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TEST REPORT

EMI Test for FCC Certification of LCWB-005EA Model

APPLICANT

LG Electronics Inc.

REPORT NO.

HCT-EM-2312-FC002-R1

DATE OF ISSUE

January 16, 2024

Tested by

Hyun-Jin Lim



(signature)

Technical Manager

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Accredited by KOLAS, Republic of KOREA

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<h1 style="margin: 0;">TEST REPORT</h1> <p style="margin: 0;">EMI Test for FCC Certification</p>	<p>REPORT NO. HCT-EM-2312-FC002-R1</p> <p>DATE OF ISSUE January 16, 2024</p> <p>FCC ID. BEJ-LCWB005EA</p>
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	Applicant	LG Electronics Inc. 170, SeongsanPachong-ro, Seongsan-gu, Changwon-si, Gyeongsangnam-do 51533, Republic of Korea
	Product Name	RF Module
	Model Name	LCWB-005EA
	Date of Test	November 21, 2023
	Location of Test	<input checked="" type="checkbox"/> Permanent Testing Lab <input type="checkbox"/> On Site Testing (Address: See clause 1.5)
	Test Standard Used	FCC CFR 47 PART 15 Subpart B Class B ANSI C63.4-2014
	Test Results	Refer to the present document
	Manufacturer	LG Electronics Inc.
	Trade Name	LG

REVISION HISTORY

The revision history for this test report is shown in table.

Revision No.	Date of Issue	Description
0	December 06, 2023	Initial Release
1	January 16, 2024	Changed the FCC certification classification. Before: FCC SDoC, After: FCC Certification

Notice

Content

The results shown in this test report only apply to the sample(s), as received, provided by the applicant, unless otherwise stated.

The test results have only been applied with the test methods required by the standard(s).

The laboratory is not accredited for the test results marked *.

Information provided by the applicant is marked **.

Test results provided by external providers are marked ***.

When confirmation of authenticity of this test report is required, please contact www.hct.co.kr

The test results in this test report are not associated with the ((KS Q) ISO/IEC 17025) accreditation by KOLAS (Korea Laboratory Accreditation Scheme) that are under the ILAC (International Laboratory Accreditation Cooperation) Mutual Recognition Agreement (MRA).

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1. GENERAL INFORMATION

1.1 Description of EUT

FCC ID.	BEJ-LCWB005EA
Product Name	RF Module
Model Name	LCWB-005EA
Frequency Range	2 402 MHz to 2 480 MHz (Bluetooth) 2 412 MHz to 2 462 MHz (WiFi 2.4 GHz)
Rated Voltage	DC 5 V, DC 12 V
Manufacturer	LG Electronics Inc.

1.2 Tested System Details

All equipment descriptions used in the tested system (including inserted cards) are:

Device Type	Model Name	Serial Number	Manufacturer
RF Module	LCWB-005EA	-	LG Electronics Inc.
External antenna	-	-	Shenzhen feixun Wireless technology Co., Ltd
JIG Board	-	-	LG Electronics Inc.
DC Power Supply	PWS-3003D	04050810	Protek

1.3 Cable Description

Product Name	Port	Power Cord Shielded (Y/N)	I/O Cable Shielded (Y/N)	Length (m)
EUT	8 pin	N	N	(P,D) 0.16
	1 pin	N	N	(D) 0.45
Jig Board	GND	N	N	(P) 0.3
DC Power Supply	AC IN	N	N	(P) 1.8

“(D)” data cable and “(P)” power cable.

1.4 Noise Suppression Parts on Cable (I/O Cable)

Product Name	Port	Ferrite Bead (Y/N)	Location	Metal Hood (Y/N)	Location
EUT	8 pin	N	N/A	N	N/A
	1 pin	N	N/A	N	N/A
Jig Board	GND	N	N/A	N	N/A
DC Power Supply	AC IN	N	N/A	N	N/A

1.5 Test Facility

Test site is located at 74, Seoicheon-ro 578beon-gil, Majang-myeon, Icheon-si, Gyeonggi-do, Korea.

Those measurement facilities are constructed in conformance with the requirements of ANSI C63.4-2014.

The Normalized site attenuations (30 MHz to 1 GHz) and Site validation (1 GHz to 18 GHz) were performed in accordance with the standard in ANSI C63.4-2014 and ANSI C63.4a-2017

Our laboratories are accredited and designated in accordance with the provisions of Radio Waves ACT and International Standard ISO/IEC 17025:2017. (National Radio Research Agency, CABID No. KR0032)

1.6 Calibration of Measuring Instrument

The measuring equipment, which was utilized in performing the tests documented herein, has been calibrated in accordance with the manufacturers recommendations for utilizing calibration equipment, which is traceable to recognized national standards.

Especially, all antenna for measurement is calibrated in accordance with the requirements of C63.5:2017

1.7 Measurement Uncertainty

The measurement uncertainties shown below were calculated in accordance with the requirements of ANSI C63.4-2014. All measurement uncertainty values are shown with a coverage factor of $k = 2$ to indicate a 95 % level of confidence. The measurement data shown herein meets or exceeds the U_{CISPR} measurement uncertainty values specified in CISPR 16-4-2 and, thus, can be compared directly to specified limits to determine compliance.

Parameter	Test Site	Expanded Uncertainty
Radiated Emission (30 MHz to 1 GHz)	3 m Semi Anechoic Chamber #1	5.8 dB
Radiated Emission (1 GHz to 18 GHz)	3 m Semi Anechoic Chamber #1	4.8 dB

2. DESCRIPTION OF TESTING

2.1 Measurement of Conducted Emission

The test procedure was in accordance with ANSI C63.4-2014, Clause 7.3

a. The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN).

If the EUT is connected to the PC through USB, the AC power-line adapter of the PC is directly connected to a line impedance stabilization network (LISN).

Other support units were connected to the power mains through another LISN. The two LISNs provide 50 Ohm/ 50uH of coupling impedance for the measuring instrument.

b. Both conducted lines are measured in Quasi-Peak and Average mode, including the worst-case data points for each tested configuration.

c. The frequency range from 150 kHz to 30 MHz was searched.

Conducted Emission Limits

Frequency (MHz)	Resolution Bandwidth (kHz)	Class A		Class B	
		Quasi-Peak (dB μ V)	Average (dB μ V)	Quasi-Peak (dB μ V)	Average (dB μ V)
0.15 to 0.5	9	79	66	66 to 56*	56 to 46*
0.5 to 5	9	73	60	56	46
5 to 30	9	73	60	60	50

NOTE. Decreases with the logarithm of the frequency.

2.2 Measurement of Radiated Emission

The test procedure was in accordance with ANSI C63.4-2014, Clause 8.3

- a. The EUT was placed on the top of a turn table 0.8 meters above the ground at a semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The EUT was set 3 m away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c. The antenna height is varied from 1 m to 4 m above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 m to 4 m and the turn table was turned from 0 degrees to 360 degrees to find the maximum reading.
- e. The test-receiver system was set to Quasi-Peak detect function and specified bandwidth with maximum hold mode when the test frequency is below 1 GHz.
- f. The test-receiver system was set to Peak and Average detect function and specified bandwidth with maximum hold mode when the test frequency is above 1 GHz.
- g. Place the measurement antenna away from each area of the EUT determined to be a source of emissions at the specified measurement distance, while keeping the measurement antenna aimed at the source of emissions at each frequency of significant emissions, with polarization oriented for maximum response. (1 GHz to 40 GHz)

Radiated Emission Limits

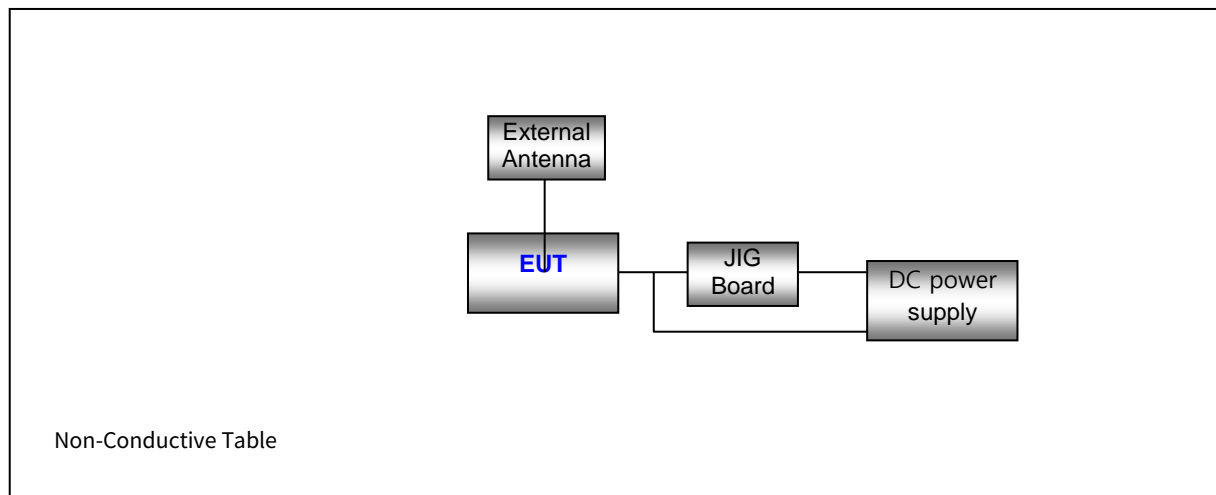
Frequency (MHz)	Class A			Class B		
	Antenna Distance (m)	Field Strength ($\mu\text{V/m}$)	Quasi-Peak (dB $\mu\text{V/m}$)	Antenna Distance (m)	Field Strength ($\mu\text{V/m}$)	Quasi-Peak (dB $\mu\text{V/m}$)
30 to 88	10	90	39.0	3	100	40.0
88 to 216	10	150	43.5	3	150	43.5
216 to 960	10	210	46.4	3	200	46.0
Above 960	10	300	49.5	3	500	54.0
Frequency (MHz)	Antenna Distance (m)	Class A		Class B		
		Peak (dB $\mu\text{V/m}$)	Average (dB $\mu\text{V/m}$)	Peak (dB $\mu\text{V/m}$)	Average (dB $\mu\text{V/m}$)	
Above 1 000	3	80	60	74	54	

Frequency Range of Radiated Measurements

An unintentional radiator, including a digital device, the spectrum shall be investigated from the lowest radio frequency signal generated or used in the device, without going below the lowest frequency for which a Radiated Emission limit is specified, up to the frequency shown in the following table

Highest frequency generated or used in the device or on which the device operates or tunes (MHz)	Upper frequency of measurement range (MHz)
Below 1.705	30
1.705 to 108	1 000
108 to 500	2 000
500 to 1 000	5 000
Above 1 000	5th harmonic of the highest frequency or 40 GHz, whichever is lower

2.3 Configuration of Tested System



3. OPERATION OF THE EUT

During preliminary test and final tests, the following operating mode was investigated.
It was tested the following operating mode, after connecting all peripheral devices.;

Operating Modes: [Input voltage: 5 V] Idle mode
[Input voltage: 12 V] Idle mode

4. MEASURING INSTRUMENTS

Type	Model Name	Manufacturer	Serial Number	Calibration Cycle	Next Calibration Date
Conducted emission					
<input type="checkbox"/>	EMI Test Receiver	ESR7	Rohde & Schwarz	101910	1 year 05.26.2024
<input type="checkbox"/>	LISN	ENV216	Rohde & Schwarz	102245	1 year 08.02.2024
<input type="checkbox"/>	LISN	ENV216	Rohde & Schwarz	100073	1 year 05.11.2024
<input type="checkbox"/>	Software	EMC32	Rohde & Schwarz	-	-
Radiated emission below 1 GHz					
<input checked="" type="checkbox"/>	EMI Test Receiver	ESU40	Rohde & Schwarz	100524	1 year 05.09.2024
<input checked="" type="checkbox"/>	Bilog Antenna	VULB9168	Schwarzbeck	255	2 year 03.10.2025
<input checked="" type="checkbox"/>	Antenna master	MA4640-XP-ET	INNCO SYSTEM	-	N/A -
<input checked="" type="checkbox"/>	Antenna master controller	CO3000	INNCO SYSTEM	CO3000/870 /35990515/L	N/A -
<input checked="" type="checkbox"/>	Turn Table	1060	INNCO SYSTEM	-	N/A -
<input checked="" type="checkbox"/>	Turn Table controller	CO2000	INNCO SYSTEM	CO2000/095 /7590304/L	N/A -
<input checked="" type="checkbox"/>	DC Power Supply	PWS-3003D	PROTEK	04050810	1 year 11.10.2024
<input checked="" type="checkbox"/>	Software	EMC32	Rohde & Schwarz	-	-
Radiated emission above 1 GHz					
<input checked="" type="checkbox"/>	EMI test receiver	ESU40	Rohde & Schwarz	100524	1 year 05.09.2024
<input checked="" type="checkbox"/>	Horn Antenna	BBHA 9120D	Schwarzbeck	01836	1 year 07.21.2024
<input checked="" type="checkbox"/>	Power Amplifier	TK-PA18H	TESTEK	170034-L	1 year 11.01.2024
<input checked="" type="checkbox"/>	Antenna master	MA4640-XP-ET	INNCO SYSTEM	-	N/A -
<input checked="" type="checkbox"/>	Antenna master controller	CO3000	INNCO SYSTEM	CO3000/870/ 35990515/L	N/A -
<input checked="" type="checkbox"/>	Turn Table	1060	INNCO SYSTEM	-	N/A -
<input checked="" type="checkbox"/>	Turn Table controller	CO2000	INNCO SYSTEM	CO2000/095/ 7590304/L	N/A -
<input type="checkbox"/>	Horn Antenna	BBHA 9170	Schwarzbeck	BBHA 9170 #786	1 year 11.01.2024
<input type="checkbox"/>	Power Amplifier	TK-PA1840H	TESTEK	170030-L	1 year 02.22.2024
<input checked="" type="checkbox"/>	DC Power Supply	PWS-3003D	PROTEK	04050810	1 year 11.10.2024
<input checked="" type="checkbox"/>	Software	EMC32	Rohde & Schwarz	-	-

5. EMISSION TEST SUMMARY

5.1 Conducted Emission (Not Applicable)

5.1.1 Operating Condition

The test results of conducted emission at mains ports provide the following information:

Test Standard Used	FCC CFR 47 PART 15 Subpart B Class B ANSI C63.4-2014
Power Supply	AC 120 V, 60 Hz
Frequency Range	150 kHz to 30 MHz
Detector	Quasi-Peak, CISPR-Average
Bandwidth	9 kHz (6 dB)
Test Site	EMI Shielded Room
Temperature	min. - °C / max. - °C
Relative Humidity	min. - % / max. - %
Test Date	-

A Conducted emission is calculated by the following equation.;

Calculation Formula: $Corr. = LISN\ Factor + Cable\ Loss$
 $QuasiPeak\ or\ CAverage = Receiver\ Reading + Corr.$
 $Margin = Limit - QuasiPeak\ or\ CAverage$
 *Conductor L1 = Live, Conductor N = Neutral

5.1.2 Measuring Data

Not Applicable

NOTE. Since the module is supplied with DC power, the test is not applicable.

5.2 Radiated Emission Below 1 GHz

5.2.1 Operating Condition

The test results of radiated emission provide the following information:

Used Test Standard	FCC CFR 47 PART 15 Subpart B Class B ANSI C63.4-2014
Power Supply	DC 5V, DC 12V
Frequency Range	30 MHz to 1 000 MHz
Detector	Quasi-Peak
Bandwidth	120 kHz (6 dB)
Measurement Distance	3 m
Antenna Height	1 m to 4 m
Antenna Polarity	Horizontal, Vertical
Test Site	3 m Semi Anechoic Chamber #1
Temperature	min. 20.0 °C, max. 22.4 °C
Relative Humidity	min. 35.5 %, max. 41.9 %
Test Date	November 21, 2023

A field strength is calculated by the following equation.;

$$\begin{aligned} \text{Calculation Formula: } \quad & \text{QuasiPeak} = \text{Reading (Receiver Reading)} + \text{Corr.} \\ & \text{Corr. (Correction Factor)} = \text{Antenna Factor} + \text{Cable Loss} \\ & \text{Margin} = \text{Limit} - \text{QuasiPeak} \end{aligned}$$

5.2.2 Measuring Data

[Input voltage: 5 V] Idle mode

Frequency (MHz)	QuasiPeak (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Height (cm)	Polarization (H/V)	Azimuth (deg)	Corr. (dB)
84.4960	27.63	40.00	12.37	206.8	V	252.0	15.0
98.9769	29.04	43.50	14.46	205.8	H	44.0	15.2
188.9620	30.85	43.50	12.65	184.8	H	88.0	17.7
251.4371	34.94	46.00	11.06	109.7	H	82.0	19.0
267.5321	33.82	46.00	12.18	100.0	H	77.0	19.5
950.5715	32.21	46.00	13.79	325.3	H	244.0	32.2

[Input voltage: 12 V] Idle mode

Frequency (MHz)	QuasiPeak (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Height (cm)	Polarization (H/V)	Azimuth (deg)	Corr. (dB)
84.6430	28.83	40.00	11.17	385.8	H	32.0	15.0
90.1755	32.06	43.50	11.44	116.9	V	215.0	14.6
192.3180	36.69	43.50	6.81	125.1	H	94.0	17.5
331.1938	39.09	46.00	6.91	100.0	H	205.0	21.2
416.6006	37.74	46.00	8.26	100.0	H	308.0	23.5
954.7808	32.24	46.00	13.76	125.0	H	326.0	32.2

5.3 Radiated Emission Above 1 GHz

5.3.1 Operating Condition

The test results of radiated emission provide the following information:

Used Test Standard	FCC CFR 47 PART 15 Subpart B Class B ANSI C63.4-2014
Power Supply	DC 5V, DC 12V
Detector	Peak, CISPR-Average
Bandwidth	1 MHz
Highest Frequency	2 480 MHz
Tested Frequency Range	1 GHz to 18 GHz
Measurement Distance	3 m
Antenna Height	1 m to 4 m
Antenna Polarity	Horizontal, Vertical
Test Site	3 m Semi Anechoic Chamber #1
Temperature	min. 20.0 °C, max. 22.4 °C
Relative Humidity	min. 35.5 %, max. 41.9 %
Test Date	November 21, 2023

A field strength is calculated by the following equation.;

Calculation Formula: $\text{Peak or CAverage} = \text{Reading (Receiver Reading)} + \text{Corr.}$
 $\text{Corr. (Correction Factor)} = \text{Antenna Factor} + \text{Cable Loss} - \text{Amplifier Gain}$
 $\text{Margin} = \text{Limit} - \text{Peak or CAverage}$

5.3.2 Measuring Data

[Input voltage: 5 V] Idle mode

Frequency (MHz)	MaxPeak (dB μ V/m)	CAverage (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Height (cm)	Pol (H/V)	Azimuth (deg)	Corr. (dB)
5015.7100	---	24.72	54.00	29.28	201.5	V	303.0	-17.5
5015.7100	36.89	---	74.00	37.11	201.5	V	303.0	-17.5
7471.0350	42.27	---	74.00	31.73	109.5	V	102.0	-10.1
7471.0350	---	29.60	54.00	24.40	109.5	V	102.0	-10.1
9648.0350	50.11	---	74.00	23.89	105.6	H	61.0	-7.5
9648.0350	---	44.88	54.00	9.12	105.6	H	61.0	-7.5
13456.9100	---	33.30	54.00	20.70	125.2	H	345.0	-2.3
13456.9100	45.73	---	74.00	28.27	125.2	H	345.0	-2.3
14554.9450	47.49	---	74.00	26.51	112.5	H	190.0	0.0
14554.9450	---	34.76	54.00	19.24	112.5	H	190.0	0.0
17999.2417	54.26	---	74.00	19.74	400.0	H	232.0	10.8
17999.2417	---	41.78	54.00	12.22	400.0	H	232.0	10.8

[Input voltage: 12 V] Idle mode

Frequency (MHz)	MaxPeak (dB μ V/m)	CAverage (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Height (cm)	Pol (H/V)	Azimuth (deg)	Corr. (dB)
5019.4900	37.29	---	74.00	36.71	309.8	H	40.0	-17.5
5019.4900	---	24.90	54.00	29.10	309.8	H	40.0	-17.5
7373.0150	---	29.78	54.00	24.22	400.0	V	234.0	-10.4
7373.0150	41.99	---	74.00	32.01	400.0	V	234.0	-10.4
9790.1000	---	31.70	54.00	22.30	325.0	V	91.0	-7.2
9790.1000	44.68	---	74.00	29.32	325.0	V	91.0	-7.2
13294.5500	44.71	---	74.00	29.29	108.5	V	276.0	-2.7
13294.5500	---	32.45	54.00	21.55	108.5	V	276.0	-2.7
14509.1500	47.54	---	74.00	26.46	397.7	V	255.0	0.0
14509.1500	---	35.21	54.00	18.79	397.7	V	255.0	0.0
17966.2950	53.35	---	74.00	20.65	274.7	H	37.0	10.3
17966.2950	---	41.35	54.00	12.65	274.7	H	37.0	10.3

6. APPENDIX A. TEST SETUP PHOTO

Please refer to Appendix. A and test setup photo file no. as follows;

File No.	Date of Issue	Description
HCT-EM-2312-FC002-P	December 06, 2023	Initial Release

End of report