

EMF TEST REPORT

Test Report No. : OT-22N-RWD-058

Reception No. : 2209002852

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 : Car Navigation

FCC ID. : BEJ-MIB3OI01

Model Name : MIB3 OI

Multiple Model Name : N/A

Serial number : N/A

Total page of Report : 13 pages (including this page)

Date of Incoming : October 13, 2022

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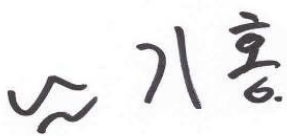
SUMMARY

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.

This report is not correlated with the "KS Q ISO/IEC 17025 and KOLAS accreditation" of Korean Laboratory Accreditation Scheme.


Tested by
Ju-Yun, Park / Manager
ONETECH Corp.
Reviewed by
Tae-Ho, Kim / General Manager
ONETECH Corp.
Approved by
Ki-Hong, Nam / General Manager
ONETECH Corp.

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Revision History

Rev. No.	Issue Report No.	Issued Date	Revisions	Section Affected
0	OT-22N-RWD-058	November 21, 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 : BEJ-MIB3OI01

Model Name : MIB3 OI

Brand Name : Volkswagen, Seat

Serial Number : N/A

Date : November 21, 2022

EQUIPMENT CLASS	DSS – PART 15 SPREAD SPECTRUM TRANSMITTER DTS – DIGITAL TRNSMISSION SYSTEM Unlicensed National Information infrastructure(UNII)
E.U.T. DESCRIPTION	Car Navigation
THIS REPORT CONCERNS	Original Grant
MEASUREMENT PROCEDURES	ANSI C63.10: 2013
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 MIB3 OI (referred to as the EUT in this report) is a Car Navigation. The product specification described herein was obtained from product data sheet or user's manual.

DEVICE TYPE	Car Navigation	
OPERATING FREQUENCY	Bluetooth	2 402 MHz ~ 2 480 MHz
	WLAN 2.4 GHz	2 412 MHz ~ 2 462 MHz (802.11b/g/n(HT20))
	WLAN	5 180 MHz ~ 5 240 MHz (802.11a/n(HT20))
	5 150 MHz ~	5 190 MHz ~ 5 230 MHz (802.11n(HT40))
	5 250 MHz Band	5 210 MHz (802.11ac(VHT80))
	WLAN	5 745 MHz ~ 5 825 MHz (802.11a/n(HT20))
	5 725 MHz ~	5 755 MHz ~ 5 795 MHz (802.11n(HT40))
	5 850 MHz Band	5 775 MHz (802.11ac(VHT80))
MODULATION TYPE	Bluetooth	GFSK for 1Mbps, $\pi/4$ -DQPSK for 2Mbps, 8-DPSK for 3Mbps
	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	2.16 dBm
		2 Mbps	0.93 dBm
		3 Mbps	1.07 dBm
	WLAN 2.4 GHz	10.49 dBm(802.11b) 10.88 dBm(802.11g) 11.11 dBm(802.11n_HT20)	
	WLAN 5 150 MHz ~ 5 250 MHz Band	Antenna 0	9.39 dBm(802.11a) 8.37 dBm(802.11n_HT20) 8.24 dBm(802.11n_HT40) 8.21 dBm(802.11ac_VHT80)
		Antenna 1	8.46 dBm(802.11a) 8.45 dBm(802.11n_HT20) 8.29 dBm(802.11n_HT40) 8.24 dBm(802.11ac_VHT80)
		Multiple Antenna	11.96 dBm(802.11a) 11.42 dBm(802.11n_HT20) 11.28 dBm(802.11n_HT40) 11.24 dBm(802.11ac_VHT80)
	WLAN 5 725 MHz ~ 5 850 MHz Band	Antenna 0	13.70 dBm(802.11a) 13.72 dBm(802.11n_HT20) 13.86 dBm(802.11n_HT40) 13.98 dBm(802.11ac_VHT80)
		Antenna 1	12.68 dBm(802.11a) 12.71 dBm(802.11n_HT20) 12.62 dBm(802.11n_HT40) 12.67 dBm(802.11ac_VHT80)
		Multiple Antenna	16.22 dBm(802.11a) 16.25 dBm(802.11n_HT20) 16.29 dBm(802.11n_HT40) 16.38 dBm(802.11ac_VHT80)

ANTENNA TYPE	Bluetooth	PCB Antenna	
	WLAN 2.4 GHz	Chip Antenna	
	WLAN 5 GHz	Antenna 0	Chip Antenna
		Antenna 1	PCB Antenna
ANTENNA GAIN	Bluetooth	1.39 dBi	
	WLAN 2.4 GHz	4.64 dBi	
	5 150 MHz ~ 5 250 MHz Band	Antenna 0	3.19 dBi
		Antenna 1	4.62 dBi
		Multiple Antenna	6.97 dBi
	5 725 MHz ~ 5 850 MHz Band	Antenna 0	2.29 dBi
		Antenna 1	7.30 dBi
		Multiple Antenna	8.49 dBi
List of each Osc. or crystal Freq.(Freq. >= 1 MHz)		55.466 67 MHz, 40 MHz, 32 MHz, 28.63636 MHz, 25 MHz, 26 MHz, 20 MHz. 19.2 MHz	
RATED SUPPLY VOLTAGE		DC 12.0 V	

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/cm² for the frequency range between 300 MHz and 1 500 MHz and 1.0 mW/cm² for the frequency range between 1 500 MHz and 100 000 MHz.

The electric field generated for a 1 mW/cm² 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/cm², 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

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

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/cm²

4.2 EUT Description

Kind of EUT	Car Navigation
Device Category	☐ Portable (< 20 cm separation) ☐ Mobile (> 20 cm separation) ☒ Others
Exposure Evaluation Applied	☒ MPE ☐ SAR ☐ N/A

4.3 Calculated MPE Safe Distance for WLAN

4.3.1 DATA for Antenna 0

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 ²) @ 20 cm Separation	Limit (mW/cm ²)
			(dBm)	(mW)	Log	Linear			
2 400 ~ 2 483.5	802.11b	10.49 ± 0.5	10.99	12.56	4.64	2.91	1.71	0.007 3	1
	802.11g	10.88 ± 0.5	11.38	13.74			1.78	0.008 0	1
	802.11n_HT20	11.11 ± 0.5	11.61	14.49			1.83	0.008 4	1
5 150 ~ 5 250	802.11a	9.39 ± 0.5	9.89	9.75	3.19	2.08	1.27	0.004 0	1
	802.11n HT20	8.37 ± 0.5	8.87	7.71			1.13	0.003 2	1
	802.11n HT40	8.24 ± 0.5	8.74	7.48			1.11	0.003 1	1
	802.11ac80	8.21 ± 0.5	8.71	7.43			1.11	0.003 1	1
5 725 ~ 5 850	802.11a	13.70 ± 0.5	14.20	26.30	2.29	1.69	1.88	0.008 9	1
	802.11n HT20	13.72 ± 0.5	14.22	26.42			1.89	0.008 9	1
	802.11n HT40	13.86 ± 0.5	14.36	27.29			1.92	0.009 2	1
	802.11ac80	13.98 ± 0.5	14.48	28.05			1.94	0.009 5	1

According to above table, for 2 400 ~ 2483.5 MHz Band(802.11 b), safe distance,

$$D = 0.282 * \sqrt{(12.56 * 2.91)/1.00} = 1.71 \text{ cm.}$$

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

$$S = P * G / (4\pi * R^2) = 12.56 * 2.91 / (4 * \pi * 20^2) = 0.007 3$$

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 Antenna 1

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 ²) @ 20 cm Separation	Limit (mW/cm ²)
			(dBm)	(mW)	Log	Linear			
5 150 ~ 5 250	802.11a	8.46 ± 0.5	8.96	7.87	4.62	2.90	1.35	0.004 5	1
	802.11n HT20	8.45 ± 0.5	8.95	7.85			1.35	0.004 5	1
	802.11n HT40	8.29 ± 0.5	8.79	7.57			1.32	0.004 4	1
	802.11ac80	8.24 ± 0.5	8.74	7.48			1.31	0.004 3	1
5 725 ~ 5 850	802.11a	12.68 ± 0.5	13.18	20.80	7.30	5.37	2.98	0.022 2	1
	802.11n HT20	12.71 ± 0.5	13.21	20.94			2.99	0.022 4	1
	802.11n HT40	12.62 ± 0.5	13.12	20.51			2.96	0.021 9	1
	802.11ac80	12.67 ± 0.5	13.17	20.75			2.98	0.022 2	1

According to above equation, the following result was obtained.

According to above table, for 5 150 ~ 5250 MHz Band(802.11 a), safe distance,

$$D = 0.282 * \sqrt{(7.87 * 2.90)/1.00} = 1.35 \text{ cm.}$$

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

$$S = P * G / (4\pi * R^2) = 7.87 * 2.90 / (4 * \pi * 20^2) = 0.004 5$$

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

4.3.3 DATA for Multiple 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		Antenna Gain		Safe Distance (cm)	Power Density (mW/cm ²) @ 20 cm Separation	Limit (mW/cm ²)
			(dBm)	(mW)	Log	Linear			
5 150 ~ 5 250	802.11a	11.96 ± 0.5	12.46	17.62	6.97	4.98	2.64	0.017 4	1
	802.11n HT20	11.42 ± 0.5	11.92	15.56			2.48	0.015 4	1
	802.11n HT40	11.28 ± 0.5	11.78	15.07			2.44	0.014 9	1
	802.11ac80	11.24 ± 0.5	11.74	14.93			2.43	0.014 8	1
5 725 ~ 5 850	802.11a	16.22 ± 0.5	16.72	46.99	8.49	7.06	5.14	0.066 0	1
	802.11n HT20	16.25 ± 0.5	16.75	47.32			5.16	0.066 5	1
	802.11n HT40	16.29 ± 0.5	16.79	47.75			5.18	0.067 1	1
	802.11ac80	16.38 ± 0.5	16.88	48.75			5.23	0.068 5	1

According to above equation, the following result was obtained.

According to above table, for 5 150 ~ 5250 MHz Band(802.11 a), safe distance,

$$D = 0.282 * \sqrt{(17.62 * 4.98)/1.00} = 2.64 \text{ cm.}$$

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

$$S = P * G / (4\pi * R^2) = 17.62 * 4.98 / (4 * \pi * 20^2) = 0.017 4$$

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 Calculated MPE Safe Distance for Bluetooth

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 ²) @ 20 cm Separation	Limit (mW/cm ²)
			(dBm)	(mW)	Log	Linear			
2 402 ~ 2 480	1 Mbps	2.16 ± 0.5	2.66	1.85	1.39	1.38	0.45	0.000 5	1
	2 Mbps	0.93 ± 0.5	1.43	1.39			0.39	0.000 4	1
	3 Mbps	1.07 ± 0.5	1.57	1.44			0.40	0.000 4	1

According to above table, for 2 402 ~ 2480 MHz Band(1 Mbps), safe distance,

$$D = 0.282 * \sqrt{(1.85 * 1.38)/1.00} = 0.45 \text{ cm.}$$

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

$$S = P * G / (4\pi * R^2) = 1.85 * 1.38 / (4 * \pi * 20^2) = 0.000 5$$

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

4.5 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 ²) @ 20 cm Separation	Sum Power Density (mW/cm ²) @ 20 cm Separation	Limit
			(dBm)	(mW)			
Bluetooth + WLAN 2 G	Bluetooth (1 Mbps)	2.16 ± 0.5	2.66	1.85	0.000 5	0.008 9	1.00
	WLAN 2 G (802.11 n(HT20)_Ant 0)	11.11 ± 0.5	11.61	14.49	0.008 4		
Bluetooth + WLAN 5 G	Bluetooth (1 Mbps)	2.16 ± 0.5	2.66	1.85	0.000 5	0.010 0	1.00
	WLAN 5 G (UNII 1 802.11ac(VHT80) _Ant 0)	13.98 ± 0.5	14.48	28.05	0.009 5		