.7	40.0	13.3	395.0	12.0	
3	98.385	V	54.3	-22.4	31.9	40.0	8.1	106.0	145.0	
4	143.248	H	57.3	-25.2	32.1	40.0	7.9	400.0	149.0	
5	148.098	V	55.9	-25.2	30.7	40.0	9.3	100.0	157.0	
6	249.948	V	53.2	-18.8	34.4	47.0	12.6	100.0	266.0	

◆ Calculation

Corrected Amplitude [dBuV] = Amplitude[dBuV] + Correction Factor [dB]

Corrected Amplitude : The Final Value, Amplitude : Reading Value,

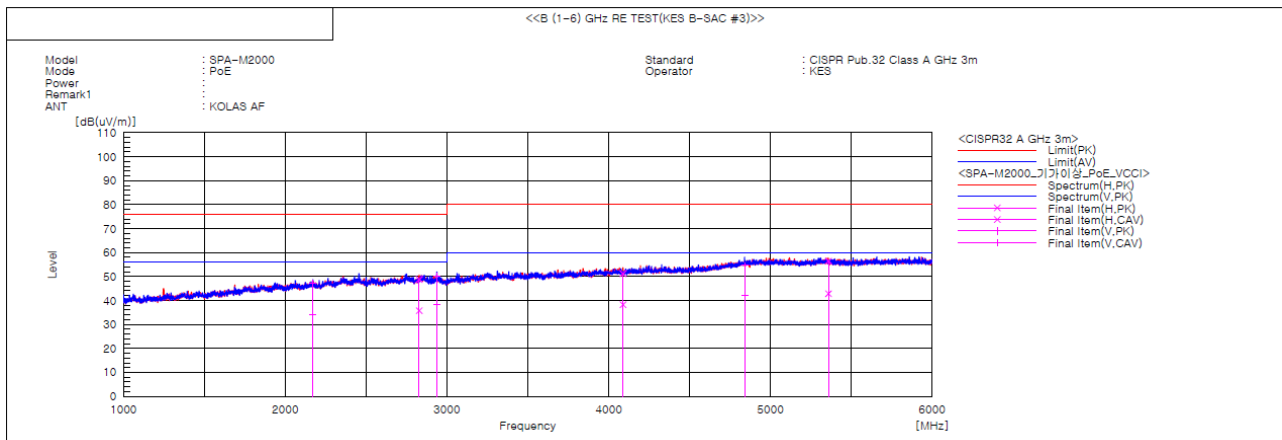
Correction Factor : ANT FACTOR + Cable loss

**Radiated Electric Field Emissions(Above 1 GHz)****DC 24 V 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	1716.158	H	56.9	28.3	1.9	58.8	30.2	76.0	56.0	17.2	25.8	100.0	222.0	
2	1733.339	V	56.2	28.6	2.1	58.3	30.7	76.0	56.0	17.7	25.3	100.0	351.2	
3	1734.690	H	48.3	28.7	2.1	50.4	30.8	76.0	56.0	25.6	25.2	100.0	225.6	
4	2625.135	H	42.3	28.4	6.6	48.9	35.0	76.0	56.0	27.1	21.0	100.0	186.4	
5	3606.259	V	45.6	25.9	10.0	55.6	35.9	80.0	60.0	24.4	24.1	100.0	23.4	
6	4045.448	H	41.5	27.9	11.0	52.5	38.9	80.0	60.0	27.5	21.1	100.0	254.6	
7	5419.110	V	40.8	25.6	15.8	56.6	41.4	80.0	60.0	23.4	18.6	100.0	326.4	



■ PoE 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	2171.058	V	42.3	29.1	5.0	47.3	34.1	76.0	56.0	28.7	21.9	100.0	61.5	
2	2829.225	H	41.0	28.0	7.8	48.8	35.8	76.0	56.0	27.2	20.2	100.0	240.5	
3	2938.950	V	42.5	30.6	7.5	50.0	38.1	76.0	56.0	26.0	17.9	100.0	190.7	
4	4088.305	H	40.1	27.2	11.1	51.2	38.3	80.0	60.0	28.8	21.7	100.0	311.0	
5	4840.450	V	40.0	27.5	14.6	54.6	42.1	80.0	60.0	25.4	17.9	100.0	65.2	
6	5358.558	H	40.8	27.2	15.7	56.5	42.9	80.0	60.0	23.5	17.1	100.0	5.9	

◆ Calculation

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

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

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

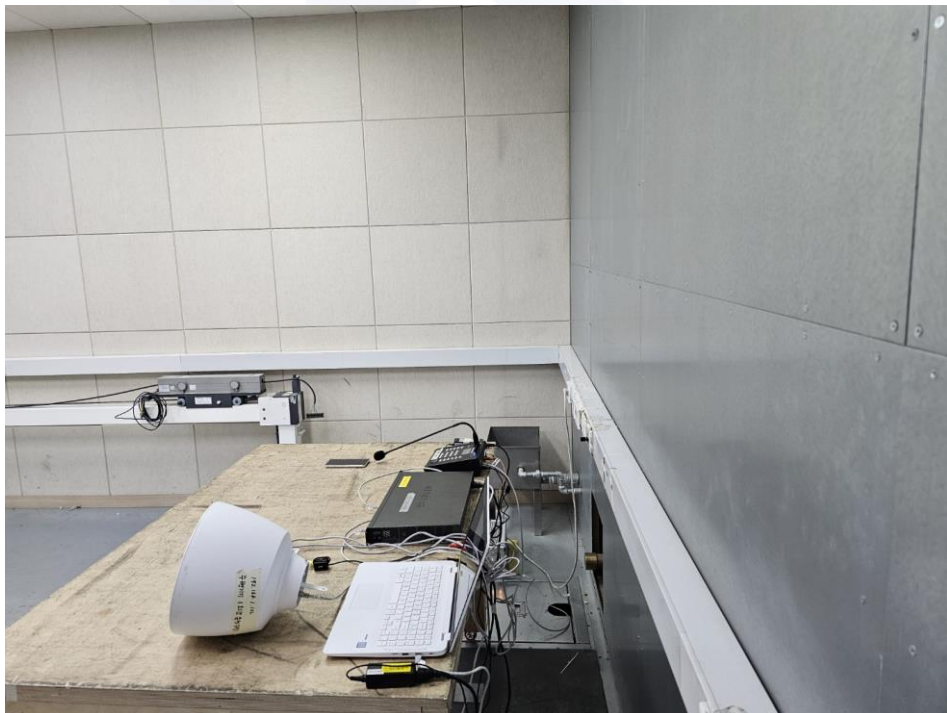
Limit(QP) : Limit value, c.f : (ANT Factor + Cable Loss - Preamp Factor), Margin: Margin value



Test Setup Photos and Configuration

Conducted Emissions at Mains Power Ports

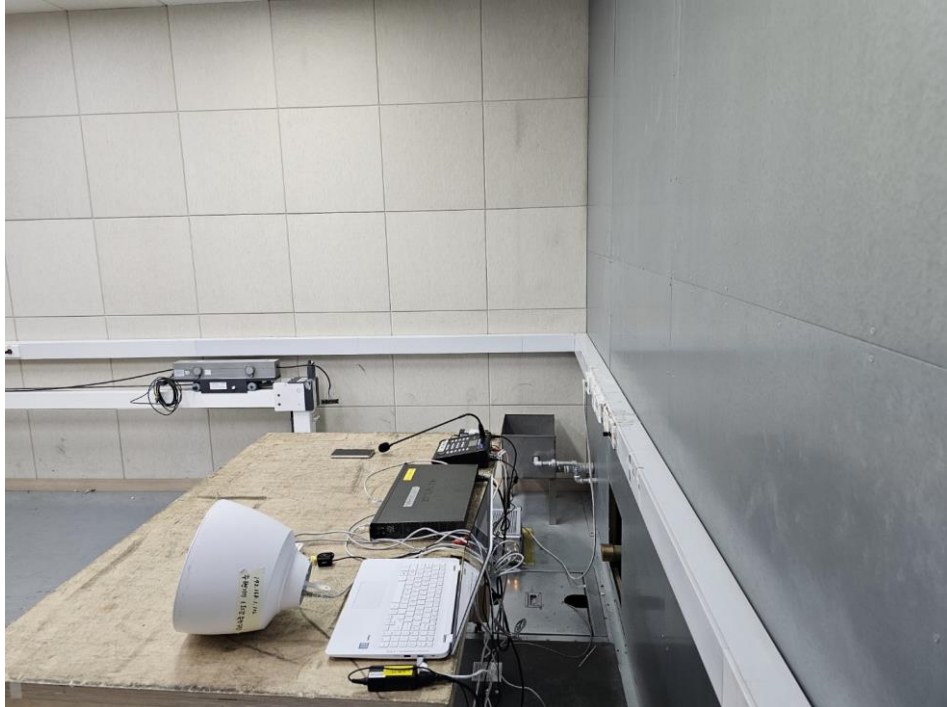
■ DC 24 V Mode





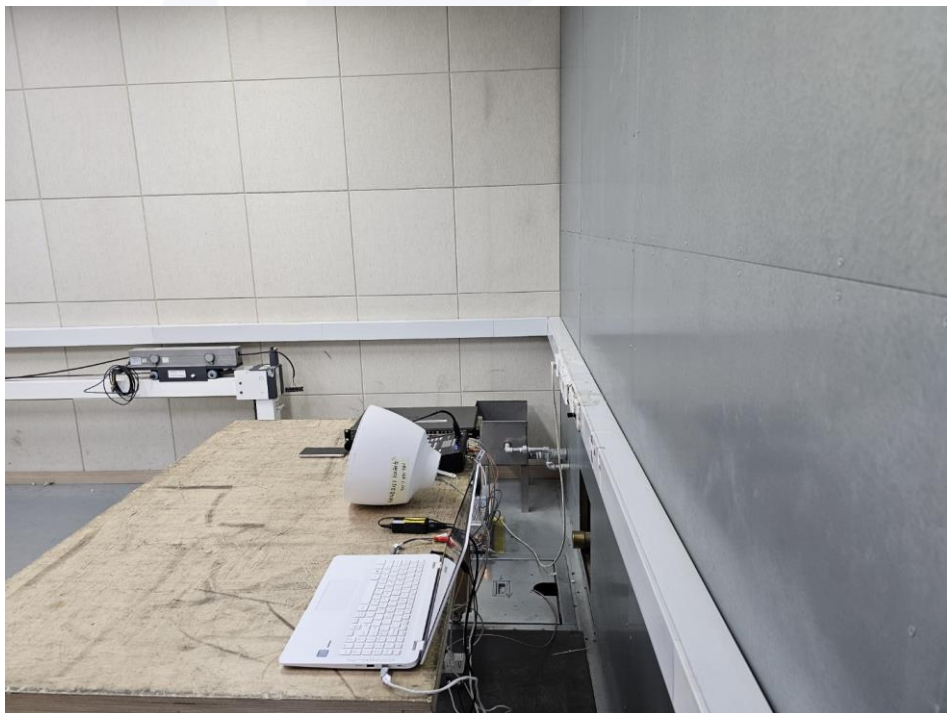
Conducted Emissions at Telecommunication Ports

■ DC 24 V Mode





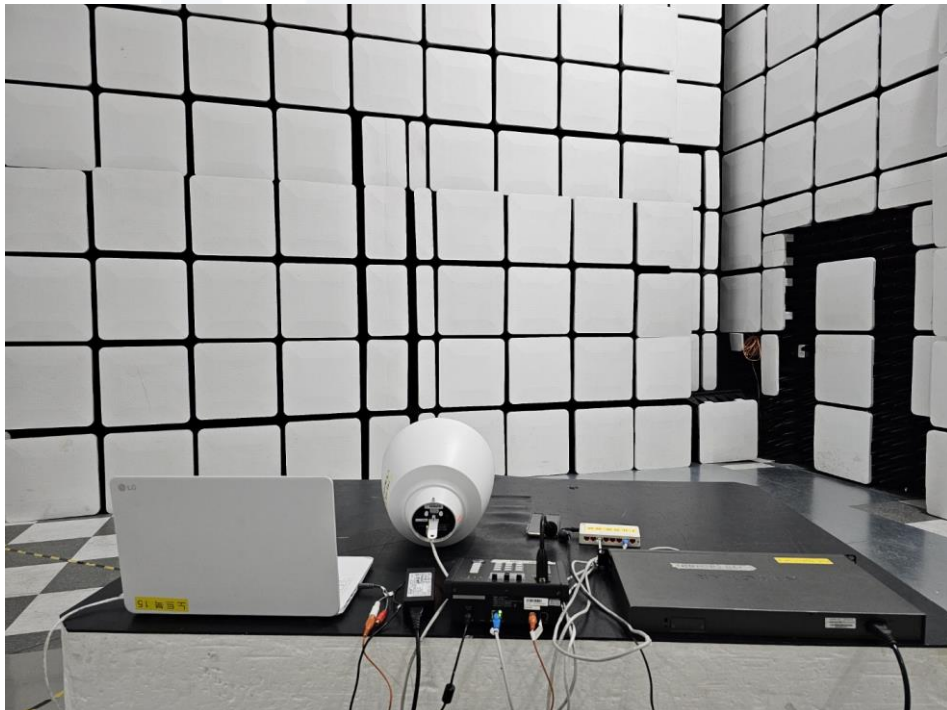
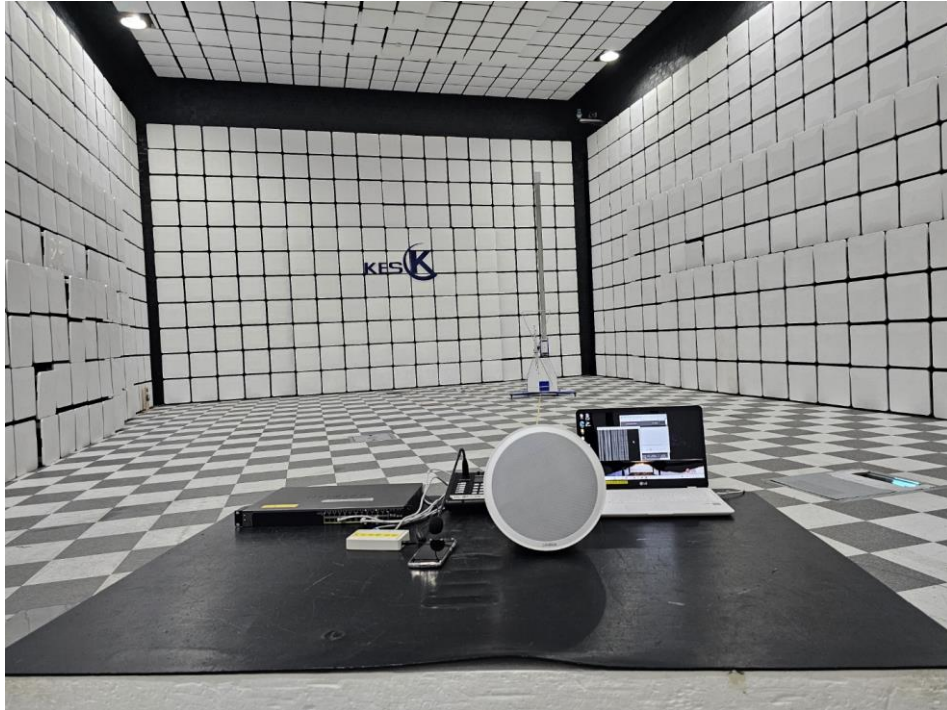
■ PoE Mode





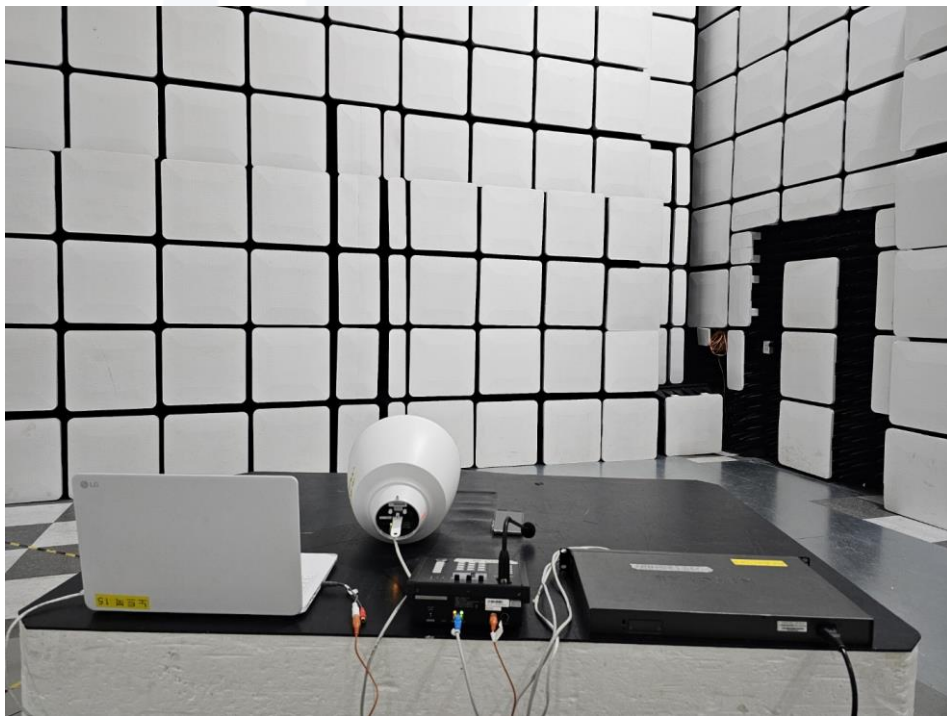
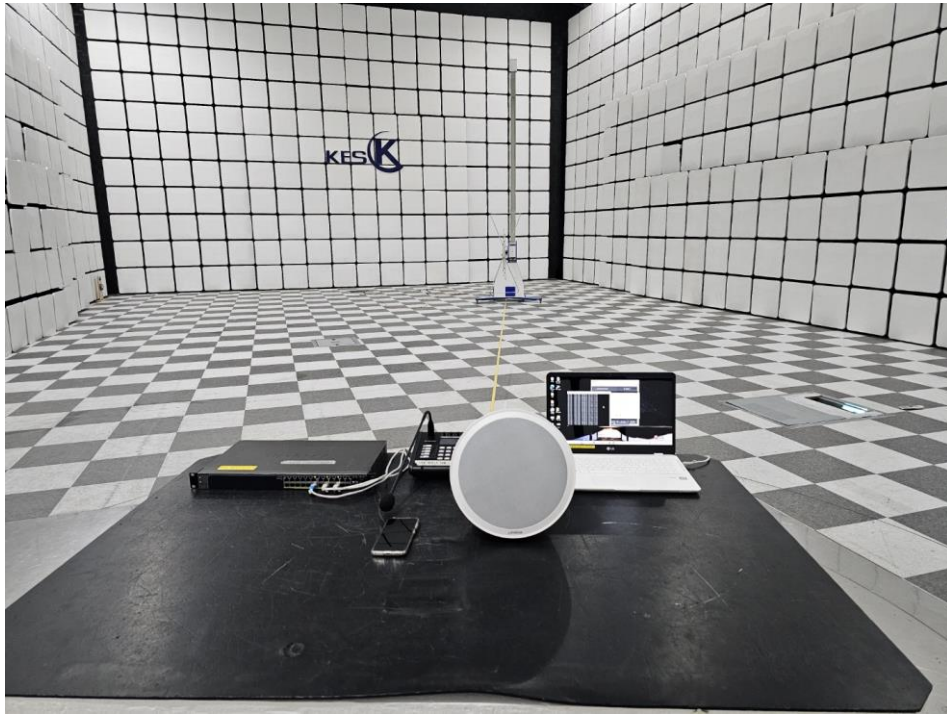
Radiated Electric Field Emissions(Below 1 GHz)

■ DC 24 V Mode





■ PoE Mode





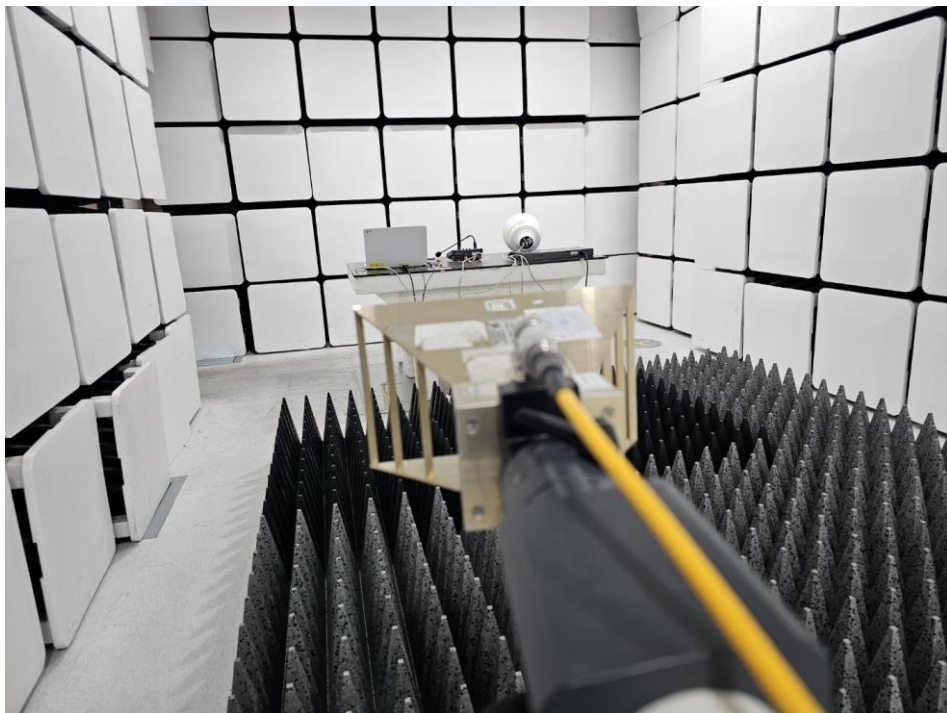
Radiated Electric Field Emissions(Above 1 GHz)

■ DC 24 V Mode





■ PoE Mode





EUT External Photographs

(Top)



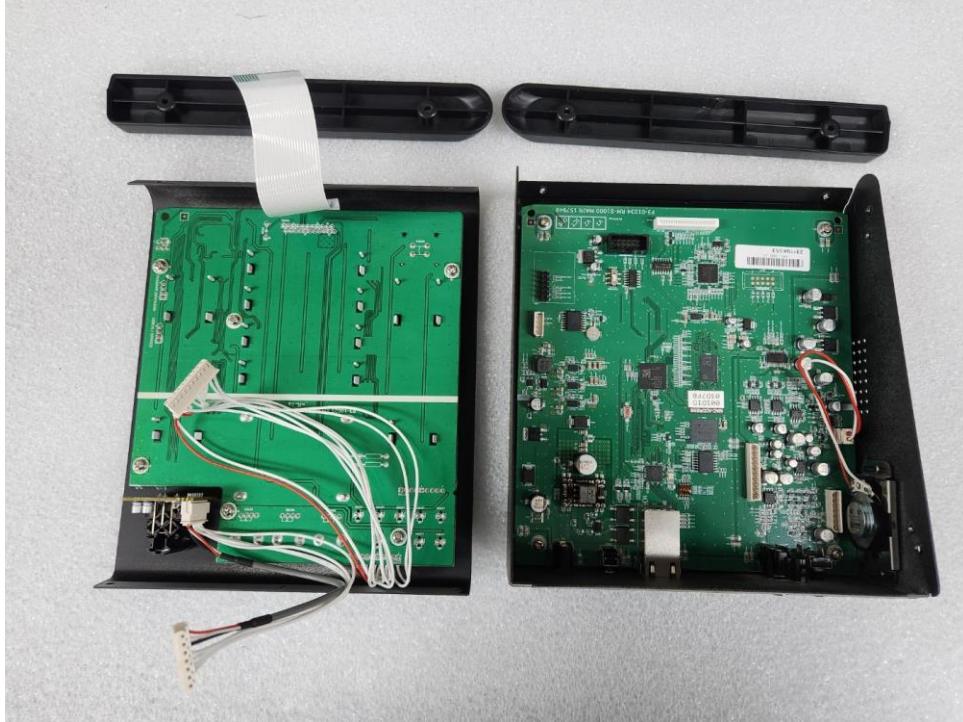
(Bottom)





EUT Internal Photographs

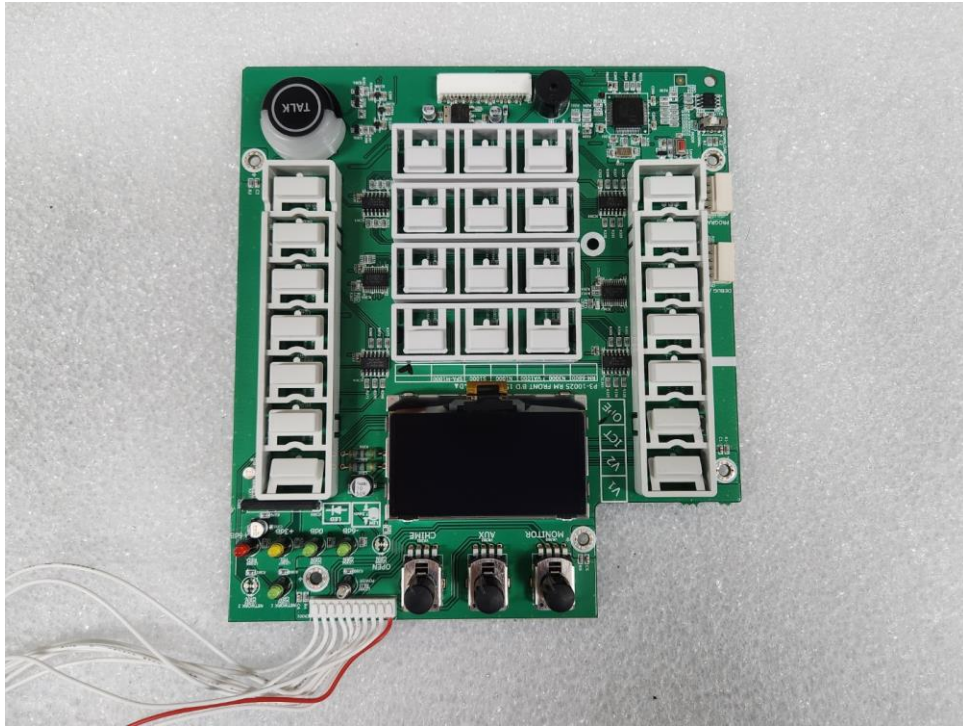
(Internal View)



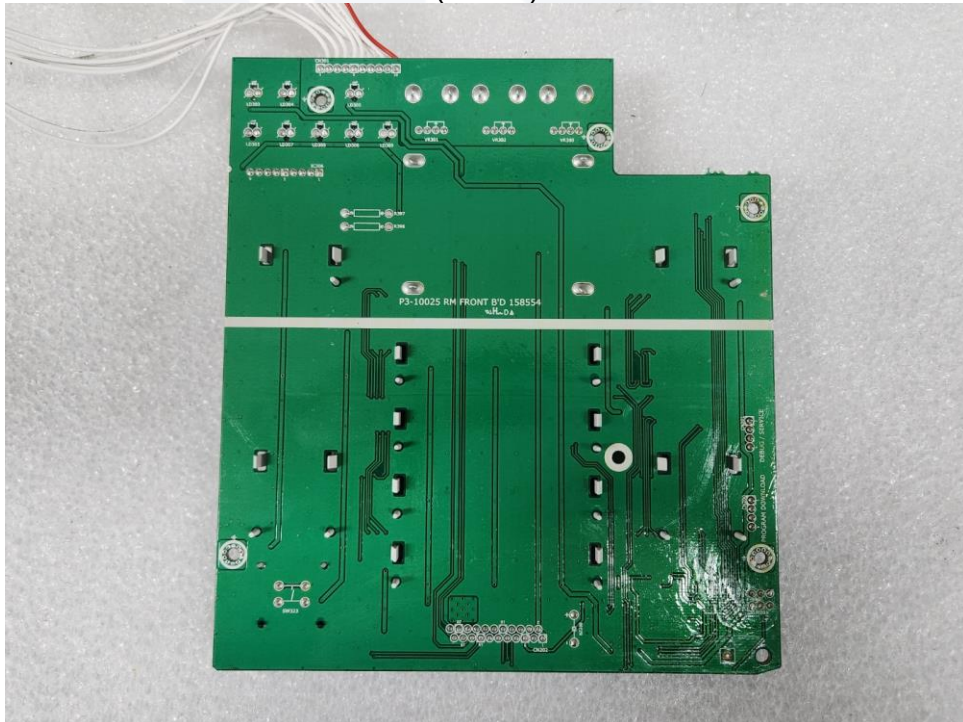


EUT Internal View – Board 2

(Top)



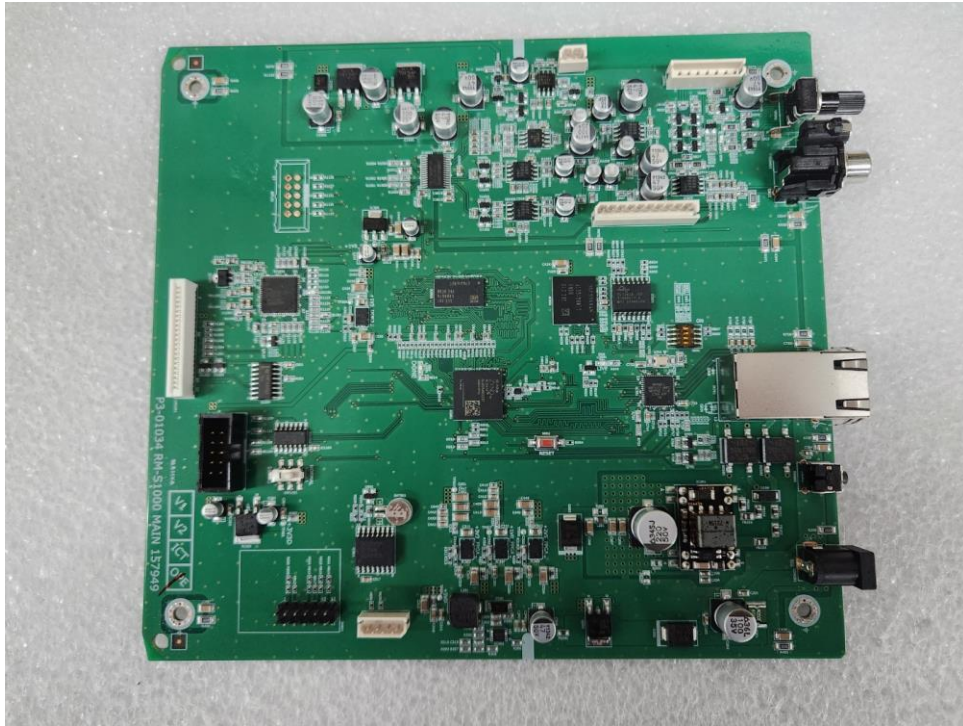
(Bottom)



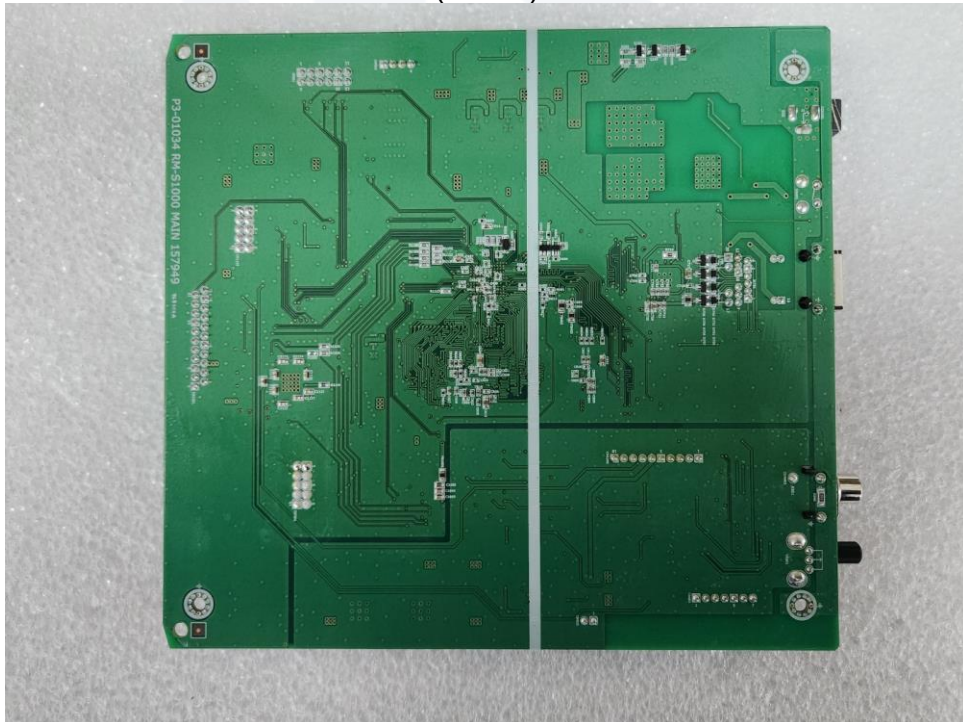


EUT Internal View – Board 3

(Top)

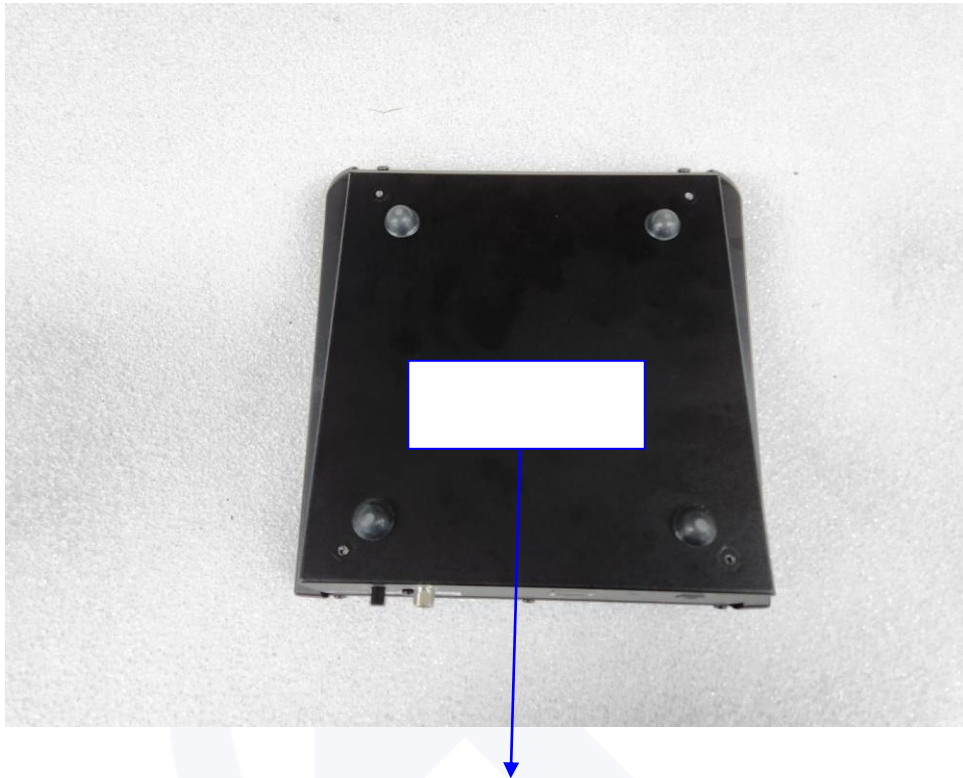


(Bottom)





Label Photographs



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