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TEST REPORT

EMI Test for FCC SDoC of LCWB-002EA Model

APPLICANT
LG Electronics Inc.

REPORT NO.
HCT-EM-2303-FC006

DATE OF ISSUE
March 31, 2023

Tested by
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(signature)

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Accredited by KOLAS, Republic of KOREA

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TEST REPORT

EMI Test for
FCC SDoC

REPORT NO.

HCT-EM-2303-FC006

DATE OF ISSUE

March 31, 2023

FCC ID.

BEJ-LCWB002EA

Applicant

LG Electronics Inc.

170, Seongsanpaechong-ro, Seongsan-gu, Changwon-si
Gyeongsangnam-do 51533 Republic of Korea

Product Name

RF Module

Model Name

LCWB-002EA

Date of Test

March 23, 2023 to March 28, 2023

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.

The result shown in this test report refer only to the sample(s) tested unless otherwise stated.

This test results were applied only to the test methods required by the standard.
This laboratory is not accredited for the test results marked *.



REVISION HISTORY

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

Revision No.	Date of Issue	Description
0	March 31, 2023	Initial Release

The above Test Report is the accredited test result by (KS Q) ISO/IEC 17025 and KOLAS(Korea Laboratory Accreditation Scheme), which signed the ILAC-MRA. (KOLAS Accreditation No. KT197)

If this report is required to confirmation of authenticity, please contact to www.hct.co.kr



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1. GENERAL INFORMATION

1.1 Description of EUT

The EUT is RF Module.

FCC ID	BEJ-LCWB002EA
Model Name	LCWB-002EA
Product Name	RF Module
Frequency Range	Bluetooth: 2 402 MHz to 2 480 MHz WiFi: 2 412 MHz to 2 462 MHz
Operating Voltage	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:

Product Name	Model Name	Serial Number	Manufacturer
RF Module	LCWB-002EA	-	LG Electronics Inc.
Antenna	-	-	LG Electronics Inc.

NOTE. AD/DC Adapter is not enclosed with EUT.

AC/DC Adapter details.

Input: AC 100~240 V, 50/60 Hz, 0.3 A, Output: DC 12 V, 1.0 A



1.3 Cable Description

Product Name	Port	Power Cord Shielded (Y/N)	I/O Cable Shielded (Y/N)	Length (m)
EUT	4 PIN	N	N/A	(P) 0.2
	Antenna	N/A	N	(D) 0.2

"(D)" Data cable, "(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	4 PIN	N	N/A	N	N/A
	Antenna	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, South 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.

Test Item	Test Site (Chamber)	Expanded Uncertainty
Conducted Emission (0.15 MHz to 30 MHz)	EMI Shield Room	N/A
Radiated Emission (30 MHz to 1 GHz)	3 m Semi Anechoic Chamber #1	5.9 dB
Radiated Emission (1 GHz to 18 GHz)	3 m Semi Anechoic Chamber #1	4.8 dB

2. DESCRIPTION OF TEST

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 $50\ \Omega$ / $50\ \mu\text{H}$ 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

- 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.
- The EUT was set 3 m away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- 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.
- 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.
- 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.
- 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.
- 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

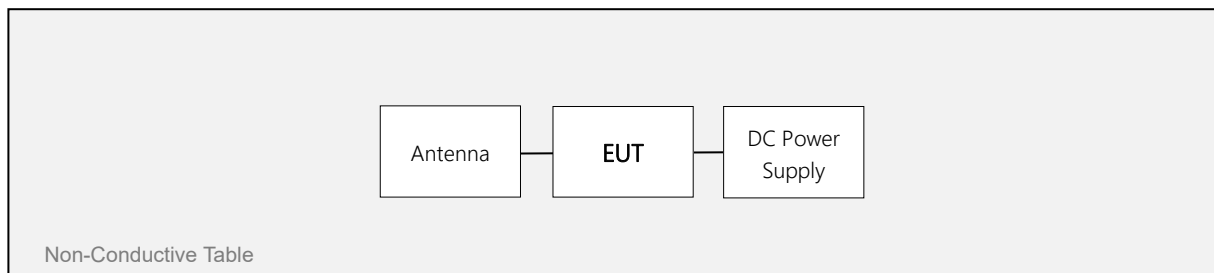
Frequency (MHz)	Class A			Class B		
	Antenna Distance (m)	Field Strength (μV/m)	Quasi-Peak (dBμV/m)	Antenna Distance (m)	Field Strength (μV/m)	Quasi-Peak (dBμV/m)
30 to 88	10	90	39.0	3	100	40.0
88 to 216	10	150	43.5	3	150	43.5
216 to 960	10	210	46.4	3	200	46.0
Above 960	10	300	49.5	3	500	54.0
Frequency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

2.2.1 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.

3.1 Conducted Emission

It was tested the following operating mode, after connecting all peripheral devices.

Operating Mode: Not applicable

3.2 Radiated Emission

It was tested the following operating mode, after connecting all peripheral devices.

Operating Mode: [Input voltage: 5 VDC] IDLE mode
[Input voltage: 12 VDC] IDLE mode

4. CONDUCTED EMISSION AND RADIATED EMISSION TEST SUMMARY

4.1 Conducted Emission (Not Applicable)

4.1.1 Measuring instruments

Type	Model Name	Manufacturer	Serial Number	Calibration Cycle	Calibration Date
<input type="checkbox"/> EMI Test Receiver	ESR7	Rohde & Schwarz	101910	1 year	06.07.2022
<input type="checkbox"/> LISN	ENV216	Rohde & Schwarz	102245	1 year	08.22.2022
<input type="checkbox"/> LISN	ENV216	Rohde & Schwarz	100073	1 year	05.12.2022
<input type="checkbox"/> Software	EMC32	Rohde & Schwarz	-	-	-

4.1.2 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
Frequency Range	0.15 MHz to 30 MHz
Detector	Quasi-Peak, CISPR-Average
Bandwidth	9 kHz (6 dB)
Test Site	EMI Shield Room
Temperature	min. - °C / max. - °C
Relative Humidity	min. - % / max. - %
Test Date	-

- Calculation Formula:
1. Conductor L1 = Hot, Conductor N = Neutral
 2. Corr. = LISN Factor + Cable Loss
 3. QuasiPeak or CAverage= Receiver Reading + Corr.
 4. Margin = Limit – QuasiPeak or CAverage



4.1.3 Measuring Data

Not applicable



4.2 Radiated Emission Below 1 GHz

4.2.1 Measuring instruments

Type	Model Name	Manufacturer	Serial Number	Calibration Cycle	Calibration Date
3 m Semi Anechoic Chamber #1					
<input checked="" type="checkbox"/> EMI Test Receiver	ESU40	Rohde & Schwarz	100524	1 year	05.10.2022
<input checked="" type="checkbox"/> Bilog Antenna	VULB9168	Schwarzbeck	255	2 year	03.10.2023
<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"/> Software	EMC32	Rohde & Schwarz	-	-	-
<input checked="" type="checkbox"/> DC Power Supply	PWS-3003D	PROTEK	04050810	1 year	10.25.2022

4.2.2 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
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
Test Site	3 m Semi Anechoic Chamber #1
Temperature	min. 22.1 °C / max. 23.8 °C
Relative Humidity	min. 27.5 % / max. 32.9 %
Test Date	March 23, 2023 ~ March 28, 2023

Calculation Formula:

1. POL. H = Horizontal, POL. V = Vertical
2. QuasiPeak = Reading (Receiver Reading) + Corr.
3. Corr. (Correction Factor) = Antenna Factor + Cable Loss
4. Margin = Limit - QuasiPeak

4.2.3 Measuring Data

Figure 1: Radiated Emission (30 to 1 000) MHz, [Input voltage: 5 VDC] IDLE mode

Frequency (MHz)	Quasi Peak (dBμV/m)	Antenna Height (cm)	POL. (H/V)	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)
30.6940	19.32	202.9	V	152.0	18.5	20.68	40.00
49.8689	21.20	100.0	V	196.0	20.2	18.80	40.00
159.9797	25.41	174.9	H	30.0	19.7	18.09	43.50
240.0048	25.01	100.0	H	334.0	18.6	20.99	46.00
328.5353	34.89	100.0	H	252.0	21.1	11.11	46.00
816.5838	32.02	100.0	H	155.0	30.6	13.98	46.00

Figure 2: Radiated Emission (30 to 1 000) MHz, [Input voltage: 12 VDC] IDLE mode

Frequency (MHz)	Quasi Peak (dBμV/m)	Antenna Height (cm)	POL. (H/V)	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)
30.7331	20.16	200.7	V	0.0	18.5	19.84	40.00
99.9743	18.81	125.2	V	182.0	15.2	24.69	43.50
159.9716	26.77	184.7	H	10.0	19.7	16.73	43.50
368.7344	30.42	100.0	H	233.0	22.2	15.58	46.00
458.8219	26.91	125.2	V	339.0	24.4	19.09	46.00
952.8782	32.22	318.8	H	18.0	32.1	13.78	46.00



4.3 Radiated Emission Above 1 GHz

4.3.1 Measuring instruments

Type	Model Name	Manufacturer	Serial Number	Calibration Cycle	Calibration Date
3 m Semi Anechoic Chamber #1					
<input checked="" type="checkbox"/> EMI test receiver	ESU40	Rohde & Schwarz	100524	1 year	05.10.2022
<input checked="" type="checkbox"/> Horn Antenna	BBHA 9120D	SCHWARZBECK	01836	1 year	07.21.2022
<input checked="" type="checkbox"/> Low Noise amplifier	TK-PA18H	TESTEK	170034-L	1 year	11.04.2022
<input checked="" type="checkbox"/> Antenna master	MA4640-XP-ET	INNCO Systems	-	N/A	-
<input checked="" type="checkbox"/> Antenna master controller	CO3000	INNCO Systems	CO3000/870/ 35990515/L	N/A	-
<input checked="" type="checkbox"/> Turn table	1060	INNCO Systems	-	N/A	-
<input checked="" type="checkbox"/> Turn table controller	CO2000	INNCO Systems	CO2000/095/ 7590304/L	N/A	-
<input checked="" type="checkbox"/> Software	EMC32	Rohde & Schwarz	-	-	-
<input checked="" type="checkbox"/> DC Power Supply	PWS-3003D	PROTEK	04050810	1 year	10.25.2022

4.3.2 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
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
Test Site	3 m Semi Anechoic Chamber #1
Temperature	min. 22.6 °C / max. 23.8 °C
Relative Humidity	min. 27.5 % / max. 32.5 %
Test Date	March 28, 2023

- Calculation Formula:
1. POL. H = Horizontal, POL. V = Vertical
 2. Peak or CAverage = Reading (Receiver Reading) + Corr.
 3. Corr. (Correction Factor) = Antenna Factor+ Cable Loss –Amplifier Gain
 4. Margin = Limit - Peak or CAverage

4.3.3 Measuring Data

Figure 3: Radiated Emission (1 to 18) GHz, [Input voltage: 5 VDC] IDLE mode

Frequency (MHz)	Peak (dBμV/m)	Antenna Height (cm)	POL. (H/V)	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)
1076.2600	32.77	195.5	H	283.0	-31.1	41.23	74.00
4963.3550	37.91	149.7	H	121.0	-17.9	36.09	74.00
9648.1150	47.95	110.6	V	159.0	-7.3	26.05	74.00
11717.8600	45.38	112.5	V	104.0	-3.6	28.62	74.00
14439.2950	47.32	128.7	V	162.0	-0.4	26.68	74.00
17893.0850	53.51	150.1	V	54.0	9.8	20.49	74.00

Frequency (MHz)	CAverage (dBμV/m)	Antenna Height (cm)	POL. (H/V)	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)
1076.2600	19.54	195.5	H	283.0	-31.1	34.46	54.00
4963.3550	24.94	149.7	H	121.0	-17.9	29.06	54.00
9648.1150	40.43	110.6	V	159.0	-7.3	13.57	54.00
11717.8600	33.08	112.5	V	104.0	-3.6	20.92	54.00
14439.2950	35.16	128.7	V	162.0	-0.4	18.84	54.00
17893.0850	41.59	150.1	V	54.0	9.8	12.41	54.00

Figure 4: Radiated Emission (1 to 18) GHz, [Input voltage: 12 VDC] IDLE mode

Frequency (MHz)	Peak (dBμV/m)	Antenna Height (cm)	POL. (H/V)	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)
1014.9354	33.24	162.6	H	250.0	-31.3	40.76	74.0
4914.8000	36.15	207.7	V	350.0	-18.0	37.85	74.0
7374.4950	41.88	150.1	V	0.0	-10.7	32.12	74.0
10462.4050	45.11	149.9	V	24.0	-5.0	28.89	74.0
14462.5000	47.34	126.7	V	326.0	-0.3	26.66	74.0
17820.7850	54.17	217.7	V	1.0	8.7	19.83	74.0

Frequency (MHz)	CAverage (dBμV/m)	Antenna Height (cm)	POL. (H/V)	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)
1014.9354	21.96	162.6	H	250.0	-31.3	32.04	54.0
4914.8000	24.01	207.7	V	350.0	-18.0	29.99	54.0
7374.4950	29.32	150.1	V	0.0	-10.7	24.68	54.0
10462.4050	32.89	149.9	V	24.0	-5.0	21.11	54.0
14462.5000	35.16	126.7	V	326.0	-0.3	18.84	54.0
17820.7850	41.64	217.7	V	1.0	8.7	12.36	54.0



5. 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-2303-FC006-P	March 31, 2023	Initial Release

End of report