EVALUATION REPORT

for Certification

Applicant: Ohsung Electronics Co., Ltd.

#181 Gongdan-dong, Gumi-si, Gyeonsangbuk-Do

South Korea

Attn: Mr. Hak Ki, Kim/ General Manager

Date of Issue: Dec. 26, 2023

Order Number: GETEC-C1-23-829

Test Report Number: GETEC-E3-23-090

Test Site: GUMI UNIVERSITY EMC CENTER

CAB Designation Number: KR0033

RESPONSIBLE PARTY	**: Ohsung Electronics Co., Ltd.**
ADDRESS	**: #181 Gongdan-dong, Gumi-si, Gyeongsangbuk-do, South Korea**
CONTACT PERSON	**: Mr. Hak-Ki, Kim / General Manager**

Rule Part(s)	**: FCC Part 15 Subpart C-Intentional Radiator § 15.247**
Test Method	**: ANSI C63.10 (2013)**
Equipment Class	**: Digital Transmission System(DTS)**
EUT Type	**: Remote Controller**
Type of Authority	**: Certification**
Model Name	**: C008-WAL-TFA**

This equipment has been shown to be in compliance with the applicable technical standards as indicated in the measurement report and was tested in accordance with the measurement procedures specified in ANSI C63.10 (2013)

I attest to the accuracy of data. All measurements reported herein were performed by me or were made under my supervision and are correct to the vest of my knowledge and belief. I assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them.

Tested by,

Jong-Wook Park, Senior Engineer
GUMI UNIVERSITY EMC CENTER

Reviewed by,

Hyun Kim, Technical Manager
GUMI UNIVERSITY EMC CENTER

This test report only contains the result of a specific sample supplied by applicant for the testing.
It is not allowed to copy this report even partly without the approval of EMC center

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Version

Test Report No.	Date	Description
GETEC-E3-23-090	Dec. 26, 2023	- First Approval Report

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Scope: *Measurement and determination of electromagnetic emissions (EME) of radio frequency devices including intentional and / or unintentional radiators for compliance with technical rules and regulations of the Federal Communications Commission.*

1. General Information

Applicant: Ohsung Electronics Co., Ltd.

Applicant Address: #181 Gongdan-dong, Gumi-si, Gyeongsangbuk-do, South Korea

Manufacturer: Ohsung Electronics Co., Ltd.

Manufacturer Address: #181 Gongdan-dong, Gumi-si, Gyeongsangbuk-do, South Korea

Contact Person: Mr. Hak ki, Kim/ General Manager

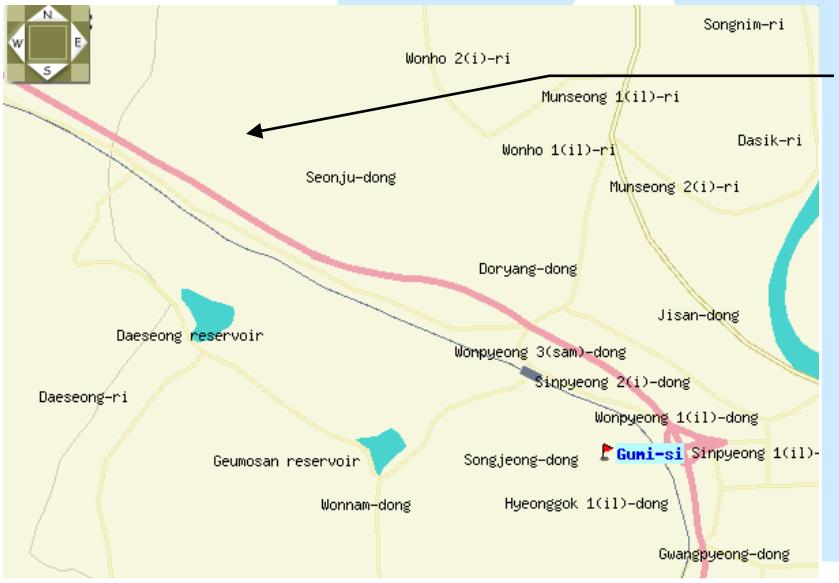
Telephone Number: +82-54-468-7281 **Fax Number: +82-54-461-8368**

- **FCC ID.** OZ5C008
- **Equipment Class** Digital Transmission System (DTS)
- **EUT Type** Remote Controller
- **Model Name** C008-WAL-TFA
- **Rule Part(s)** FCC Part 15 Subpart C-Intentional Radiator § 15.247
- **Test Method** ANSI C63.10 (2013)
- **Type of Authority** Certification
- **Test Procedure(s)** ANSI C63.10 (2013), KDB558074 D01 DTS Meas Guidance v05r02
- **Dates of Test** Dec. 15, 2023 ~ Dec. 18, 2023
- **Place of Test** **GUMI UNIVERSITY EMC CENTER**
  37 Yaeun-ro, Gumi-si, Gyeongsangbuk-do, 730-711, Republic of Korea
  (FCC Test firm Registration No.: 269701)
  (ISED Test Site Registration No.: 7620A)
- **Test Report Number** GETEC-E3-23-090
- **Dates of Issue** Dec. 26, 2023

2. Introduction

The measurement procedure described in American National Standard for Methods of Measurement of Radio-Nose Emissions From Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz (ANSI C63.4-2014) was used in determining radiated and conducted emissions emanating from **Ohsung Electronics Co., Ltd. Remote Controller. (Model name: C008-WAL-TFA)**

These measurement tests were conducted at **GUMI UNIVERSITY EMC CENTER**.
The site address is 37 Yaeun-ro, Gumi-si, Gyeongsangbuk-do, 730-711, South Korea
This test site is one of the highest point of Gumi 1 college at about 200 kilometers away from Seoul city and 40 kilometers away from Daege city. It is located in the valley surrounded by mountains in all directions where ambient radio signal conditions are quiet and a favorable area to measure the radio frequency interference on open field test site for the computing and ISM devices manufactures. The detailed description of the measurement facility was found to be in compliance with the requirements of §2.948 according to ANSI C63.10 (2013)



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Republic of Korea
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Fig 1. The map above shows the Gumi University in vicinity area.

3. Product Information

3.1 Description of EUT

The Equipment under Test (EUT) is the **Ohsung Electronics Co., Ltd. Remote Controller. (Model name: C008-WAL-TFA)**
FCC ID.: OZ5C008

-. Equipment	: Remote Controller
-. Model name	: C008-WAL-TFA
-. Brand name	: Ohsung Electronics Co., Ltd.
-. Serial number	: Proto type
-. Electrical Rating	: DC 3.0 V('AA' Battery x2)
-. Channel Separations	: 2 MHz
-. Type of Modulation	: GFSK
-. Type of Technique	: Bluetooth LE
-. Frequency range	: 2 402 MHz ~ 2 480 MHz
-. Number of channel	: 40
-. Type of chain	: One
-. Antenna specification	: Manufacturer: Ohsung Electronics Co., Ltd. Antenna type : PIFA antenna Peak Gain : 4.85 dBi

3.2 Definition of models

-None.

3.3 Support Equipment / Cables used

3.3.1 Used Support Equipment

Description	Manufacturer	Model Name	S/N & FCC ID.
None.	-	-	S/N: - FCC ID.: -

3.3.2 System configuration

Description	Manufacturer	Model Name	S/N & FCC ID.
None.	-	-	S/N: - FCC ID.: -

3.3.3 Used Cable(s)

Cable Name	Condition	Description
None.	-	-

3.4 Modification Item(s)

-. None

4. Antenna Requirement - §15.203

An intentional radiator antenna shall be designed to ensure that no antenna other than that furnished by the applicant can be used with the device. The use of permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with this requirement.

4.1 Description of Antenna

The **Ohsung Electronics Co., Ltd. Remote Controller.** comply with the requirement of §15.203 with a built-in PCB pattern antenna permanently attached to the transmitter.

5. Description of tests

5.1 Test Condition

The EUT was installed, arranged and operated in a manner that is most representative of equipment as typically used.

The measurements were carried out while varying operating modes and cable positions within typically arrangement to determine maximum emission level.

The representative and worst test mode(s) were noted in the test report.

- Test Voltage / Frequency: 3 V / DC

- Operating condition during the test(s) :
  -. Continuous RF transmitting mode with maximum RF output power.
  -. Operating channel frequency and moderation technology

Mode	Available channel	Frequency	Type of Modulation
Bluetooth LE	0~39	2402 ~ 2480 MHz	GFSK

-. EUT set condition (Test Software)

Test Software	EMI TEST
Test Software version	1.5

6. References Standards

- FCC Part 15 (2009) Subpart C-Intentional Radiator §15.247
- ANSI C 63.10 (2013): American National Standard for Testing Unlicensed Wireless Devices
- KDB 558074 D01 DTS meas Guidance v05r02: Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247

8. SUMMARY OF TEST RESULTS

FCC Part Section(s)	Test Description	Test Result
§15.247(a)(2)	6 dB Bandwidth	N/A[1)]
§15.247(b)(3)	Conducted Maximum Peak Output Power	N/A[1)]
§15.247(e)	Power Spectral Density	N/A[1)]
§15.247(d)	Conducted Out of Band Emission Emissions	N/A[1)]
§15.207(a)	AC Power line Conducted Emissions	N/A[2)]
§15.205, 15.209	Radiated Spurious Emissions	Pass
§15.247(d), 15.205, 15.209	Radiated Restricted Band Edge	N/A[1)]

Note)

1) The EUT has changed non-transmitter parts. Therefore the test was not applicable.
2) The EUT is supplied power from battery. Therefore the test was not applicable.

9. Radiated Spurious

Exploratory Radiated measurements were conducted at the 3m semi anechoic chamber in order to identify the highest emission by operating the EUT in a range of typical modes of operation, cable positions, system configuration and arrangement.
Based on exploratory measurements, the final measurements were conducted at the worst test conditions.

Final measurements of below 1GHz were made at 3m or 10 m Chamber that complies with CISPR 16/ANSI C63.10.
Above 1GHz final measurements were conducted at the 3m Chamber only.

For measurements above 1GHz, the bottom side of 3m chamber was installed with absorbers in order to meet SVSWR Limit.
Exploratory measurements were scanned using Peak mode of EMI Test receiver and final measurements were measured with Quasi-Peak mode (Below 1GHz) and Peak & Average mode (Above 1GHz).

The measurements were performed by rotating the EUT 360° and adjusting the receive antenna height from 1.0 m to 4.0 m. All frequencies were investigated in both horizontal and vertical antenna polarity.

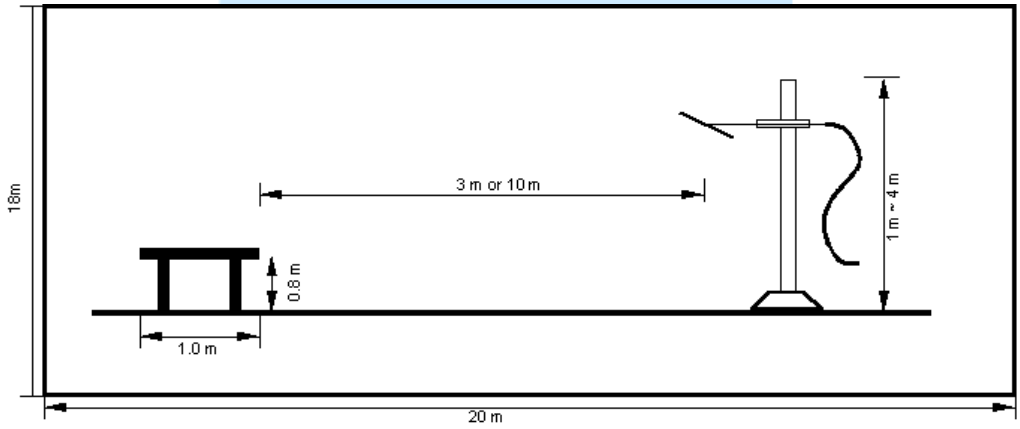

Fig 3. Dimensions of test site (Below 1GHz)

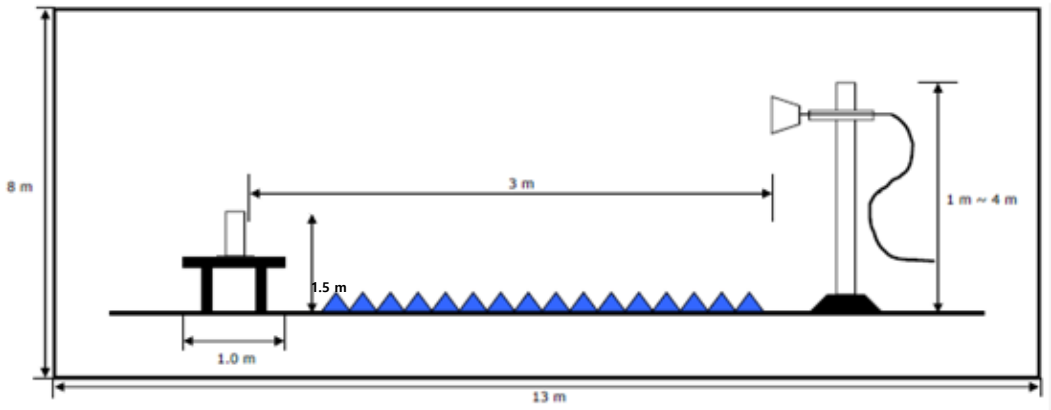

Fig 4. Dimensions of test site (Above 1GHz)

9.1 Operating environment

Temperature : 22.1 ℃
Relative humidity : 37.7 % R.H.

9.2 Test set-up

A preliminary and final measurement was at 3 m anechoic chamber.
The EUT was placed on a non-conducting table.
For emissions testing at or below 1 GHz, the table height is 80 cm above the reference ground plane.
For emission measurements above 1 GHz, the table height is 1.5 m above the reference ground plane.

The turntable with EUT was rotated 360°, and the antenna was varied in height between 1.0 m and 4.0 m in order to determine the maximum emission levels.
This procedure was performed for both horizontal and vertical polarization of the receiving antenna.

9.3 Measurement uncertainty

The measurement uncertainty was calculated in accordance with ISO “Guide to the expression of uncertainty in measurement”.
The measurement uncertainty was given with a confidence of 95 %.

Test items(Anechoic Chamber)	Uncertainty	Remark
Radiated emission (30 MHz ~ 300 MHz, 3 m, Vertical)	4.78 dB	Confidence level of approximately 95 % (k = 2)
Radiated emission (30 MHz ~ 300 MHz, 3 m, Horizontal)	4.77 dB	Confidence level of approximately 95 % (k = 2)
Radiated emission (300 MHz ~ 1 000 MHz, 3 m, Vertical)	6.20 dB	Confidence level of approximately 95 % (k = 2)
Radiated emission (300 MHz ~ 1 000 MHz, 3 m, Horizontal)	5.12 dB	Confidence level of approximately 95 % (k = 2)
Radiated emission (1 000 MHz ~ 6 000 MHz, 3 m, V/H)	4.56 dB	Confidence level of approximately 95 % (k = 2)
Radiated emission (6 000 MHz ~ 18 000 MHz, 3 m, V/H)	4.88 dB	Confidence level of approximately 95 % (k = 2)
Radiated emission (18 000 MHz ~ 26 000 MHz, 3 m, V/H)	5.03 dB	Confidence level of approximately 95 % (k = 2)

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2.
The listed uncertainties are the worst case uncertainty for the entire range of measurement. please note that the uncertainty values are provided for informational purposes only are not used in determining the PASS/FAIL results

9.4 Limit

20 dB in any 100 kHz bandwidth outside the operating frequency band. In case the emission fall within the restricted band specified on 15.205(a) limit in the table below has to be followed.

Frequencies (MHz)	Field Strength (microvolt/meter)	Measurement Distance (meters)
0.009 ~ 0.490	2 400/F (kHz)	300
0.490 ~ 1.705	2 400/F (kHz)	30
1.705 ~ 30.0	30	30
30 ~ 88	100	3
88 ~ 216	150	3
216 ~ 960	200	3
Above 960	500	3

9.5 Test Equipment used

Model Name	Manufacturer	Description	Serial Number	Due to Calibration
■ - ESU40	Rohde & Schwarz	EMI Test Receiver	100266	Apr. 04, 2023
■ - HFH2-Z2	Rohde & Schwarz	Loop Antenna	100041	Apr. 14, 2024
■ - VULB9160	Schwarzbeck	Broadband Test Antenna	3193	Apr. 18, 2024
■ - 3117	ETS LINDGREN	Horn Antenna	218908	Apr. 17, 2024
■ - BBHA9170	Schwarzbeck	Horn Antenna	766	Apr. 17, 2024
■ - MCU066	maturo GmbH	Position Controller	1390306	N/A
■ - TT2.5SI	maturo GmbH	Turntable	1390307	N/A
■ - CO3000	Innco system GmbH	Position Controller	CO3000/1804/4 2760218/P	N/A
■ - MA4640-XP-ET	Innco system GmbH	Antenna Mast	5580916	N/A
■ - 310N	Sonoma Instrument	Amplifier	187164	Apr. 05. 2024
■ - TK-PA18H	TESTEK	Low Noise Amplifier	220107-L	Apr. 06, 2024
■ - TK-PA1840H	TESTEK	Amplifier	170007-L	Apr. 09, 2024
■ - WHKX3.0/18G-10SS	WAINWRIGHT INSTRUMENTS	High pass filter	SN31	Apr. 07, 2023
■- EMC 32	Rohde & Schwarz	Testing Software	VER10.50.10	N/A

9.6 Test data for Radiated Spurious Emission

-. Test Date : Dec. 15 ~ 18, 2023
-. Reference Standard : Part 15 Subpart C, Sec. 15.247(d)
-. Measuring Distance : 3 m
-. Resolution Bandwidth : 200 Hz, 9 kHz(Below 30 MHz) / 120 kHz(30 MHz ~ 1GHz) / 1 MHz(Above 1GHz)
-. Detector mode : Quasi Peak detector mode / Peak detector mode / Average detector mode
-. Power Source : DC 3.0 V
-. Note : Through three orthogonal axes were investigated and the worst case is report

Radiated Spurious Emission (9 kHz to 30 MHz): 2 402 MHz

Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas.Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
0.81	45.84	49.36	2.62	1000	9	100	V	307	19.7

Radiated Spurious Emission (9 kHz to 30 MHz): 2 440 MHz

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas.Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
0.81	46.33	49.32	2.99	1000	9	100	V	317	19.7

Radiated Spurious Emission (9 kHz to 30 MHz): 2 480 MHz

Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas.Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
0.63	47.72	51.55	3.82	1000	9	100	H	214	19.7

Radiated Spurious Emission (30 MHz to 1 000 MHz): 2 402 MHz

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas.Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
876.77	37.27	46.02	8.75	1000	120	181	V	334	-2.5

Radiated Spurious Emission (30 MHz to 1 000 MHz): 2 440 MHz

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas.Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
33.45	29.11	40.00	10.89	1000	120	125	H	325	-18.9

Radiated Spurious Emission (30 MHz to 1 000 MHz): 2 480 MHz

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas.Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
876.71	37.30	46.02	8.72	1000	120	219	H	326	-2.5

Radiated Spurious Emission (1 GHz to 26 GHz): 2 402 MHz

Frequency [MHz]	Pol.	Frequency Component	Reading [dBuV]	Transducer Factor [dB]	Test Result [dBuV/m]	Limits [dBuV/m]	Margin [dB]	Detector Type
4803.50	H	Harmonics	67.17	-1.50	65.67	74.00	8.33	PK
7205.00	H	Harmonics	58.47	3.40	61.87	74.00	12.13	PK
9608.50	H	Harmonics	64.67	3.40	68.07	74.00	5.93	PK
12008.00	H	Harmonics	51.36	11.20	62.56	74.00	11.44	PK

Radiated Spurious Emission (1 GHz to 26 GHz): 2 440 MHz

Frequency [MHz]	Pol.	Frequency Component	Reading [dBuV]	Transducer Factor [dB]	Test Result [dBuV/m]	Limits [dBuV/m]	Margin [dB]	Detector Type
4880.00	V	Harmonics	62.90	-2.00	60.90	74.00	13.10	PK
7320.50	H	Harmonics	56.53	3.80	60.33	74.00	13.67	PK
9760.00	V	Harmonics	64.72	4.20	68.92	74.00	5.08	PK
12201.00	V	Harmonics	53.82	10.30	64.12	74.00	9.88	PK

Radiated Spurious Emission (1 GHz to 26 GHz): 2 480 MHz

Frequency [MHz]	Pol.	Frequency Component	Reading [dBuV]	Transducer Factor [dB]	Test Result [dBuV/m]	Limits [dBuV/m]	Margin [dB]	Detector Type
4960.00	V	Harmonics	63.77	-2.60	61.17	74.00	12.83	PK
7439.50	H	Harmonics	59.40	4.60	64.00	74.00	10.00	PK
9920.00	H	Harmonics	66.30	6.10	72.40	74.00	1.60	PK
12398.50	V	Harmonics	50.12	9.60	59.72	74.00	14.28	PK

Note:
If the maximized peak measured value complies with the average limit, then it is unnecessary to perform an average measurement.
Record the result only if the margin is 10 dB or less.
Test Result = Reading + Transducer Factor
Where, Transducer Factor = Cable loss + Preamplifier gain + Antenna factor + High Pass Filter
Pol.: H(Horizontal), V(Vertical)

10. Sample Calculations

$$dB\mu V = 20 \text{ Log } {}_{10}(\mu V/m)$$
$$dB\mu V = dBm + 107$$
$$\mu V = 10^{(dB\mu V/20)}$$

10.1 Example 1 :

■ **20.3 MHz**

Class B Limit = 250 μV = 48 dBμV

Reading = 39.2 dBμV

$10^{(39.2dB\mu V/20)}$ = 91.2 μV

Margin = 48 dBμV - 39.2 dBμV

= 8.8 dB

10.2 Example 2 :

■ **66.7 MHz**

Class B Limit = 100 μV/m = 40.0 dBμV/m

Reading = 31.0 dBμV

Antenna Factor + Cable Loss = 5.8 dB

Total = 36.8 dBμV/m

Margin = 40.0 dBμV/m – 36.8 dBμV/m

= 3.2 dB

11. Recommendation & Conclusion

The data collected shows that the **Ohsung Electronics Co., Ltd. Remote Controller (Model Name: C008-WAL-TFA)** was complies with §15.247 of the FCC Rules.

- The end -