

# EMC TEST REPORT

Test Report No. : KES-EM-23T0024-R2  
Date of Issue : Feb. 24, 2023  
Product name : WALL SPEAKER  
Model/Type No. : SPA-W100W  
Variant Model : SPA-W100B  
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. 03, 2023 ~ Jan. 04, 2023  
Test Results :  **In Compliance**  **Not in Compliance**

*Tested by*

Eun Gu, Jeon  
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 REVISION HISTORY**

<b>Date</b>	<b>Test Report No.</b>	<b>Revision History</b>
Jan. 05, 2023	KES-EM-23T0024	Issued
Jan. 27, 2023	KES-EM-23T0024-R1	Change Manufacturer
Feb. 24, 2023	KES-EM-23T0024-R2	Change the Applicant at the request of the customer

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# 1.0 General Product Description

## Main Specifications of EUT are:

<b>Product</b>	Type	Network Wall speaker
<b>MIC Input</b>	Input Sensitivity	-48dBV ±3dB
	Frequency Response	20Hz ~ 20kHz ±3dB
<b>Line Output</b>	Output Level	0 dBV ± 3dB
	Frequency Response	20Hz ~ 20kHz ±3dB
	THD + N Ratio	less than 0.01%
	S/N Ratio (20Hz HPF, 20kHz LPF)	greater than 85dB
<b>Power Amp</b>	Output Power (8Ω, 1kHz Sine wave)	7W(PoE), 15W (PoE+)
	Frequency Response (1W, 8Ω)	20Hz ~ 20kHz ±3dB
	S/N Ratio (20Hz HPF, 20kHz LPF)	greater than 85dB
<b>Network</b>	Ethernet	10/100 Base-T
<b>Memory</b>	Internal Memory	1 GBytes
	External Memory (Micro SD)	SDHC upto 32GB (SANDISK)
<b>Contact</b>	Contact Input	One channel
	Contact Output (Rating : 1A DC 30V, 0.3A AC 125V)	One channel
<b>General</b>	Operating Temperature	-20 ~ 50°C (-4°F ~ 122°F)
	Operating Humidity	10~100% RH Non-condensing
	IP code	IP45
	Weight	2.35Kg
	Size	170(W)*250(H)*134(D)
	Color	White
	Certificate	EMC – FCC part 15 Class A , ICES-003 Class A Safety – UL-60950 , Environment – IEC and NEMA based on the Product specs
<b>Power</b>	PoE	PoE (IEEE 802.3 af type 1 Class 3)
	PoE+	PoE+(IEEE 802.3 at type 2 Class 4)
<b>Audio</b>	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 Component
<b>Speaker</b>	Max. Sound Pressure Level (PoE : 7 Watt)	97dB
	Max. Sound Pressure Level (PoE+ : 15 Watt)	100dB
	Max. Power (Peak)	200W
	Frequency Response	87Hz~20kHz
	Sensitivity (1Watt)	89dB
	Coverage Pattern	170° X 140°
<b>Network</b>	Security	Password protection ; admin,setup,user,guest (sha-2, Digest authentication, User access log)
	Supported Protocols	IPv4, HTTP, SIP, Bonjour, DNS, NTP, TCP, UDP, DHCP, ARP, SSH, ICMP
<b>System Integration</b>	API (Application Programming Interface)	Including SUNAPI Integration with HTW WAVE (VMS)
	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.
	VoIP	Tested with PBX suppliers such as Cisco and Asterisk. Supported SIP features: DTMF (RFC2976 and RFC2833) Supported codecs: PCMU, PCMA, speex/8000, speex/16000
	TTS	Domestic Version : Korean 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 1 , Big Sur 11.1 1	
Supported Web viewer	Chrome Version : 91.0.4472.114 1	

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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
WALL SPEAKER	SPA-W100W	-	Inter-M Corporation	EUT
AUDIO MODULE	SPA-D1000	-	Inter-M Corporation	-

## 1.5 Support Equipments

Description	Model Number	Serial Number	Manufacturer	Remarks
NOTEBOOK	Latitude 5300	8C47BE45C060	DELL INC.	-
NOTEBOOK ADAPTER	HA65NM130	-	Chicony Power Technology (Suzhou)Co.,Ltd.	-
PoE INJECTOR	PT-PSE109GBRO-AH-S	-	Dongguan PROCET Network Technology Co.,Ltd	-
BUTTON ALARM	-	-	-	-
ALARM	-	-	-	-
Micro SD Card	-	-	-	8 GB
Speaker	E5	-	PreSonus®	-



## 1.6 External I/O Cabling

Start		END		Cable Spec.	
Description	I/O Port	Description	I/O Port	Length	Shield
WALL SPEAKER (EUT)	RJ -45	PoE INJECTOR	RJ-45	3.0	U
	Micro SD Slot	Micro SD Card	Micro SD Slot	-	-
	ALARM IN	BUTTON ALARM	Line	3.0	U
	ALARM OUT	ALARM	Line	3.0	U
	Groud	Groud	Groud	1.8	U
	LINE OUT (3 Pin)	Speaker	XLR	1.0	U

\* Unshielded = U, Shielded = S

## 1.7 EUT Operating Mode(s)

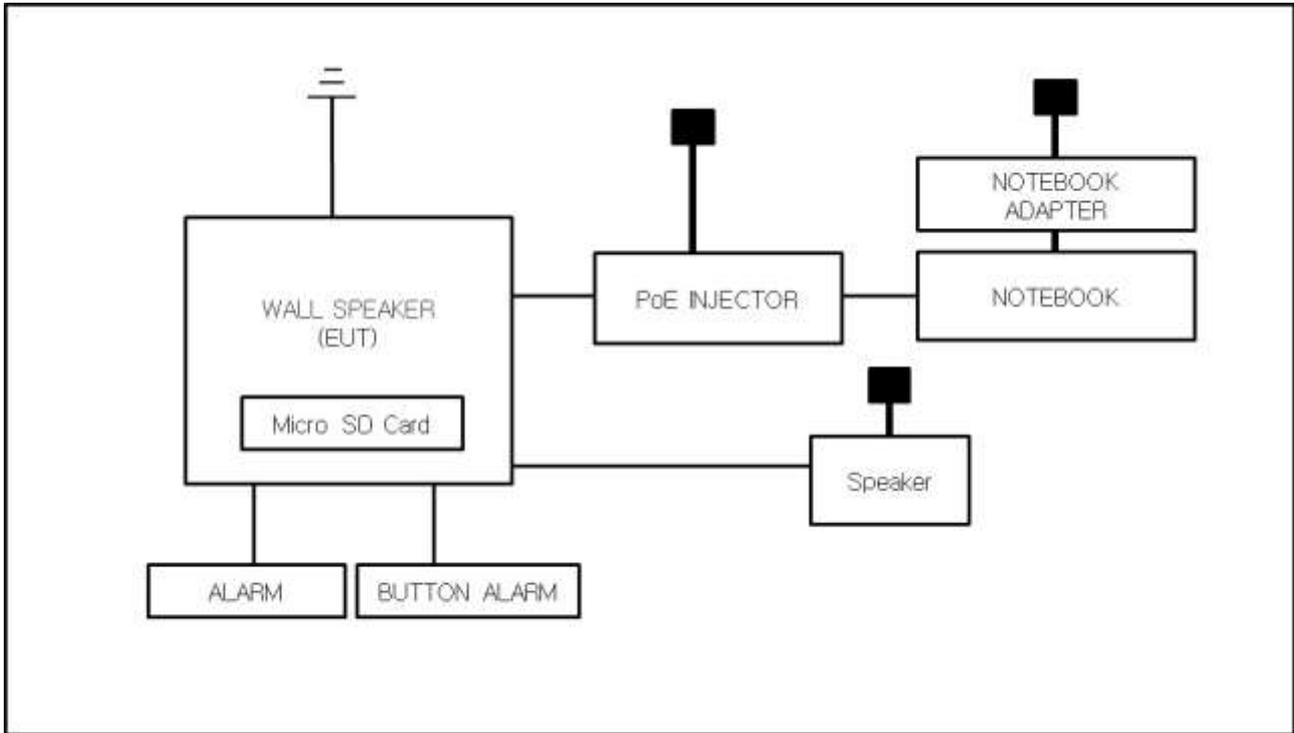
Test mode	operating
Operation	<ol style="list-style-type: none"> <li>1. Ping Test Mode.</li> <li>2. After accessing the web browser, the operation status was checked by playing the 1KHz Tone.</li> <li>3. Test by uploading the sound source stored on the Micro SD Card through the web viewer</li> <li>4. Tested while connecting to a web viewer and checking the operation status at the ALARM IN/OUT port.</li> </ol>

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

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## 1.8 Configuration

■ AC Main  
□ DC Main



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## 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

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## 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



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## 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
<input type="checkbox"/>	EMI Test S/W	EMC32	R & S	9.12.00	-
<input type="checkbox"/>	EMI TEST RECEIVER	ESR3	R & S	101783	11, 11, 2023
<input type="checkbox"/>	LISN	ENV216	R & S	101787	11, 10, 2023
<input type="checkbox"/>	LISN	ESH2-Z5	R & S	100450	11, 10, 2023
<input type="checkbox"/>	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'

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## 2.2 Conducted Emissions at Telecommunication Ports

### Test Date

Jan. 04, 2023

### Test Location

Electro wave Shieldroom #6

### Test Equipment

Used	Description	Model Number	Manufacturer	Serial Number	Cal. Due
<input checked="" type="checkbox"/>	EMI Test S/W	EMC32	R & S	9.12.00	-
<input checked="" type="checkbox"/>	EMI TEST RECEIVER	ESR3	R & S	101783	11, 11, 2023
<input checked="" type="checkbox"/>	LISN	ENV216	R & S	101787	11, 10, 2023
<input checked="" type="checkbox"/>	LISN	ESH2-Z5	R & S	100450	11, 10, 2023
<input checked="" type="checkbox"/>	PULSE LIMITER	ESH3-Z2	R & S	101915	11, 10, 2023
<input checked="" type="checkbox"/>	8-WIRE ISN CAT3,5	ENY81	R & S	100174	11, 22, 2023
<input type="checkbox"/>	8-WIRE ISN CAT6	ENY81-CAT6	R & S	101665	11, 22, 2023
<input type="checkbox"/>	CDN	CDNS502A	TESEQ	40431	11, 10, 2023

### Test Conditions

Temperature: (22,7 ± 0,1) °C  
Relative Humidity: (45,4 ± 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
<input checked="" type="checkbox"/>	EMI Test S/W	EP5/RE	TOYO Corporation	6.0.0	-
<input checked="" type="checkbox"/>	EMI TEST RECEIVER	ESU26	R & S	100551	03, 31, 2023
<input checked="" type="checkbox"/>	AMPLIFIER	SCU 01	R & S	100603	11, 10, 2023
<input checked="" type="checkbox"/>	TRILOG-BROADBAND ANTENNA	VULB9163	Schwarzbeck	715	11, 17, 2024
<input checked="" type="checkbox"/>	ATTENUATOR	8491A	HP	32173	03, 08, 2023

### Test Conditions

Temperature: (22,8 ± 0,1) °C  
Relative Humidity: (45,1 ± 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
<input checked="" type="checkbox"/>	EMI Test S/W	EP5/RE	TOYO Corporation	6.0.0	-
<input checked="" type="checkbox"/>	EMI TEST RECEIVER	ESR7	R & S	101190	08, 01, 2023
<input checked="" type="checkbox"/>	PREAMPLIFIER	8449B	AGILENT	3008A01967	04, 01, 2023
<input checked="" type="checkbox"/>	ATTENUATOR	8491A	HP	35496	03, 08, 2023
<input checked="" type="checkbox"/>	DOUBLE RIDGED HORN ANTENNA	SAS-571	A.H.SYSTEM,INC	781	03, 03, 2023

**Test Conditions**

Temperature: (22,1 ± 0,2) °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
<input type="checkbox"/>	EMI Test S/W	net.control	EM TEST	2.1.4	-
<input type="checkbox"/>	DIGITAL POWER ANALYZER	DPA 500N	EM TEST	V1024106759	04, 06, 2023
<input type="checkbox"/>	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
<input type="checkbox"/>	EMI Test S/W	net.control	EM TEST	2.1.4	-
<input type="checkbox"/>	DIGITAL POWER ANALYZER	DPA 500N	EM TEST	V1024106759	04, 06, 2023
<input type="checkbox"/>	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
<input checked="" type="checkbox"/>	ESD SIMULATOR	ESS-2000	Noise Ken	ESS01Z0454	02, 24, 2023
<input checked="" type="checkbox"/>	HCP	-	KES	-	-
<input checked="" type="checkbox"/>	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

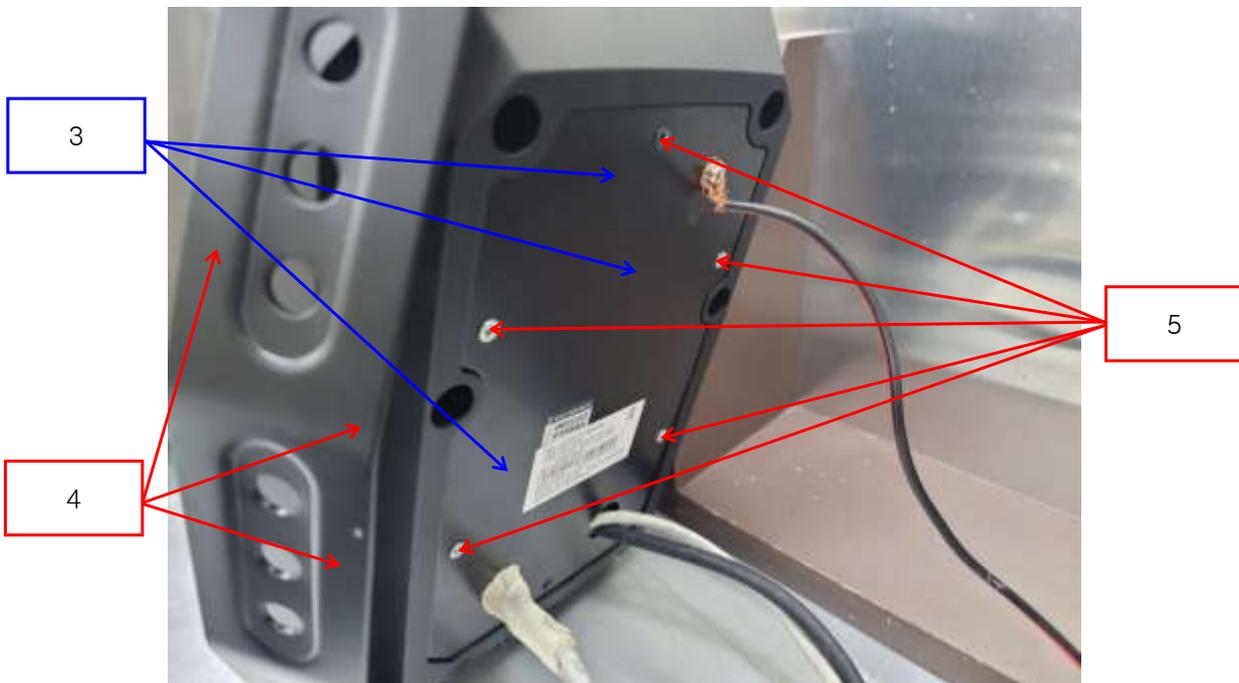
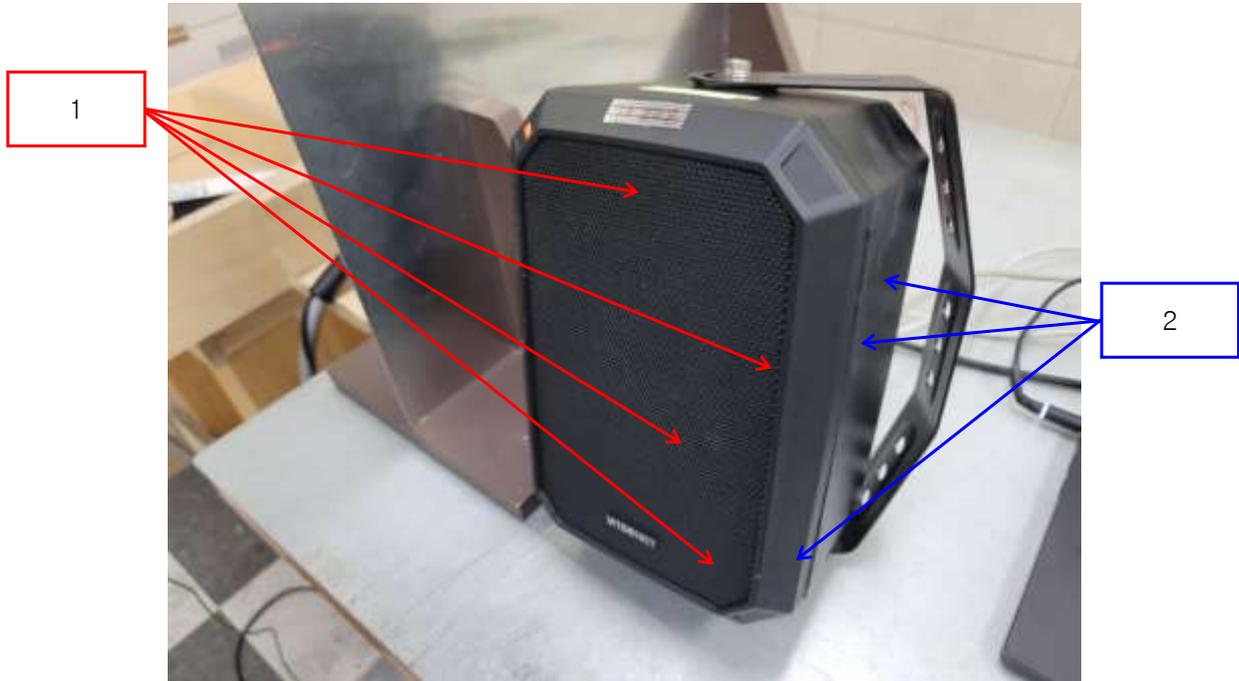
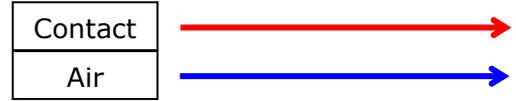
Discharge Voltage:	Contact	Air	HCP	VCP
	<input type="checkbox"/> 2 kV	<input checked="" type="checkbox"/> 2 kV	<input type="checkbox"/> 2 kV	<input type="checkbox"/> 2 kV
	<input checked="" type="checkbox"/> 4 kV			
	<input type="checkbox"/> 6 kV			
	<input type="checkbox"/> 8 kV	<input checked="" type="checkbox"/> 8 kV	<input type="checkbox"/> 8 kV	<input type="checkbox"/> 8 kV
	<input type="checkbox"/> 15 kV			

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

Required Performance Criteria:  B

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**Location of Discharge:**



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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	Speaker	Contact Discharge	B	A	-
2	Enclosure 1	Air Discharge	B	A	-
3	Enclosure 2	Air Discharge	B	A	-
4	Enclosure 3	Contact Discharge	B	A	-
5	Screw	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.

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## 3.2 Radiated Electric Field Immunity

### Reference Standard

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

### Test Date

Jan. 03, 2023

### Test Location

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

### Test Equipment

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

### Test Conditions

Temperature: (22,1 ± 0,2) °C  
 Relative Humidity: (45,4 ± 0,2) % R.H.  
 Atmospheric Pressure: (99,9 ± 0,1) 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	85.68	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

- Any degradations of performance was not observed during in the test.
- 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
<input checked="" type="checkbox"/>	EMS Test S/W	iec.control	EM TEST	5.4.8	-
<input checked="" type="checkbox"/>	ULTRA COMPACT SIMULATOR	UCS 500N7	EM TEST	P1608172950	11, 28, 2023
<input checked="" type="checkbox"/>	MOTOR VARIAC	MV2616	EM TEST	P1552169719	11, 29, 2023
<input checked="" type="checkbox"/>	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 ± 0,2) kPa

**Test Specifications**

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

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

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**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	B	A	A
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**

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



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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
<input type="checkbox"/>	EMS Test S/W	iec.control	EM TEST	5.4.8	-
<input type="checkbox"/>	ULTRA COMPACT SIMULATOR	UCS 500N7	EM TEST	P1608172950	11, 28, 2023
<input type="checkbox"/>	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

**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. 04, 2023

**Test Location**

EMS-CS: Electro wave Shieldroom #6

**Test Equipment**

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

**Test Conditions**

Temperature: (22,7 ± 0,1) °C  
Relative Humidity: (45,4 ± 0,2) % R.H.  
Atmospheric Pressure: (100,8 ± 0,2) 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	Clamp	A	A
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	CDN	86.21	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**

- Any degradations of performance was not observed during in the test.
- 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
<input checked="" type="checkbox"/>	EMS Test S/W	iec.control	EM TEST	5.4.8	-
<input checked="" type="checkbox"/>	ULTRA COMPACT SIMULATOR	UCS 500N7	EM TEST	P1608172950	11, 28, 2023
<input checked="" type="checkbox"/>	MOTOR VARIAC	MV2616	EM TEST	P1552169719	11, 29, 2023
<input checked="" type="checkbox"/>	MAGNETIC FIELD COIL	MS 100N	EM TEST	P1536163691	11, 28, 2023
<input checked="" type="checkbox"/>	CURRENT TRANSFORMER	MC 2630	EM TEST	P1629182219	11, 28, 2023

**Test Conditions**

Temperature: (22,57 ± 0,1) °C  
 Relative Humidity: (45,1 ± 0,1) % R.H.  
 Atmospheric Pressure: (100,5 ± 0,2) 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

**Remarks**

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

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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
<input type="checkbox"/>	EMS Test S/W	iec.control	EM TEST	5.4.8	-
<input type="checkbox"/>	ULTRA COMPACT SIMULATOR	UCS 500N7	EM TEST	P1608172950	11, 29, 2023
<input type="checkbox"/>	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]**

N/A

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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))

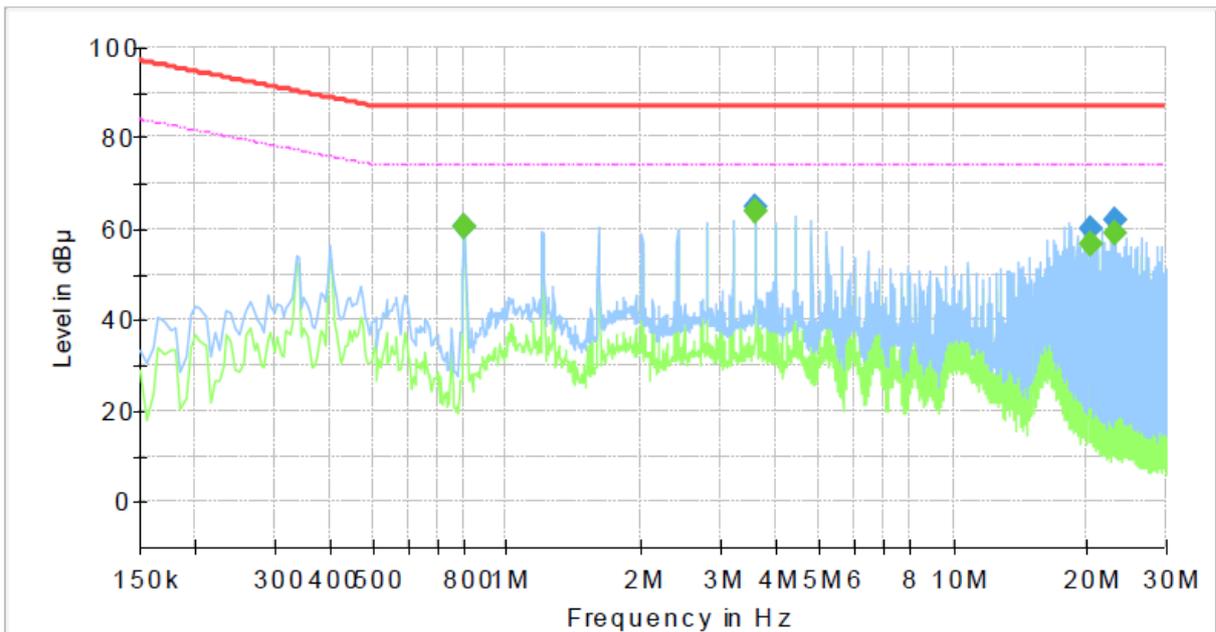
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## Conducted Emissions at Telecommunication Ports [100 Mbps]

### Common Information

Test Description:	Telecommunication Emission
Model No.:	SPA-W100W
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	---	60.47	74.00	13.53	1000.0	9.000	Single Line	20.0
0.800000	60.59	---	87.00	26.41	1000.0	9.000	Single Line	20.0
3.605000	---	63.69	74.00	10.31	1000.0	9.000	Single Line	19.8
3.605000	64.92	---	87.00	22.08	1000.0	9.000	Single Line	19.8
20.260000	---	56.75	74.00	17.25	1000.0	9.000	Single Line	20.0
20.260000	59.79	---	87.00	27.21	1000.0	9.000	Single Line	20.0
23.130000	---	58.85	74.00	15.15	1000.0	9.000	Single Line	20.1
23.130000	61.76	---	87.00	25.24	1000.0	9.000	Single Line	20.1

#### ◆ Calculation

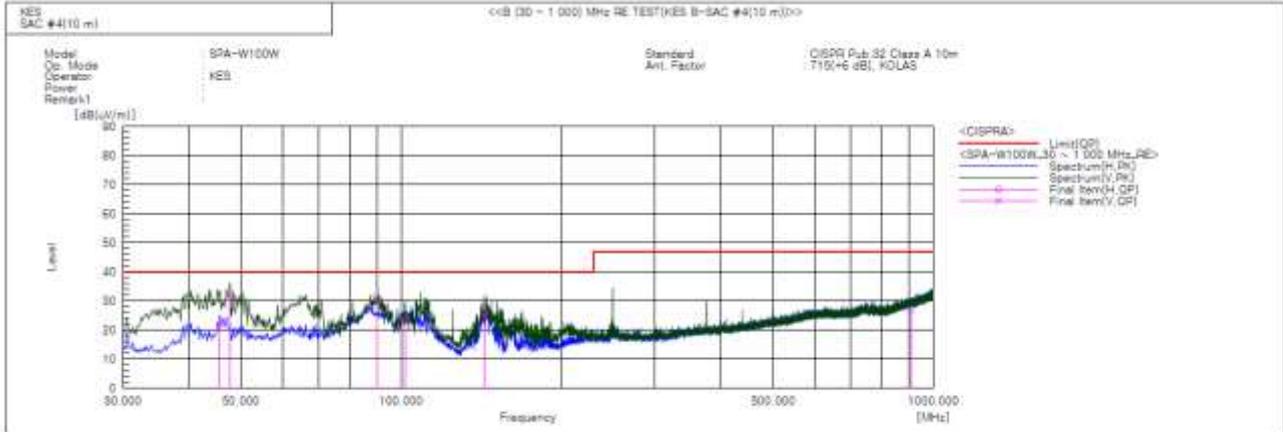
QuasiPeak [dBuV] / CAverage [dBuV] = Reading Value [dBuV] + Corr. [dB]

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)



### 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	45.641	H	42.7	-20.8	21.9	40.0	18.1	341.0	172.0	
2	47.703	V	52.4	-20.6	31.8	40.0	8.2	121.0	27.0	
3	90.383	V	53.3	-23.6	29.7	40.0	10.3	166.0	214.0	
4	101.901	H	45.4	-22.0	23.4	40.0	16.6	391.0	303.0	
5	143.248	H	51.1	-25.0	26.1	40.0	13.9	394.0	35.0	
6	907.971	V	30.6	-3.8	26.8	47.0	20.2	162.0	278.0	

### ◆ 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

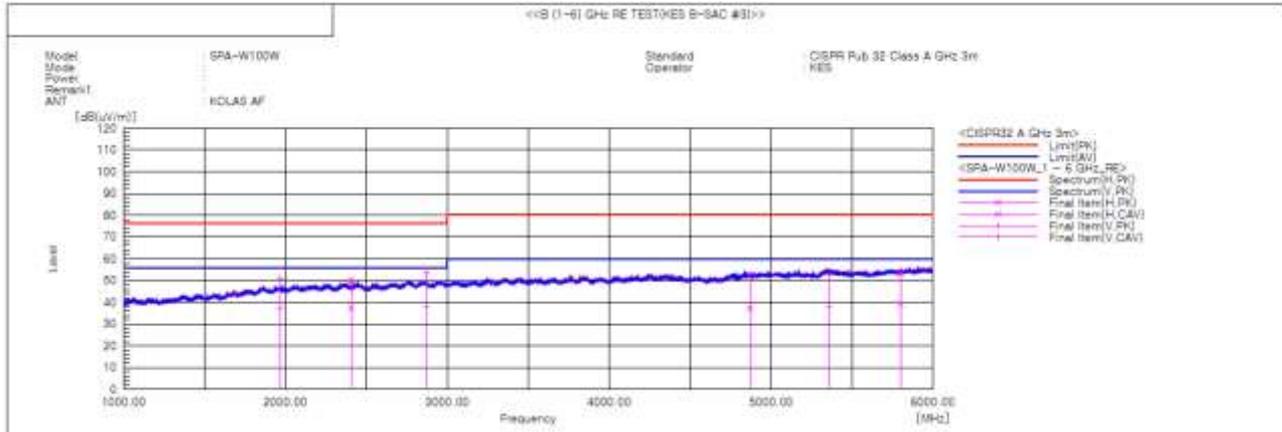
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## Radiated Electric Field Emissions(Above 1 GHz)



### ◆ 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

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

**Average harmonic current results**

Hn	Ieff [A]	% of Limit	Limit [A]	Result
		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.

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Test Data - Harmonics (continued)

**Maximum harmonic current results**

Hn	I <sub>eff</sub> [A]	% of Limit	Limit [A]	Result
		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.

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Test Data - Voltage Fluctuations

Flicker Measurements					
	<b>P<sub>It</sub></b>	<b>Max P<sub>st</sub></b>	<b>Max D<sub>c</sub></b>	<b>Max D<sub>max</sub></b>	<b>Max T<sub>max</sub></b>
<b>Line 1:</b>	N/A				
<b>Limits:</b>					
<b>Results:</b>					

---

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## **APPENDIX B – Test Setup Photos and Configuration**

### **Conducted Emissions at Mains Power Ports**

N/A

---

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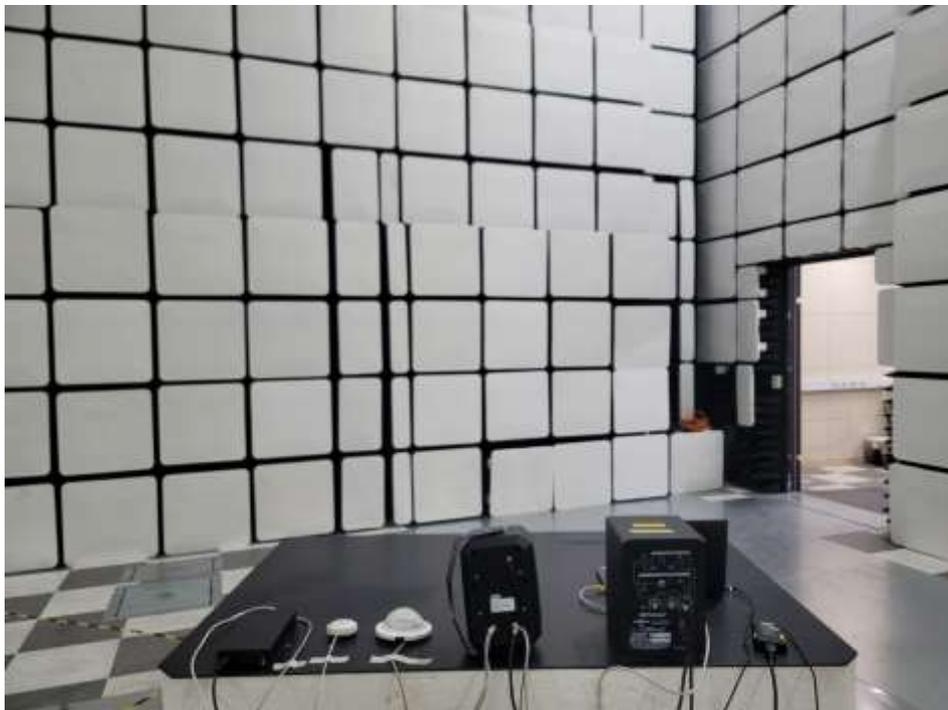
## Conducted Telecommunication Emissions



---

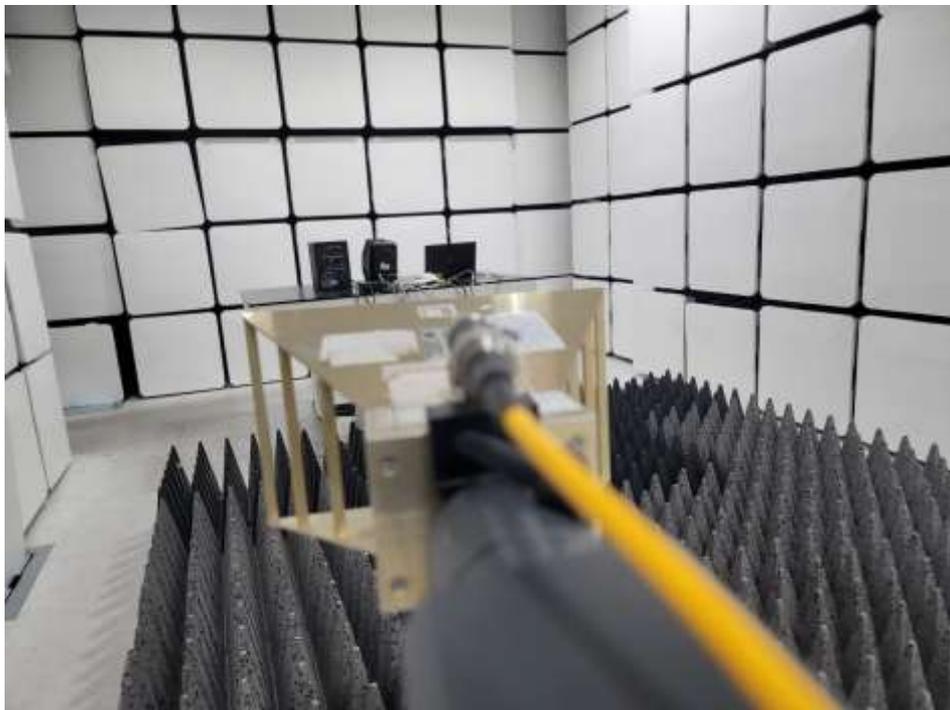
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## Radiated Electric Field Emissions(Below 1 GHz)



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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

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## Electrostatic Discharge



## Radiated Electric Field Immunity



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## Electrical Fast Transients/Bursts



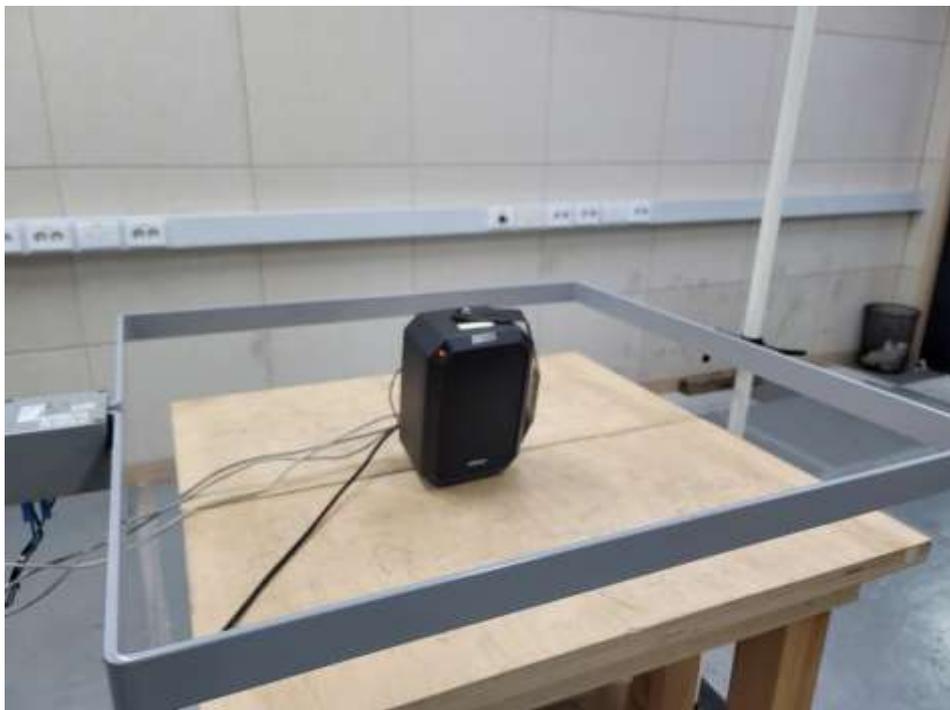
## Surge Transients

N/A

## Conducted Disturbance



## Power Frequency Magnetic Field Immunity



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## Voltage Dips and Short Interruptions

N/A

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## APPENDIX C – EUT Photographs EUT External Photographs

(Top)



(Bottom)



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## EUT Internal Photographs

(Internal View)



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## EUT Internal View – Board 1

(Top)



(Bottom)



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## EUT Internal View – Board 2

(Top)



(Bottom)



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### EUT Internal View – Board 3

(Top)



(Bottom)



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## EUT Internal View – Speaker 1

(Top)



(Bottom)



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## EUT Internal View – Speaker 2

(Top)

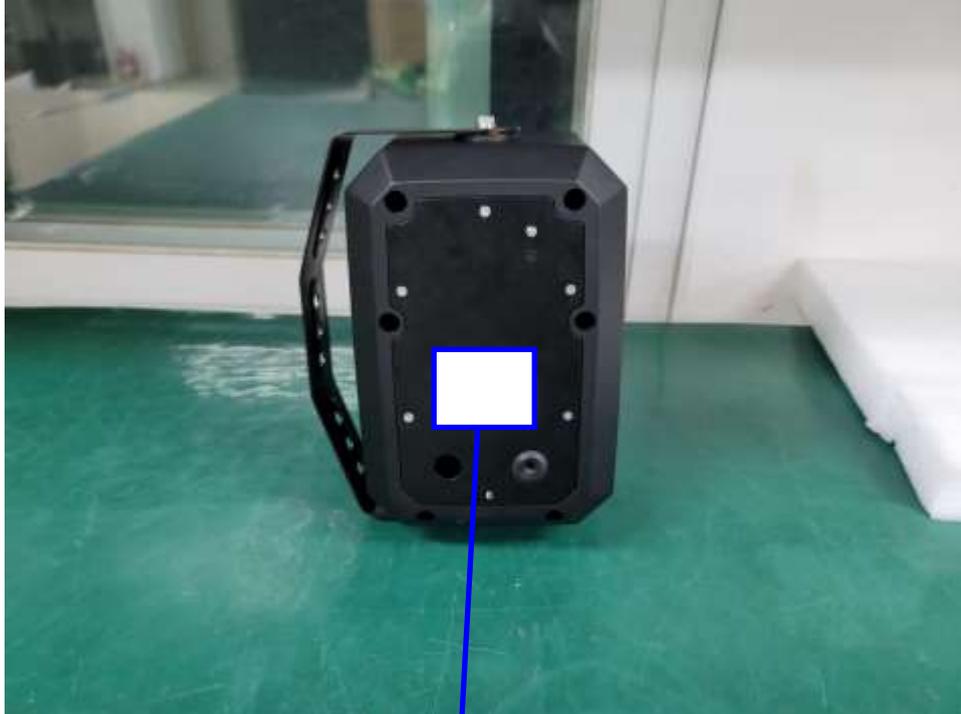


(Bottom)



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## Label and Location



**WALL SPEAKER**

Model No : SPA-W100W

Manufacturer : Inter-M Corporation

Made in Korea

