



EMC TEST REPORT

Test Report No. : KES-EM-23T0023-R2
Date of Issue : Feb. 24, 2023
Product name : CEILING SPEAKER
Model/Type No. : SPA-C100W
Variant Model : SPA-C100B
Applicant : Hanwha Vision Co., Ltd
Applicant Address : 6, Pangyo-ro 319Beon-gil, Bundang-gu, Seongnam-si,
Gyeonggi-do, Republic of Korea
Manufacturer : Inter-M Corporation
Manufacturer Address : 7-18, Gwonyul-ro 1253beon-gil, Baekseok-eup, Yangju-si,
Gyeonggi-do
Date of Receipt : Dec. 26, 2022
Test date : Jan. 02, 2023 ~ Jan. 04, 2023
Test Results : ☒ **In Compliance** ☐ **Not in Compliance**

Tested by

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EMC Test Engineer

Reviewed by

Dong-Hun, Jang
EMC Technical Manager

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

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Report No.:

KES-EM-23T0023-R2

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REPORT REVISION HISTORY

Date	Test Report No.	Revision History
Jan. 05, 2023	KES-EM-23T0023	Issued
Jan. 27, 2023	KES-EM-23T0023-R1	Change Manufacturer
Feb. 24, 2023	KES-EM-23T0023-R2	Change the Applicant at the request of the customer

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1.0 General Product Description

Main Specifications of EUT are:

Product	Type	Network Ceiling Speaker
MIC Input	Input Sensitivity	-48dBV $\pm$ 3dB
	Frequency Response	20Hz ~ 20kHz $\pm$ 3dB
Line Output	Output Level	0 dBV $\pm$ 3dB
	Frequency Response	20Hz ~ 20kHz $\pm$ 3dB
	THD + N Ratio	less than 0.01%
	S/N Ratio (20Hz HPF, 20kHz LPF)	greater than 85dB
Power Amp	Output Power (8 Ω , 1kHz Sine wave)	7W(PoE), 15W (PoE+)
	Frequency Response (1W, 8 Ω)	20Hz ~ 20kHz $\pm$ 3dB
	S/N Ratio (20Hz HPF, 20kHz LPF)	greater than 85dB
Network	Ethernet	10/100 Base-T
Memory	Internal Memory	1 GBytes
	External Memory (Micro SD)	SDHC upto 32GB (SANDISK)
Contact	Contact Input	One channel
	Contact Output (Rating : 1A DC 30V, 0.3A AC 125V)	One channel
General	Operating Temperature	-20 ~ 50°C (-4°F ~ 122°F)
	Operating Humidity	10~100% RH Non-condensing
	IP code	-
	Weight	1.95Kg
	Size	Φ 269*142.5(H)
	Color	Black
	Certificate	EMC – FCC part 15 Class A , ICES-003 Class A Safety – UL-60950 , Environment – IEC and NEMA based on the Product specs
Power	PoE	PoE (IEEE 802.3 af type 1 Class 3)
	PoE+	PoE+(IEEE 802.3 at type 2 Class 4)
Audio	Built-in microphone	50~16000 Hz
	Audio Compression	G.711 PCM 8 kHz G.726 ADPCM 8 kHz WAV, MP3 in mono/stereo from 64 kbps to 320 kbps. Sampling rate from 8 kHz up to 48 kHz PCMU, PCMA, opus, L16/16000, L16/8000, speex/8000, speex/16000, G.726-32
Speaker	Speaker Component	8" Coaxial Cone type
	Max. Sound Pressure Level (PoE : 7 Watt)	100dB
	Max. Sound Pressure Level (PoE+ : 15 Watt)	103dB
	Max. Power (Peak)	120W
	Frequency Response	99Hz~20kHz
	Sensitivity (1Watt)	92dB
Network	Coverage Pattern	120°
	Security	Password protection : admin,setup,user,guest (sha-2, Digest authentication, User access log) Digest authentication, User access log
System Integration	Supported Protocols	IPv4, HTTP, SIP, Bonjour, DNS, NTP, TCP, UDP, DHCP, ARP, SSH, ICMP
	API (Application Programming Interface)	Including SUNAPI Integration with HTW WAVE (VMS)
System Integration	Multi-source Dynamic PA control	<Controller Mode> Multi-source up to 48 (Multicast) (Audio 24CH + Mic 24CH) Up to 50 Zone Control (Multicast) Up to 255 Groups <Speaker Mode> Up to 20 Zone Streaming (Unicast) Up to 50 Zone Streaming (Multicast) <Streaming Mode> Up to 256 Zone Streaming (Multicast)
	Voice Announcement	Up to 40 pre-recorded voice announcements. Tested with PBX suppliers such as Cisco and Asterisk.
	VoIP	Supported SIP features: DTMF (RFC2976 and RFC2833) Supported codecs: PCMU, PCMA, speex/8000, speex/16000 Domestic Version : Korean
	TTS	Export Version : English(US, UK), German, French, Spanish, Russian
	Intelligent Audio	Speaker Test (by built in test tool, bandwidth check also)
	Event Triggers	Virtual Inputs Call : DTMF, State changes
	Functional Monitoring	Connection verification, Built-in system logging
	Supported OS	Windows : Windows 10 MAC : Catalina 10.15.4 ↑ , Big Sur 11.1 ↑
	Supported Web viewer	Chrome Version : 91.0.4472.114 ↑

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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.

☒ PoE

1.2 Variant Model Differences

Color Differences

1.3 Device Modifications

Not applicable

1.4 Equipment Under Test

Description	Model Number	Serial Number	Manufacturer	Remarks
CEILING SPEAKER	SPA-C100W	-	Inter-M Corporation	EUT
AUDIO MODULE	SPA-D1000	-	Inter-M Corporation	-

1.5 Support Equipments

Description	Model Number	Serial Number	Manufacturer	Remarks
Notebook	P95G001	8KM8HT2	DELL INC.	-
Notebook adapter	LA65NS2-01	-	LITE-ON TECHNOLOGY(CHANGZHOU)CO.,LTD..	-
Speaker	E5	-	PreSonus®	-
PoE INJECTOR	PT-PSE109GBRO-AH-S	-	Dongguan PROCET Network Technology Co.,Ltd	-
Button Alram	-	-	-	-
LED Alram	PRO-SL	-	SENSOR PRO	-
Micro SD card	-	-	SanDisk	4 GB



1.6 External I/O Cabling

Start		END		Cable Spec.	
Description	I/O Port	Description	I/O Port	Length	Shield
CEILING SPEAKER (EUT)	RJ-45	PoE INJECTOR	RJ-45	3.0	U
	Micro SD card Slot	Micro SD card	Micro SD card Slot	-	-
	LINE OUT	Speaker	XLR	2.0	U
	Alarm IN	Button Alarm	Line	3.0	U
	Alarm OUT	LED Alarm	Line	3.0	U
	Ground Port	Ground	Ground Port	2.0	U

* Unshielded = U, Shielded = S

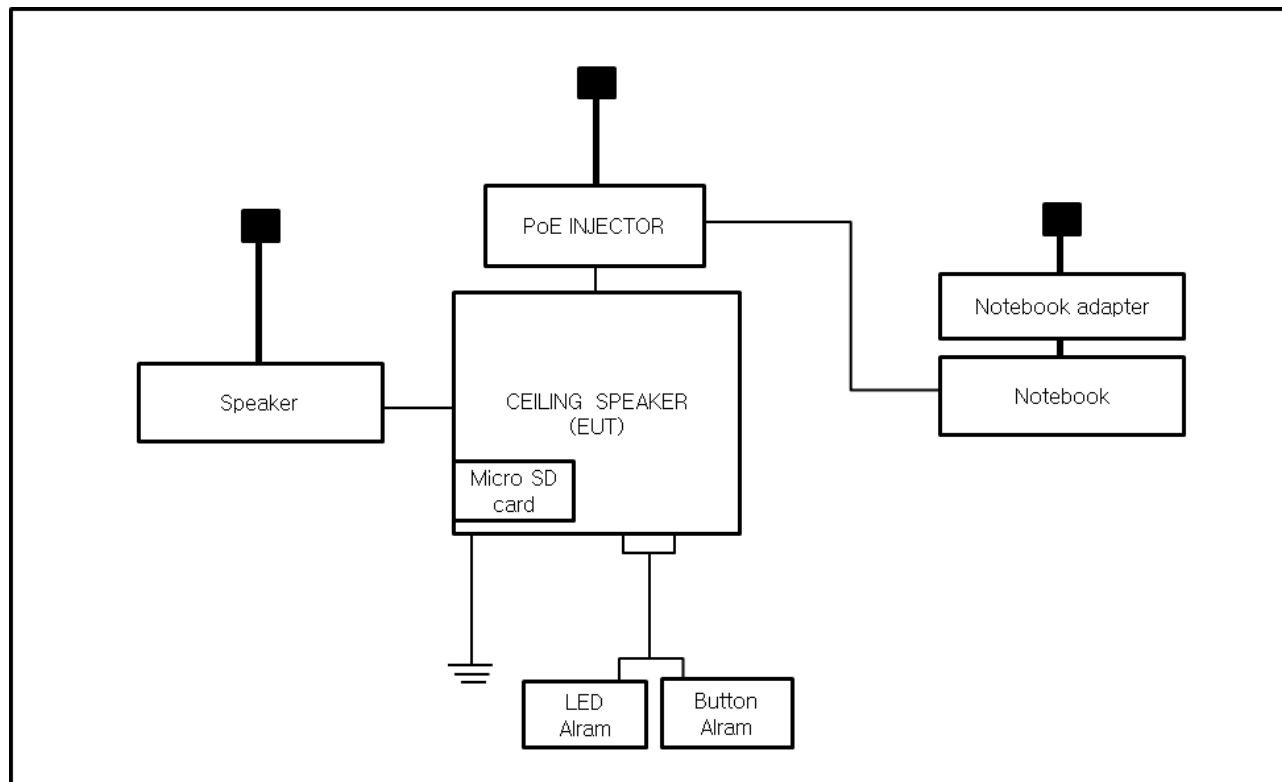
1.7 EUT Operating Mode(s)

Test mode	operating
Operation	1. Ping Test Mode. 2. After accessing the web browser, the operation status was checked by playing the 1KHz Tone. 3. Test by uploading the sound source stored on the Micro SD Card through the web viewer

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

1.8 Configuration

■ AC Main
 □ DC Main



1.9 Remarks when standards applied

The mains power ports were excluded tested, because the EUT operated by PoE powered.

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:

☒ **EMC – Directive 2014/30/EU**

☒ EN 55032:2015/A11:2020

☒ Class A

☐ Class B

☒ EN 55035:2017/A11:2020

☒ **EMC – Regulations 2016**

☒ EN 55032:2015/A11:2020

☒ Class A

☐ Class B

☒ EN 55035:2017/A11:2020



2.1 Conducted Emissions at Mains Power 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, 11, 2023
☐	LISN	ENV216	R & S	101787	11, 10, 2023
☐	LISN	ESH2-Z5	R & S	100450	11, 10, 2023
☐	PULSE LIMITER	ESH3-Z2	R & S	101915	11, 10, 2023

Test Conditions

Temperature: (±) °C

Relative Humidity: (±) % R.H.

Frequency Range of Measurement

150 kHz to 30 MHz

Instrument Settings

IF Band Width: 9 kHz

Test Results

The requirements are:

- ☐ PASS
☐ NOT PASS
☒ NOT APPLICABLE

Remarks

Refer to 'Remarks when standards applied'



2.2 Conducted Emissions at Telecommunication Ports

Test Date

Jan. 03, 2023

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, 11, 2023
☒	LISN	ENV216	R & S	101787	11, 10, 2023
☒	LISN	ESH2-Z5	R & S	100450	11, 10, 2023
☒	PULSE LIMITER	ESH3-Z2	R & S	101915	11, 10, 2023
☒	8-WIRE ISN CAT3,5	ENY81	R & S	100174	11, 22, 2023
☐	8-WIRE ISN CAT6	ENY81-CAT6	R & S	101665	11, 22, 2023
☐	CDN	CDNS502A	TESEQ	40431	11, 10, 2023

Test Conditions

Temperature: (22,6 ± 0,1) °C

Relative Humidity: (46,1 ± 0,1) % R.H.

Frequency Range of Measurement

150 kHz to 30 MHz

Instrument Settings

IF Band Width: 9 kHz

Test Results

The requirements are:

- ☒ PASS
☐ NOT PASS
☐ NOT APPLICABLE

Remarks

- See Appendix A for test data.

- For Ethernet interfaces, measurements are required at the highest data rate supported by the interface.



2.3 Radiated Electric Field Emissions(Below 1 GHz)

Test Date

Jan. 03, 2023

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	03, 31, 2023
☒	AMPLIFIER	SCU 01	R & S	100603	11, 10, 2023
☒	TRILOG-BROADBAND ANTENNA	VULB9163	Schwarzbeck	715	11, 17, 2024
☒	ATTENUATOR	8491A	HP	32173	03, 08, 2023

Test Conditions

Temperature: (22,3 ± 0,1) °C
Relative Humidity: (44,6 ± 0,1) % R.H.

Frequency Range of Measurement

30 MHz to 1 GHz

Instrument Settings

IF Band Width: 120 kHz

Test Results

The requirements are:

☒ PASS
☐ NOT PASS
☐ NOT APPLICABLE

Remarks

See Appendix A for test data.



2.4 Radiated Electric Field Emissions(Above 1 GHz)

Test Date

Jan. 03, 2023

Test Location

SEMI ANECHOIC CHAMBER #3

Test Equipment

Used	Description	Model Number	Manufacturer	Serial Number	Cal. Due
☒	EMI Test S/W	EP5/RE	TOYO Corporation	6.0.0	-
☒	EMI TEST RECEIVER	ESR7	R & S	101190	08, 01, 2023
☒	PREAMPLIFIER	8449B	AGILENT	3008A01967	04, 01, 2023
☒	ATTENUATOR	8491A	HP	35496	03, 08, 2023
☒	DOUBLE RIDGED HORN ANTENNA	SAS-571	A.H.SYSTEM,INC	781	03, 03, 2023

Test Conditions

Temperature: (22,1 ± 0,1) °C

Relative Humidity: (45,4 ± 0,1) % R.H.

Frequency Range of Measurement

1 GHz to 6 GHz

Instrument Settings

IF Band Width: 1 MHz

Test Results

The requirements are:

- ☒ PASS
☐ NOT PASS
☐ NOT APPLICABLE

Remarks

See Appendix A for test data.



2.5 Harmonic Current Emissions

Test Date

N/A

Test Location

Electro wave Shieldroom #3

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	04, 06, 2023
☐	POWER SOURCE	ACS 500N6	EM TEST	V1024106760	-

Test Conditions

Temperature: (±) °C

Relative Humidity: (±) % 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

Refer to 'Remarks when standards applied'



2.6 Voltage Fluctuations and Flicker

Test Date

N/A

Test Location

Electro wave Shieldroom #3

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	04, 06, 2023
☐	POWER SOURCE	ACS 500N6	EM TEST	V1024106760	-

Test Conditions

Temperature: (±) °C

Relative Humidity: (±) % R.H.

Test Results

The requirements are:

- ☐ PASS
☐ NOT PASS
☒ NOT APPLICABLE

Remarks

Refer to 'Remarks when standards applied'

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 61000-4-2:2009

Test Date

Jan. 04, 2023

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	02, 24, 2023
☒	HCP	-	KES	-	-
☒	VCP	-	Noise Ken	-	-

Test Conditions

Temperature: (22,5 ± 0,1) °C
Relative Humidity: (45,1 ± 0,1) % R.H.
Atmospheric Pressure: (100,5 ± 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

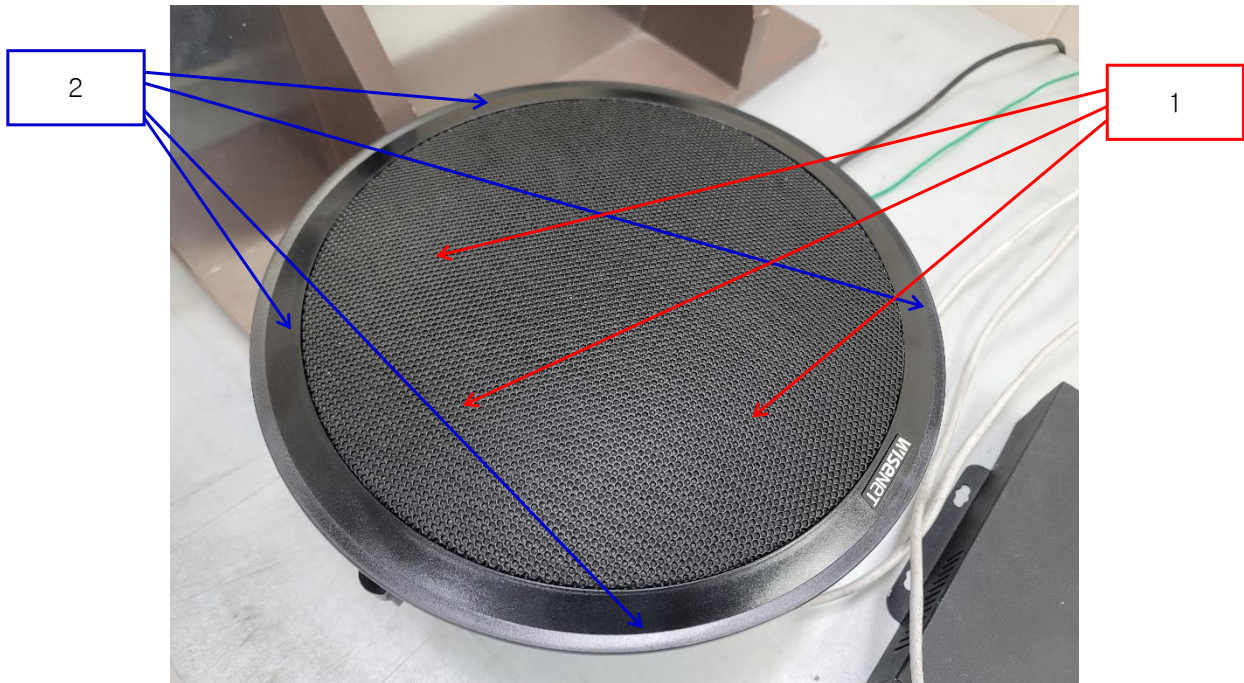
Notes: HCP: Horizontal coupling plane

VCP: Vertical coupling plane

Required Performance Criteria: ☒ B

Location of Discharge:

Contact
Air



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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 1	Contact Discharge	B	A	-
2	Enclosure 2	Air 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**N/A

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3.2 Radiated Electric Field Immunity

Reference Standard

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

Test Date

Jan. 04, 2023

Test Location

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

Test Equipment

Used	Description	Model Number	Manufacturer	Serial Number	Cal. Due
☒	EMS Test S/W	EMC32	R & S	10.10.02	-
☒	SIGNAL GENERATOR	SMB 100A	Rohde & Schwarz	108252	08, 01, 2023
☒	HIGH POWER DUAL AMP	SSA532	SUNGSAN	SSA532-001	-
☒	POWER METER	E4419B	Agilent	GB40203000	03, 31, 2023
☒	AVERAGE POWER SENSOR	E9301A	Agilent	MY52170007	04, 04, 2023
☒	AVERAGE POWER SENSOR	E9301A	Agilent	MY41498669	04, 04, 2023
☒	STACKED DOUBLE LOG-PER- ANTENNA	STPL9128 E	Schwarzbeck	9128ES-121	-
☒	DOUBLE RIDGED HORN ANTENNA	SAS-571	A.H.SYSTEM,INC	781	03, 03, 2023
☒	SOUND ACOUSTIC TESTER	TST-1000	TESTEK	150045	11, 01, 2023
☒	MICROPHONE	MP201	BSWA	551675	10, 31, 2023

Test Conditions

Temperature: (22,7 ± 0,1) °C
Relative Humidity: (45,0 ± 0,1) % R.H.
Atmospheric Pressure: (100,6 ± 0,0) kPa



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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 ($\pm 1\%$) (spot test)

Modulation: ☒ AM, 80 %, 1 kHz sine wave
☐ PM, 1 Hz (0,5 s ON : 0,5 s OFF)

Frequency step: ☒ 1 % step

Dwell Time: ☒ 1 s ☐ 3 s

of Sides Radiated: ☒ 4

Required Performance Criteria: ☒ A

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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
EUT Speaker	Off-ear	89.47	Low	A	A	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**

The acoustic disturbance ratio during/after the test is 20 db lower than the reference level, so it is suitable for the technical standard.

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3.3 Electrical Fast Transients/Bursts

Reference Standard

EN 61000-4-4:2012

Test Date

Jan. 04, 2023

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, 28, 2023
☒	MOTOR VARIAC	MV2616	EM TEST	P1552169719	11, 29, 2023
☒	CAPACITIVE COUPLING CLAMP	HFK	EM TEST	P1633183115	11, 28, 2023

Test Conditions

Temperature: (22,5 ± 0,1) °C
Relative Humidity: (45,1 ± 0,1) % R.H.
Atmospheric Pressure: (100,5 ± 0,0) kPa

Test Specifications

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

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

Burst Period: ☒ 300 ms ☐ 2 s

Repetition Rate: ☒ 5 kHz ☐ 100 kHz

Duration of Test Voltage: ☒ ≥ 1 min

Required Performance Criteria: ☒ B

Test Data

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

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

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

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

☒ Signal ports and telecommunication ports – Coupling Clamp used

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

N/A



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3.4 Surge

Reference Standard

EN 61000-4-5:2014+A1:2017

Test Date

N/A

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, 28, 2023
☐	MOTOR VARIAC	MV2616	EM TEST	P1552169719	11, 29, 2023

Test Conditions

Temperature: (±) °C
Relative Humidity: (±) % R.H.
Atmospheric Pressure: (±) kPa

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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

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Test Data☐ Line to Line – Differential Mode

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

☐ Line to Earth – Common Mode

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

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**Refer to 'Remarks when standards applied'

3.5 Conducted Disturbance

Reference Standard

EN 61000-4-6:2014

Test Date

Jan. 03, 2023

Test Location

EMS-CS: Electro wave Shieldroom #6

Test Equipment

Used	Description	Model Number	Manufacturer	Serial Number	Cal. Due
☒	EMS Test S/W	icd.control	EM TEST	5.3.12	-
☒	CONTINUOUS WAVE SIMULATOR	CWS 500N1.4	EM TEST	P1602169880	11, 10, 2023
☒	ATTENUATOR	ATT 6/80	EM TEST	P1614178148	11, 10, 2023
☒	CDN	CDN M016	TESEQ	43694	11, 10, 2023
☒	CDN	CDN M016	TESEQ	43697	11, 10, 2023
☒	CDN	CDN T800	TESEQ	42800	11, 10, 2023
☒	EM CLAMP	KEMZ 801A	TESEQ	44099	11, 14, 2023
☒	SOUND ACOUSTIC TESTER	TST-1000	TESTEK	150045	11, 01, 2023
☒	MICROPHONE	MP201	BSWA	551675	10, 31, 2023

Test Conditions

Temperature: (22,6 ± 0,1) °C
Relative Humidity: (46,1 ± 0,1) % R.H.
Atmospheric Pressure: (101,1 ± 0,0) kPa



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Test Specifications

Frequency range:

☐ 150 kHz to 100 MHz

☒ 150 kHz to 80 MHz

Voltage Level:

☒ 3 Vrms (150 kHz to 10 MHz)

☒ 3 Vrms to 1Vrms (10 MHz to 30 MHz)

☒ 1 Vrms (30 MHz to 80 MHz)

Modulation:

☒ AM, 80 %, 1 kHz sine wave

☐ PM, 1 Hz (0,5 s ON : 0,5 s OFF)

Frequency step:

☒ 1 % step

Dwell Time:

☒ 1 s

☐ 3 s

Required Performance Criteria: ☒ A

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Test Data

☐ Input a.c. power ports

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

☐ Input d.c. power ports

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

☒ Signal ports and telecommunication ports

Coupling Location (Line Stressed)	Coupling Method	Performance Criteria	Results
RJ-45	CDN	A	A
Alarm IN, Alarm OUT	Clamp	A	A

[Audio output function]

☐ Electrical Measurements / ☒ Acoustic Measurements

Measured parts	Test method	Level (dB)		Performance criteria	Observations	
		Criteria	Measured		Horizontal	Vertical
EUT Speaker	Off-ear	89.52	Low	A	A	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

The acoustic disturbance ratio during/after the test is 20 db lower than the reference level, so it is suitable for the technical standard.

3.6 Power Frequency Magnetic Field Immunity

Reference Standard

EN 61000-4-8:2010

Test Date

Jan. 04, 2023

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, 28, 2023
☒	MOTOR VARIAC	MV2616	EM TEST	P1552169719	11, 29, 2023
☒	MAGNETIC FIELD COIL	MS 100N	EM TEST	P1536163691	11, 28, 2023
☒	CURRENT TRANSFORMER	MC 2630	EM TEST	P1629182219	11, 28, 2023

Test Conditions

Temperature: (22,5 ± 0,1) °C
Relative Humidity: (45,1 ± 0,1) % R.H.
Atmospheric Pressure: (100,5 ± 0,0) kPa

Test Specifications

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

Frequency: ☒ 50 Hz ☐ 60 Hz

Required Performance Criteria: ☒ A

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Test Data☒ Immersion method

Coil orientation	Performance Criteria	Results
X - axis	A	A
Y - axis	A	A
Z - axis	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
☐ NOT APPLICABLE

RemarksN/A

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3.7 Voltage Dips and Short Interruptions

Reference Standard

EN 61000-4-11:2004+A1:2017

Test Date

N/A

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, 29, 2023
☐	MOTOR VARIAC	MV2616	EM TEST	P1552169719	11, 29, 2023

Test Conditions

Temperature: (±) °C
Relative Humidity: (±) % R.H.
Atmospheric Pressure: (±) kPa

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Test Data

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

Refer to 'Remarks when standards applied'

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APPENDIX A – TEST DATA

Conducted Emissions at Mains Power Ports [HOT]

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[NEUTRAL]

N/A

◆ Calculation

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

QuasiPeak / CAverage : The Final Value

Reading Value : Not shown in the table.

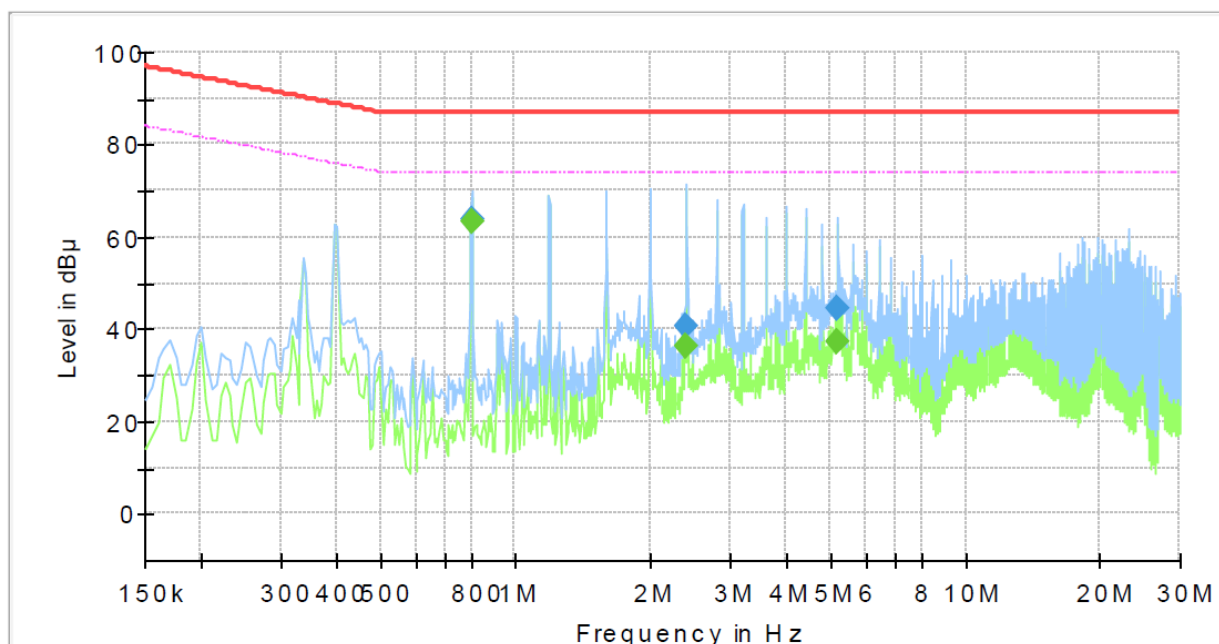
Corr. : Correction values (LISN FACTOR + (Cable Loss + Pulse Limiter FACTOR))

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Conducted Emissions at Telecommunication Ports [100 Mbps]

Common Information

Test Description: Telecommunication Emission
 Model No.: SPA-C100W
 Mode :
 Speed : 100 Mbps
 Operator Name: KES



Final Result

Frequency (MHz)	QuasiPeak (dBμV)	CAverage (dBμV)	Limit (dBμV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.800000	---	63.41	74.00	10.59	1000.0	9.000	Single Line	20.0
0.800000	63.83	---	87.00	23.17	1000.0	9.000	Single Line	20.0
2.395000	---	36.28	74.00	37.72	1000.0	9.000	Single Line	20.1
2.395000	40.73	---	87.00	46.27	1000.0	9.000	Single Line	20.1
5.210000	---	37.13	74.00	36.87	1000.0	9.000	Single Line	19.4
5.210000	44.75	---	87.00	42.25	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))



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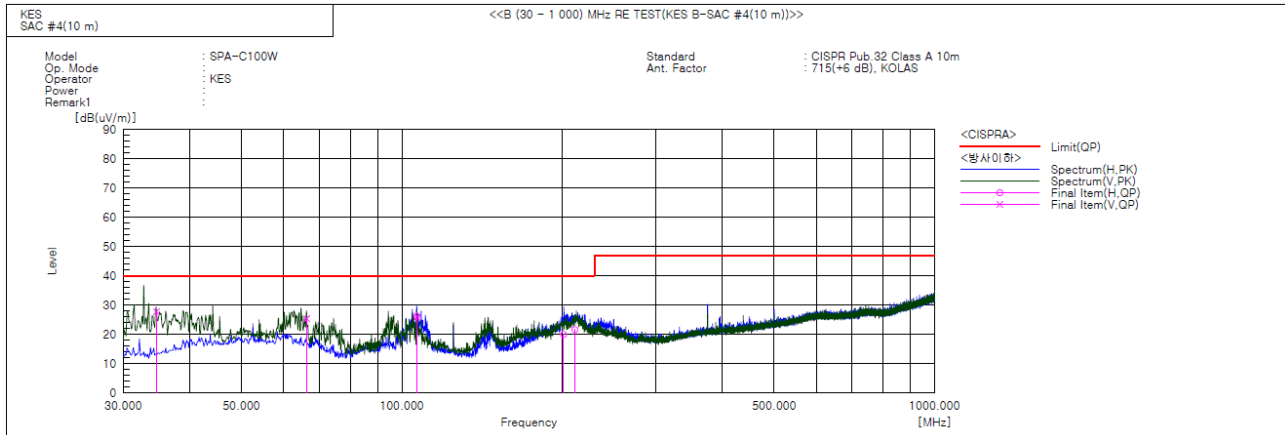
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Radiated Electric Field Emissions(Below 1 GHz)



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	34.639	V	52.0	-24.3	27.7	40.0	12.3	103.0	242.0	
2	66.266	V	48.6	-23.2	25.4	40.0	14.6	106.0	158.0	
3	106.696	H	48.6	-22.3	26.3	40.0	13.7	399.0	333.0	
4	106.720	V	48.1	-22.3	25.8	40.0	14.2	100.0	63.0	
5	201.221	H	40.9	-20.9	20.0	40.0	20.0	227.0	184.0	
6	211.338	H	41.7	-20.1	21.6	40.0	18.4	397.0	179.0	

◆ Calculation – SAC #4(10 m)

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

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

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

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

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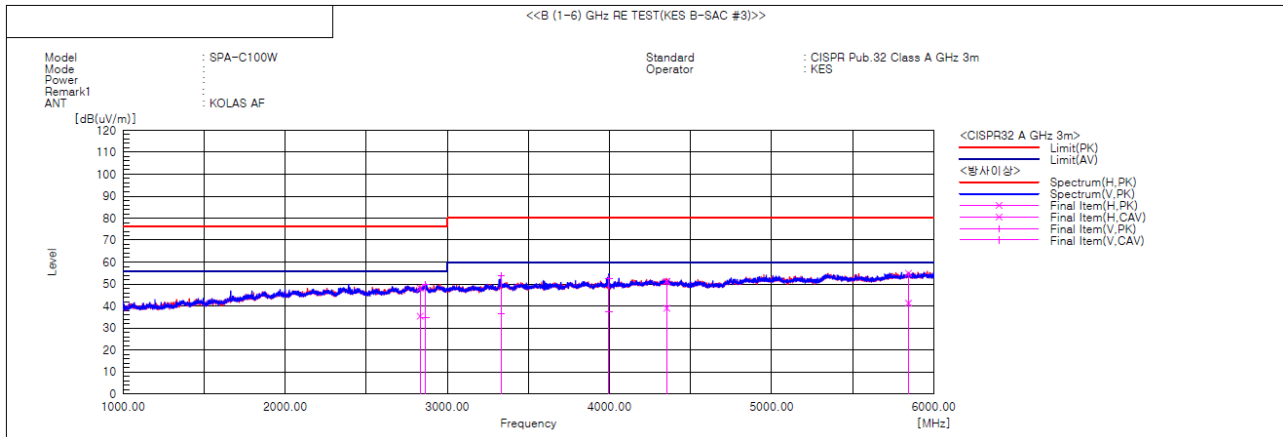
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Radiated Electric Field Emissions(Above 1 GHz)



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	2831.838	H	40.4	27.7	7.7	48.1	35.4	76.0	56.0	27.9	20.6	100.0	275.8	
2	2867.227	V	41.9	26.9	7.8	49.7	34.7	76.0	56.0	26.3	21.3	100.0	334.9	
3	3331.752	V	44.4	27.0	9.4	53.8	36.4	80.0	60.0	26.2	23.6	100.0	146.1	
4	3995.118	V	41.6	26.7	10.8	52.4	37.5	80.0	60.0	27.6	22.5	100.0	128.0	
5	4352.518	H	39.1	26.8	12.2	51.3	39.0	80.0	60.0	28.7	21.0	100.0	86.7	
6	5843.907	H	38.8	25.2	16.1	54.9	41.3	80.0	60.0	25.1	18.7	100.0	130.9	

◆ Calculation

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

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

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

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

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Test Data - Voltage Fluctuations

Flicker Measurements					
	P_{It}	Max P_{st}	Max D_c	Max D_{max}	Max T_{max}
Line 1:			N/A		
Limits:					
Results:					

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APPENDIX B – Test Setup Photos and Configuration

Conducted Voltage Emissions

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Conducted Telecommunication Emissions



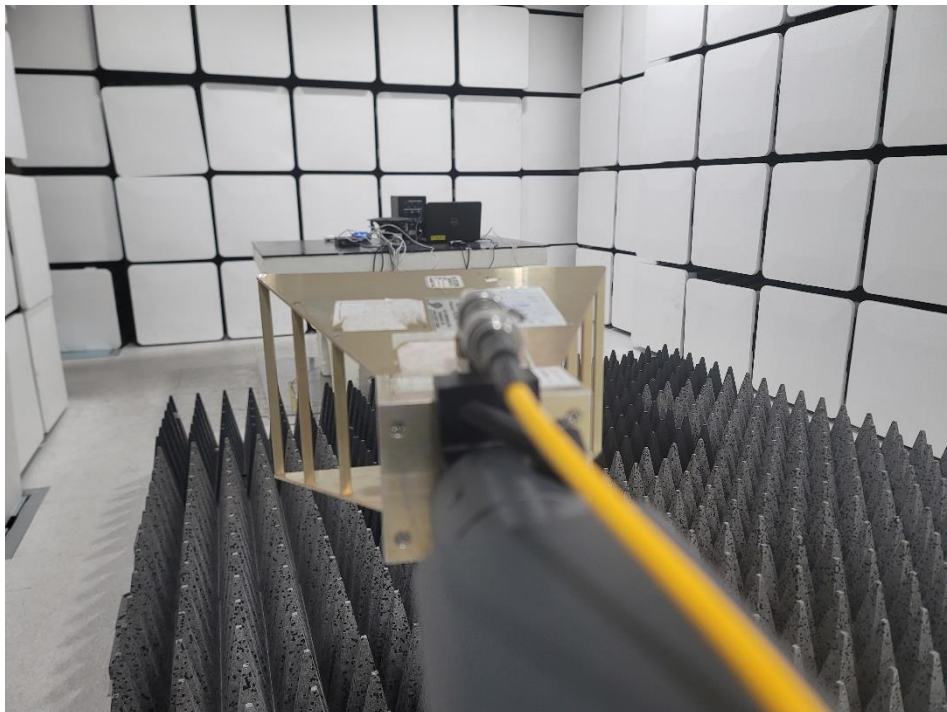
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Radiated Electric Field Emissions(Below 1 GHz)



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Radiated Electric Field Emissions(Above 1 GHz)

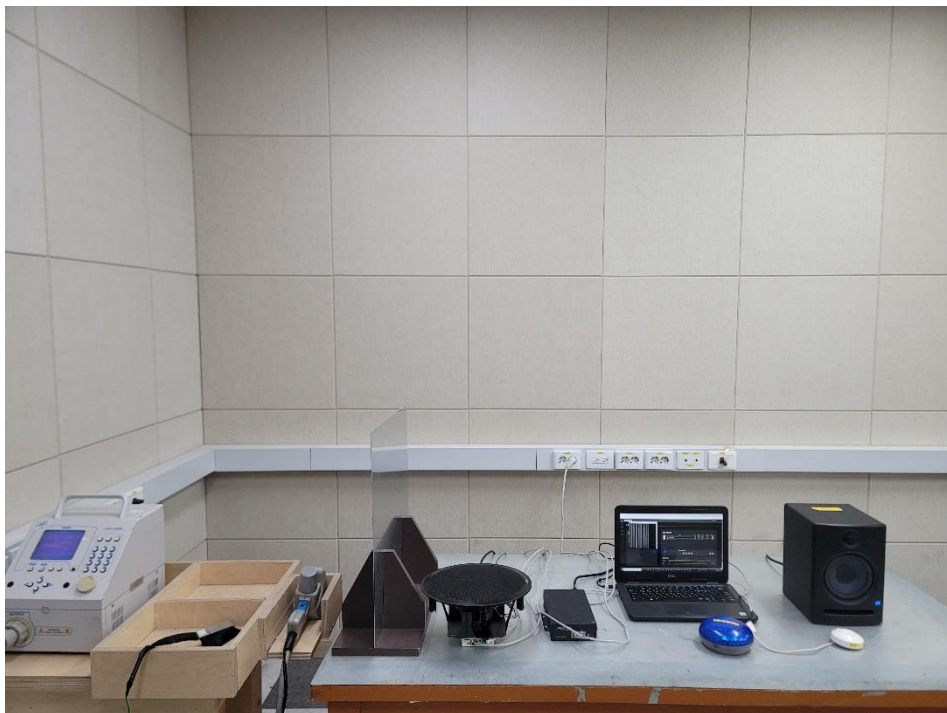


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Harmonic Current Emissions and Voltage Fluctuations and Flicker

N/A

Electrostatic Discharge



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Radiated Electric Field Immunity



Electrical Fast Transients/Bursts

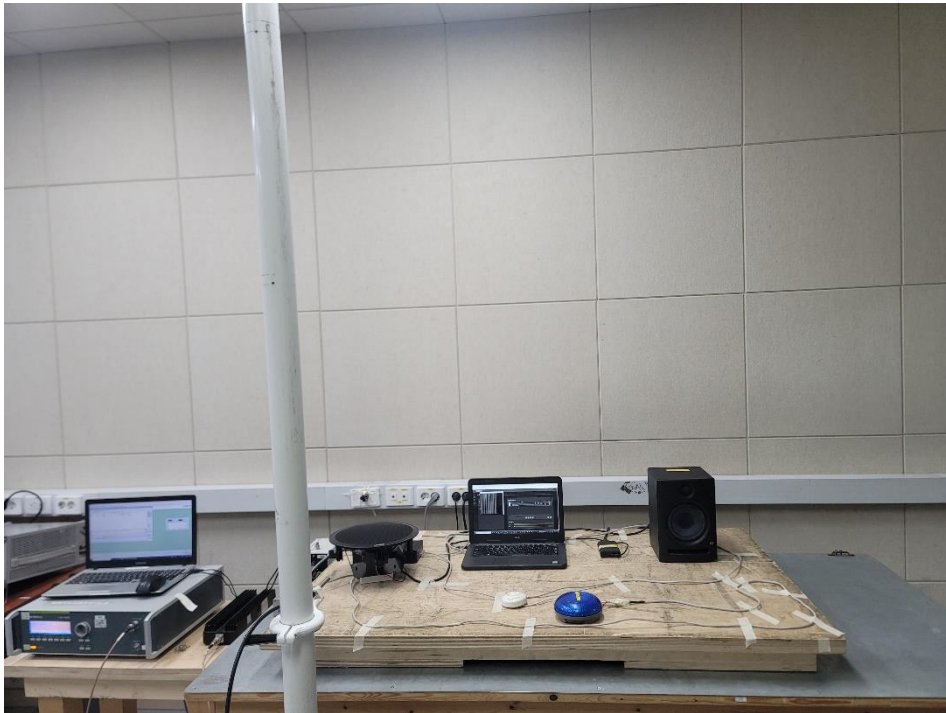


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Surge Transients

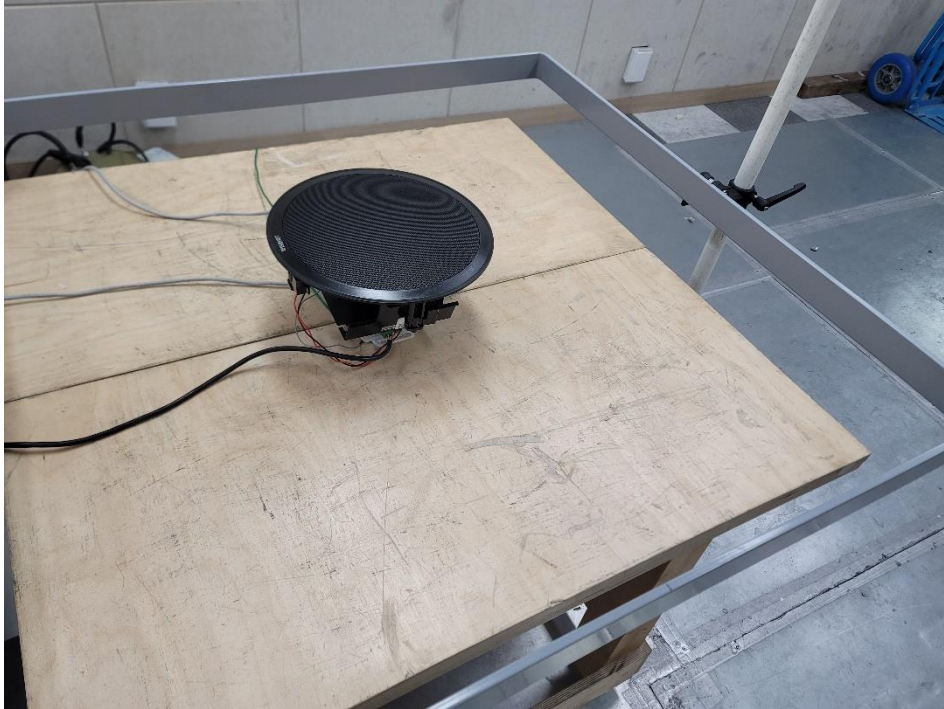
N/A

Conducted Disturbance



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Power Frequency Magnetic Field Immunity



Voltage Dips and Short Interruptions

N/A

APPENDIX C – EUT Photographs

EUT External Photographs

(Top)



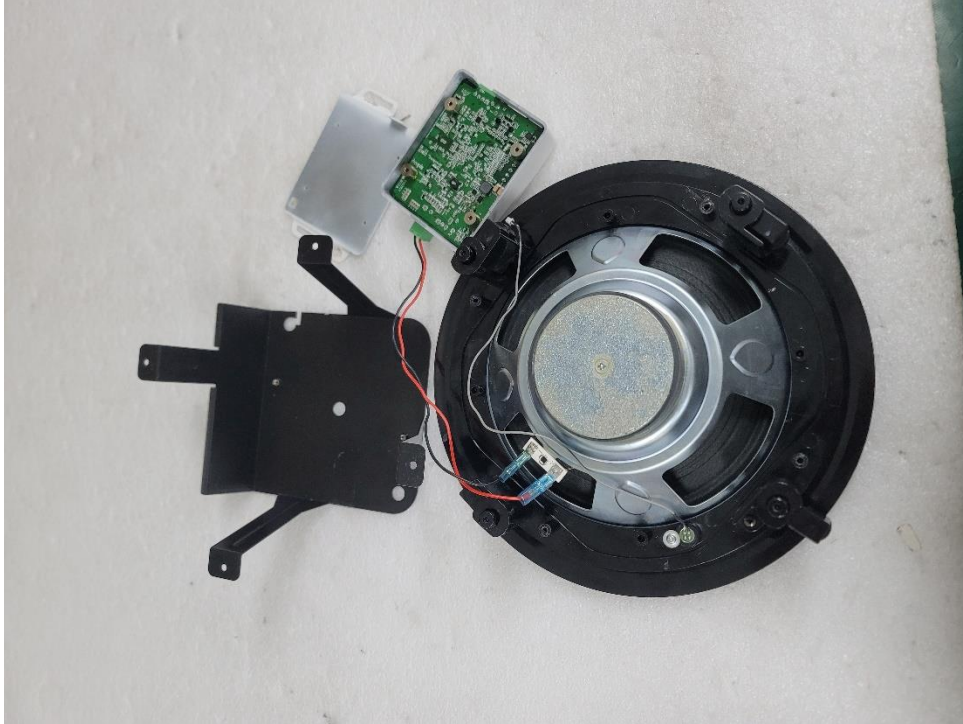
(Bottom)



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EUT Internal Photographs

(Internal View)



EUT Internal View – Module Board

(Top)



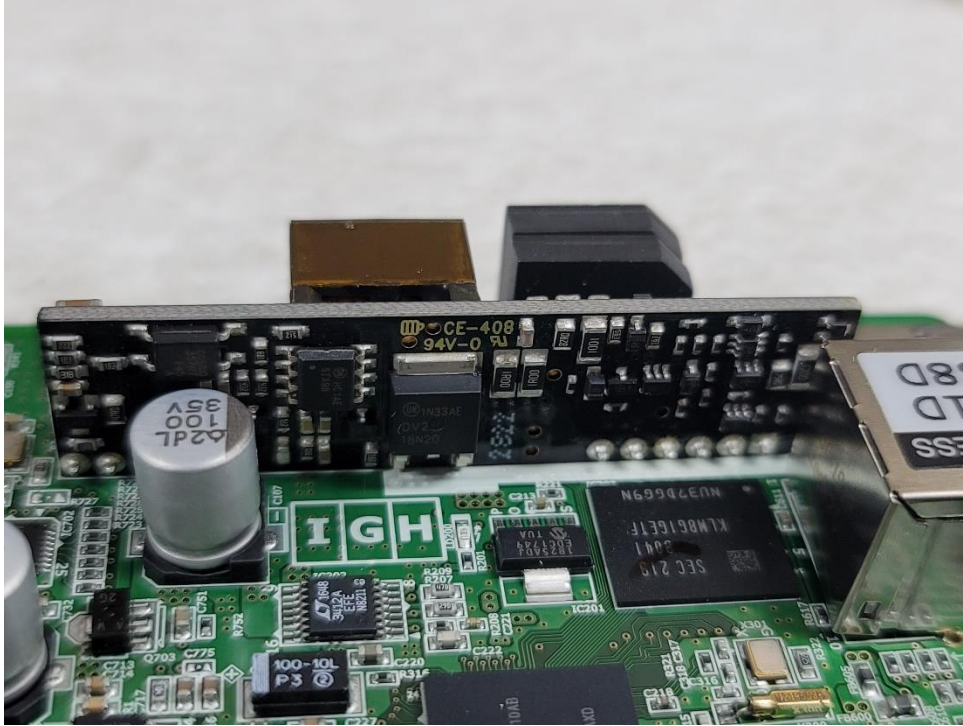
(Bottom)



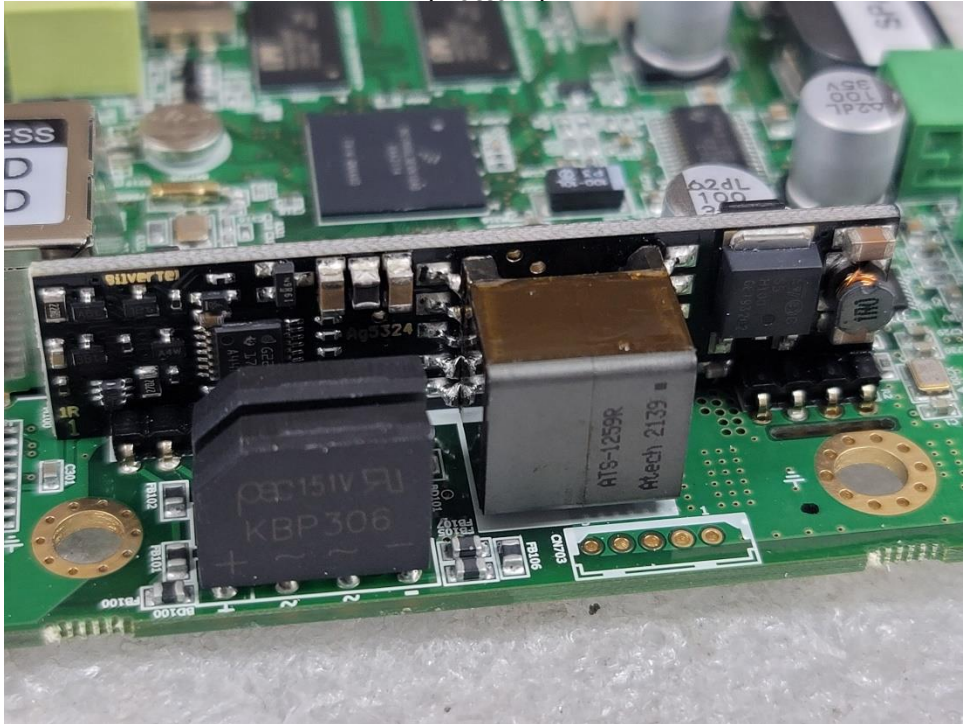
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EUT Internal View – Module Sub Board

(Top)



(Bottom)



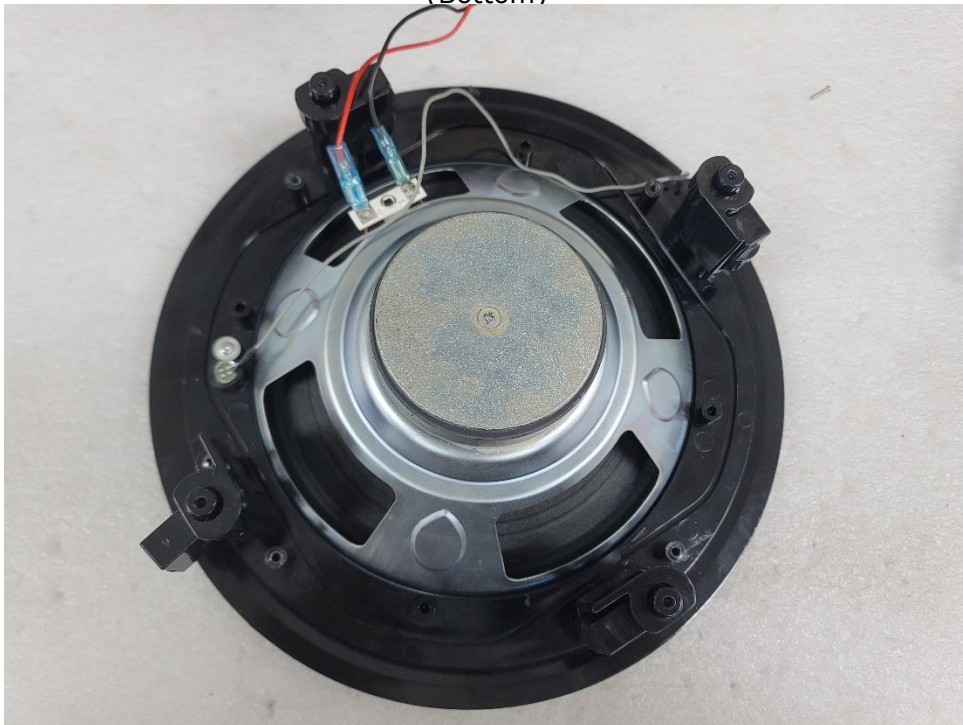
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EUT Internal View – Speaker

(Top)

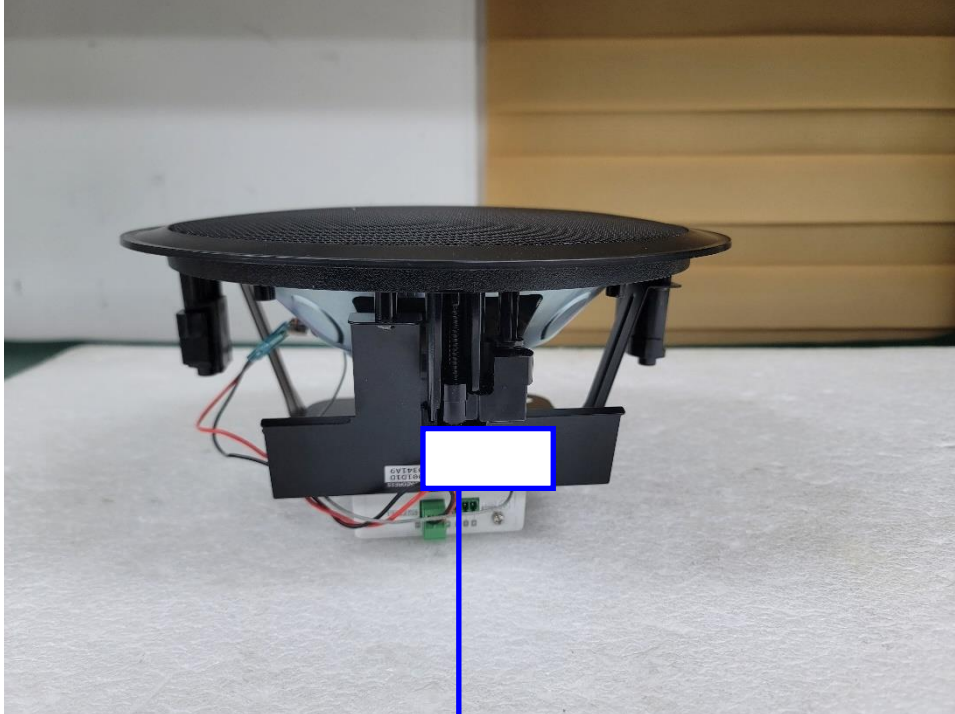


(Bottom)



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Label and Location

**CEILING SPEAKER**

Model No : SPA-C100W

Manufacturer : Inter-M Corporation

Made in Korea

