

# EMF TEST REPORT

**Test Report No.** : OT-221-RWD-066  
**Reception No.** : 2109004007  
**Applicant** : LG Electronics USA  
**Address** : 111 Sylvan Avenue, North Building, Englewood Cliffs, New Jersey, 07632, United States  
**Manufacturer** : LG Electronics Inc.  
**Address** : 222 LG-ro, Jinwi-Myeon, Pyeongtaek -Si, Gyeonggi-Do, 451-713, Korea  
**Type of Equipment** : Silverbox RADIO ASM-RECEIVER  
**FCC ID.** : BEJVCUEB  
**Model Name** : VCUEB  
**Multiple Model Name** : N/A  
**Serial number** : N/A  
**Total page of Report** : 11 pages (including this page)  
**Date of Incoming** : November 25, 2021  
**Date of issue** : January 26, 2022

## SUMMARY

The equipment complies with the regulation; **FCC CFR 47 PART 1.1310**

This test report only contains the result of a single test of the sample supplied for the examination.

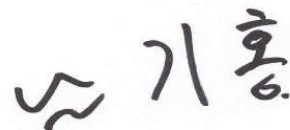
It is not a generally valid assessment of the features of the respective products of the mass-production.



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**Revision History**

Rev. No.	Issue Report No.	Issued Date	Revisions	Section Affected
0	OT-221-RWD-066	January 26, 2022	Initial Release	All

### 1. VERIFICATION OF COMPLIANCE

Applicant : LG Electronics USA  
 Address : 111 Sylvan Avenue, North Building, Englewood Cliffs, New Jersey, 07632, United States  
 Contact Person : Sung Soo Kim / Director, Regulatory and Environmental Affairs  
 Telephone No. : +201-266-2215  
 FCC ID : BEJVCUEB  
 Model Name : VCUEB  
 Brand Name : -  
 Serial Number : N/A  
 Date : January 26, 2022

EQUIPMENT CLASS	DSS – PART 15 SPREAD SPECTRUM TRANSMITTER DTS – DIGITAL TRNSMISSION SYSTEM Unlicensed National Information infrastructure(UNII)
E.U.T. DESCRIPTION	Silverbox RADIO ASM-RECEIVER
THIS REPORT CONCERNS	Original Grant
MEASUREMENT PROCEDURES	ANSI C63.10: 2020
TYPE OF EQUIPMENT TESTED	Pre-Production
KIND OF EQUIPMENT AUTHORIZATION REQUESTED	Certification
EQUIPMENT WILL BE OPERATED UNDER FCC RULES PART(S)	FCC PART 15 SUBPART C Section 15.247 KDB 558074 D01 15.247 Meas Guidance v05r02 FCC PART 15 SUBPART E Section 15.407 789033 D02 General UNII Test Procedures New Rules v02r01
Modifications on the Equipment to Achieve Compliance	None
Final Test was Conducted On	3 m, Semi Anechoic Chamber

-. The above equipment was tested by ONETECH Corp. for compliance with the requirement set forth in the FCC Rules and Regulations. This said equipment in the configuration described in this report, shows the maximum emission levels emanating from equipment are within the compliance requirements.

## 2. GENERAL INFORMATION

### 2.1 Product Description

The LG Electronics USA, Model VCUEB (referred to as the EUT in this report) is a Silverbox RADIO ASM-RECEIVER.

The product specification described herein was obtained from product data sheet or user's manual.

DEVICE TYPE	Silverbox RADIO ASM-RECEIVER	
Temperature Range	-30 °C ~ 85 °C	
OPERATING FREQUENCY	Bluetooth	2 402 MHz ~ 2 480 MHz
	WLAN 2.4 GHz	2 412 MHz ~ 2 462 MHz (802.11b/g/n(HT20))
	5 150 MHz ~ 5 250 MHz Band	5 180 MHz ~ 5 240 MHz (802.11a/n(HT20)/ac(VHT20))
		5 190 MHz ~ 5 230 MHz (802.11n(HT40)/ac(VHT40))
		5 210 MHz (802.11ac(VHT80))
	5 725 MHz ~ 5 850 MHz Band	5 745 MHz ~ 5 825 MHz (802.11a/n(HT20)/ac(VHT20))
		5 755 MHz ~ 5 795 MHz (802.11n(HT40)/ac(VHT40))
		5 775 MHz (802.11ac(VHT80))
MODULATION TYPE	Bluetooth	GFSK for 1 Mbps, $\pi$ /4-DQPSK for 2 Mbps, 8-DPSK for 3 Mbps
	WLAN 2.4 GHz	802.11b: DSSS Modulation(DBPSK/DQPSK/CCK)
		802.11g/n(HT20): OFDM Modulation(BPSK/QPSK/16QAM/64QAM)
WLAN 5 GHz	802.11a/n(HT20)/n(HT40)/ac(VHT80): OFDM Modulation(BPSK/QPSK/16QAM/64QAM)	

RF OUTPUT POWER	Bluetooth	1 Mbps	4.12 dBm	
		2 Mbps	6.20 dBm	
		3 Mbps	6.64 dBm	
	WLAN 2.4 GHz	12.77 dBm(802.11b) 12.53 dBm(802.11g) 12.45 dBm(802.11n_HT20)		
	5 150 MHz ~ 5 250 MHz Band (UNII I)	Internal Antenna	14.58 dBm(802.11a) 15.54 dBm(802.11n_HT20) 12.50 dBm(802.11n_HT40) 10.36 dBm(802.11ac_VHT80)	
		External Antenna	11.68 dBm(802.11a) 12.65 dBm(802.11n_HT20) 10.99 dBm(802.11n_HT40) 6.62 dBm(802.11ac_VHT80)	
	5 725 MHz ~ 5 850 MHz Band (UNII 3)	Internal Antenna	13.94 dBm(802.11a) 14.97 dBm(802.11n_HT20) 13.89 dBm(802.11n_HT40) 9.87 dBm(802.11ac_VHT80)	
		External Antenna	11.03 dBm(802.11a) 11.89 dBm(802.11n_HT20) 10.49 dBm(802.11n_HT40) 5.84 dBm(802.11ac_VHT80)	

ANTENNA TYPE	Bluetooth	PCB Antenna	
	WLAN 2.4 GHz	PCB Antenna	
	WLAN 5 GHz	Internal Antenna	PCB Antenna
External Antenna		PCB Antenna	
ANTENNA GAIN	Bluetooth	4.73 dBi	
	WLAN 2.4 GHz	2.10 dBi	
	5 150 MHz ~ 5 250 MHz Band	Internal Antenna	5.29 dBi
		External Antenna	2.60 dBi
	5 725 MHz ~ 5 850 MHz Band	Internal Antenna	4.29 dBi
		External Antenna	2.80 dBi
List of each Osc. or crystal Freq.(Freq. >= 1 MHz)		37.4 MHz, 100 MHz	

**2.2 Alternative type(s)/model(s); also covered by this test report.**

-. None

**3. EUT MODIFICATIONS**

-. None

## 4. MAXIMUM PERMISSIBLE EXPOSURE

### 4.1 RF Exposure Calculation

According to the FCC rule 1.1310 table 1B, the limit for the maximum permissible RF exposure for an uncontrolled environment are  $f/1500$  mW/cm<sup>2</sup> for the frequency range between 300 MHz and 1 500 MHz and 1.0 mW/cm<sup>2</sup> for the frequency range between 1 500 MHz and 100 000 MHz.

The electric field generated for a 1 mW/cm<sup>2</sup> exposure is calculated as follows:

$$E = \sqrt{(30 * P * G) / d}, \text{ and } S = E^2 / Z = E^2 / 377, \text{ because } 1 \text{ mW/cm}^2 = 10 \text{ W/m}^2$$

Where

S = Power density in mW/cm<sup>2</sup>, Z = Impedance of free space, 377 Ω

E = Electric field strength in V/m, G = Numeric antenna gain, and d = distance in meter

Combining equations and rearranging the terms to express the distance as a function of the remaining variable

$$d = \sqrt{(30 * P * G) / (377 * 10 S)}$$

Changing to units of mW and cm, using P (mW) = P (W) / 1 000, d (cm) = 0.01 \* d (m)

$$d = 0.282 * \sqrt{(P * G) / S}$$

Where

d = distance in cm, P = Power in mW, G = Numeric antenna gain, and S = Power density in mW/cm<sup>2</sup>

### 4.2 EUT Description

Kind of EUT	Silverbox RADIO ASM-RECEIVER
Device Category	<input type="checkbox"/> Portable (< 20 cm separation) <input type="checkbox"/> Mobile (> 20 cm separation) <input checked="" type="checkbox"/> Others
Exposure Evaluation Applied	<input checked="" type="checkbox"/> MPE <input type="checkbox"/> SAR <input type="checkbox"/> N/A



### 4.3 Calculated MPE Safe Distance

#### 4.3.1 DATA for Internal Antenna

According to above equation, the following result was obtained.

Operating Freq. Band (MHz)	Operating Mode	Target Power W/tolerance (dBm)	Max tune up power		Antenna Gain		Safe Distance (cm)	Power Density (mW/cm <sup>2</sup> ) @ 20 cm Separation	Limit (mW/cm <sup>2</sup> )
			(dBm)	(mW)	Log	Linear			
Bluetooth_ 2 402 ~ 2 480	1 Mbps	4.12 ± 1.0	5.12	3.25	4.73	2.97	0.88	0.001 9	1.00
	2 Mbps	6.20 ± 1.0	7.20	5.25			1.11	0.003 1	1.00
	3 Mbps	6.61 ± 1.0	7.61	5.77			1.17	0.003 4	1.00
WLAN_ 5 150 ~ 5 250	802.11a	14.58 ± 1.0	15.58	36.14	5.29	3.38	3.12	0.024 3	1.00
	802.11n_HT20	15.54 ± 1.0	16.54	45.08			3.48	0.030 3	1.00
	802.11n_HT40	12.50 ± 1.0	13.50	22.39			2.45	0.015 1	1.00
	802.11ac80	10.36 ± 1.0	11.36	13.68			1.92	0.009 2	1.00
WLAN_ 5 725 ~ 5 850	802.11a	13.94 ± 1.0	14.94	31.19	4.29	2.69	2.58	0.016 7	1.00
	802.11n_HT20	14.97 ± 1.0	15.97	39.54			2.91	0.021 1	1.00
	802.11n_HT40	13.89 ± 1.0	14.89	30.83			2.57	0.016 5	1.00
	802.11ac80	9.89 ± 1.0	10.89	12.27			1.62	0.006 6	1.00

According to above table, for WLAN\_5 150 ~ 5 250 MHz Band(802.11n\_HT20), safe distance,

$$D = 0.282 * \sqrt{(16.54 * 3.38)/1.00} = 3.48 \text{ cm.}$$

For getting power density at 20 cm separation in above table, following formula was used.

$$S = P * G / (4\pi * R^2) = 16.54 * 3.38 / (4 * \pi * 20^2) = 0.030 3$$

Where:

S = Power Density,

P = Power input to the external antenna (Output power from the EUT antenna port (dBm) – cable loss (dB)),

G = Gain of Transmit Antenna (linear gain), R = Distance from Transmitting Antenna

### 4.3.2 DATA for External Antenna

According to above equation, the following result was obtained.

Operating Freq. Band (MHz)	Operating Mode	Target Power W/tolerance (dBm)	Max tune up power		Antenna Gain		Safe Distance (cm)	Power Density (mW/cm <sup>2</sup> ) @ 20 cm Separation	Limit (mW/cm <sup>2</sup> )
			(dBm)	(mW)	Log	Linear			
WLAN_ 2 400 ~ 2 483.5	802.11b	12.77 ± 1.0	13.77	23.82	2.10	1.62	1.75	0.007 7	1.00
	802.11g	12.53 ± 1.0	13.53	22.54			1.71	0.007 3	1.00
	802.11n_HT20	12.45 ± 1.0	13.45	22.13			1.69	0.007 1	1.00
WLAN_ 5 150 ~ 5 250	802.11a	11.68 ± 1.0	12.68	18.54	2.60	1.82	1.64	0.006 7	1.00
	802.11n_HT20	12.65 ± 1.0	13.65	23.17			1.83	0.008 4	1.00
	802.11n_HT40	10.99 ± 1.0	11.99	15.81			1.51	0.005 7	1.00
	802.11ac80	6.62 ± 1.0	7.62	5.78			0.91	0.002 1	1.00
WLAN_ 5 725 ~ 5 850	802.11a	11.03 ± 1.0	12.03	15.96	2.80	1.91	1.56	0.006 0	1.00
	802.11n_HT20	11.89 ± 1.0	12.89	19.45			1.72	0.007 4	1.00
	802.11n_HT40	10.49 ± 1.0	11.49	14.09			1.46	0.005 3	1.00
	802.11ac80	5.84 ± 1.0	6.84	4.83			0.86	0.001 8	1.00

According to above table, for WLAN\_5 150 ~ 5 250 MHz Band(802.11n\_HT20), safe distance,

$$D = 0.282 * \sqrt{(23.17 * 1.82)/1.00} = 1.83 \text{ cm.}$$

For getting power density at 20 cm separation in above table, following formula was used.

$$S = P * G / (4\pi * R^2) = 23.17 * 1.82 / (4 * \pi * 20^2) = 0.008 4$$

Where:

S = Power Density,

P = Power input to the external antenna (Output power from the EUT antenna port (dBm) – cable loss (dB)),

G = Gain of Transmit Antenna (linear gain), R = Distance from Transmitting Antenna

#### 4.4 DATA for Intermodulation Transmit

According to above equation, the following result was obtained.

Operating Freq. Band (MHz)	Operating Mode	Target Power W/tolerance (dBm)	Max tune up power		Power Density (mW/cm <sup>2</sup> ) @ 20 cm Separation	Sum Power Density (mW/cm <sup>2</sup> ) @ 20 cm Separation	Limit (mW/cm <sup>2</sup> )
			(dBm)	(mW)			
Bluetooth (Internal Antenna) + WLAN 2 G (External Antenna)	Bluetooth (3 Mbps)	6.61 ± 1.0	7.61	5.77	0.003 4	0.011 1	1.00
	WLAN 2 G (802.11 b)	12.77 ± 1.0	13.77	23.82	0.007 7		
Bluetooth (Internal Antenna) + WLAN 5 G (External Antenna)	Bluetooth (3 Mbps)	6.61 ± 1.0	7.61	5.77	0.003 4	0.011 8	1.00
	WLAN 5 G (UNII 1_802.11n_HT20)	12.65 ± 1.0	13.65	23.17	0.008 4		
WLAN 5 G (Internal Antenna)+ WLAN 2 G (External Antenna)	WLAN 5 G (UNII 1_802.11n_HT20)	15.54 ± 1.0	16.54	45.08	0.030 3	0.038 0	1.00
	WLAN 2 G (802.11 b)	12.77 ± 1.0	13.77	23.82	0.007 7		