

ELECTROMAGNETIC EMISSION COMPLIANCE REPORT FOR LOW-POWER, NON-LICENSED TRANSMITTER

Test Report No. : OT-193-RWD-058
AGR No. : A18DA-151R
Applicant : LG Electronics Inc.
Address : 1000 Sylvan Avenue, Englewood Cliffs, New Jersey, United States, 07632
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-MIB3OI
Model Name : MIB3 OI
Serial number : N/A
Total page of Report : 11 pages (including this page)
Date of Incoming : January 11, 2019
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SUMMARY

The equipment complies with the regulation; ***FCC PART 15 SUBPART C Section 15.247***

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.

Reviewed by:



Yu-Seog Sim / Assistant Manager
ONETECH Corp.

Approved by:



Jae-Ho Lee / Chief Engineer
ONETECH Corp.

CONTENTS

PAGE

1. VERIFICATION OF COMPLIANCE	4
2. GENERAL INFORMATION	5
2.1 PRODUCT DESCRIPTION.....	5
2.2 ALTERNATIVE TYPE(S)/MODEL(S); ALSO COVERED BY THIS TEST REPORT.....	7
3. EUT MODIFICATIONS.....	8
4. MAXIMUM PERMISSIBLE EXPOSURE	9
4.1 RF EXPOSURE CALCULATION	9
4.2 EUT DESCRIPTION.....	9
4.3 CALCULATED MPE SAFE DISTANCE.....	10
4.4 CALCULATION RESULT OF MAXIMUM CONDUCTED POWER	11

Revision History

Rev. No.	Issue Report No.	Issued Date	Revisions	Section Affected
0	OT-193-RWD-058	March 26, 2019	Initial Issue	All

Document History

Revision No.	Issued Date	Revisions	Effect Section
Original	March 26, 2019	Initial Issue	-
Rev. 01	June 03, 2019	2.1 PRODUCT DESCRIPTION	-

1. VERIFICATION OF COMPLIANCE

Applicant : LG Electronics Inc.

Address : 1000 Sylvan Avenue, Englewood Cliffs, New Jersey, United States, 07632

Contact Person : Yong Duk Kwon / Research Engineer

Telephone No. : (201) 266-2215

FCC ID : BEJ-MIB3OI

Model Name : MIB3 OI

Brand Name : LG, Volkswagen, Seat

Serial Number : N/A

Date : March 26, 2019

EQUIPMENT CLASS	<i>DSS – PART 15 SPREAD SPECTRUM TRANSMITTER</i>
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
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 Inc., Model MIB3 OI (referred to as the EUT in this report) is a Car Navigation. Product specification information described herein was obtained from product data sheet or user's manual.

DEVICE TYPE	Car Navigation			
FREQUENCY RANGE	Bluetooth	2 402 MHz ~ 2 480 MHz		
	WLAN 2.4 GHz Band	2 412 MHz ~ 2 462 MHz (802.11b/g/n(HT20))		
	WLAN 5 GHz Band	5 150 MHz ~ 5 250 MHz Band	5 180 MHz ~ 5 240 MHz (802.11a/n/ac(HT20))	
			5 190 MHz ~ 5 230 MHz (802.11n/ac(HT40))	
			5 210 MHz (802.11ac(VHT80))	
		5 725 MHz ~ 5 850 MHz Band	5 745 MHz ~ 5 825 MHz (802.11a/n/ac(HT20))	
			5 755 MHz ~ 5 795 MHz (802.11n/ac(HT40))	
			5 775 MHz (802.11ac(VHT80))	
MAX. RF OUTPUT POWER	Bluetooth	1 Mbps	-1.40 dBm	
		2 Mbps	-0.61 dBm	
		3 Mbps	-0.07 dBm	
	WLAN 2.4 GHz Band	Wi-Fi 802.11b (15.43 dBm) Wi-Fi 802.11g (17.26 dBm) Wi-Fi 802.11n(HT20) (15.97 dBm)		
	WLAN 5 GHz Band	5 150 MHz ~ 5 250 MHz Band	Antenna 0	Wi-Fi 802.11a (10.49 dBm) Wi-Fi 802.11n(HT20) (10.44 dBm) Wi-Fi 802.11n(HT40) (8.21 dBm) Wi-Fi 802.11ac(VHT80) (7.34 dBm)
			Antenna 1	Wi-Fi 802.11a (10.15 dBm) Wi-Fi 802.11n(HT20) (10.07 dBm) Wi-Fi 802.11n(HT40) (8.35 dBm) Wi-Fi 802.11ac(VHT80) (7.68 dBm)
			Multiple transmit	Wi-Fi 802.11n(HT20) (13.24 dBm) Wi-Fi 802.11n(HT40) (11.29 dBm) Wi-Fi 802.11ac(VHT80) (10.52 dBm)

MAX. RF OUTPUT POWER	WLAN 5 GHz Band	5 725 MHz ~ 5 850 MHz Band		Antenna 0	Wi-Fi 802.11a (9.37 dBm) Wi-Fi 802.11n(HT20) (9.39 dBm) Wi-Fi 802.11n(HT40) (7.29 dBm) Wi-Fi 802.11ac(VHT80) (6.34 dBm)	
				Antenna 1	Wi-Fi 802.11a (10.42 dBm) Wi-Fi 802.11n(HT20) (10.52 dBm) Wi-Fi 802.11n(HT40) (8.49 dBm) Wi-Fi 802.11ac(VHT80) (7.74 dBm)	
				Multiple transmit	Wi-Fi 802.11n(HT20) (12.84 dBm) Wi-Fi 802.11n(HT40) (10.94 dBm) Wi-Fi 802.11ac(VHT80) (10.11 dBm)	
MODULATION TYPE	Bluetooth			GFSK for 1 Mbps, $\pi/4$ -DQPSK for 2 Mbps, 8-DPSK for 3 Mbps		
	WLAN 2.4 GHz Band			DSSS Modulation(DBPSK/DQPSK/CCK) OFDM Modulation(BPSK/QPSK/16QAM/64QAM)		
	WLAN 5 GHz Band			OFDM Modulation(BPSK/QPSK/16QAM/64QAM)		
ANTENNA TYPE	Bluetooth			PCB Antenna		
	WLAN (2.4GHz Band)			Chip Antenna		
	WLAN (5GHz Band)	Antenna 0		PCB Antenna		
		Antenna 1		Chip Antenna		
ANTENNA GAIN	Bluetooth			2.5 dBi		
	WLAN 2.4 GHz Band			3.8 dBi		
	WLAN 5 GHz Band	5 150 MHz ~ 5 250 MHz	ANT0	3.8 dBi		
			ANT1	1.6 dBi		
		5 725 MHz ~ 5 850 MHz	ANT0	5.5 dBi		
			ANT1	2.4 dBi		
	5 GHz Band (ANT 0 + 1)	5 150 MHz ~ 5 250 MHz	5.78 dBi			
		5 725 MHz ~ 5 850 MHz	7.10 dBi			
	List of each Osc. or crystal Freq.(Freq. >= 1 MHz)				31.25 MHz, 28.63636 MHz	
RATED SUPPLY VOLTAGE				DC 12.0 V		

- Directional Gain Calculations

$$\text{Directional gain} = 10 \log[(10^{G1/20} + 10^{G2/20} + \dots + 10^{GN/20})^2 / N_{\text{ANT}}] \text{ dBi}$$

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

-. The following lists consist of the added config and their differences.:

Brand	Model	Config	Feature							Tested
			BT	Wi-Fi	RVC	DAB	Amp	Tuner Configuration	Platform	
LG Volkswagen Seat	MIB3 OI	L91VW3-N200	O	O	O	O	4CH	Mercury,Merlin	MQB	☒
		L91VW3-N20A	O	O	O	O	4CH	Titan,Merlin	MQB	☐
		L91VW3-N320	O	O	O	X	4CH	Mercury,Merlin	MQB	☐
		L91VW3-N160	O	O	O	O	4CH	Mercury,Merlin	MQB	☐
		L91VW3-N16A	O	O	O	O	4CH	Titan,Merlin	MQB	☐
		L91VW3-N740	O	O	O	X	4CH	Titan,Merlin	MQB	☐
		L91VW3-N760	O	O	O	X	4CH	Mercury,Merlin	MQB	☐
		L92VW3-N200	O	O	X	O	4CH	Mercury,Titan	MQB37	☐
		L92VW3-N20A	O	O	X	O	4CH	Mercury,Titan	MQB37	☐
		L92VW3-N320	O	O	X	X	4CH	Titan,Merlin	MQB37	☐
		L92VW3-N160	O	O	X	O	4CH	Mercury,Titan	MQB37	☐
		L92VW3-N16A	O	O	X	O	4CH	Mercury,Titan	MQB37	☐
		L92VW3-N740	O	O	X	X	4CH	Titan,Merlin	MQB37	☐
		L92VW3-N760	O	O	X	X	4CH	Titan,Merlin	MQB37	☐
		L91SE3-N200	O	O	O	O	4CH	Mercury,Merlin	MQB	☐
		L91SE3-N20A	O	O	O	O	4CH	Mercury,Merlin	MQB	☐
		L91SE3-N320	O	O	O	X	4CH	Titan,Merlin	MQB	☐
		L91SE3-N620	O	O	O	O	4CH	Mercury,Merlin	MQB	☐
		L91SE3-N62A	O	O	O	O	4CH	Mercury,Merlin	MQB	☐
		L91SE3-N670	O	O	O	X	4CH	Titan,Merlin	MQB	☐
		L91SE3-N680	O	O	O	X	4CH	Titan,Merlin	MQB	☐
		L92SE3-N620	O	O	X	O	4CH	Mercury,Titan	MQB37	☐
		L92SE3-N62A	O	O	X	O	4CH	Mercury,Titan	MQB37	☐
		L92SE3-N670	O	O	X	X	4CH	Titan,Merlin	MQB37	☐
		L92SE3-N680	O	O	X	X	4CH	Titan,Merlin	MQB37	☐

Note: 1. Applicants must delegate only the models with all features applied to be tested, Therefore, this test report only guarantees the unit tested.

2. The Applicant/manufacture is responsible for the compliance of all configs.

3. EUT MODIFICATIONS

-. None

4. MAXIMUM PERMISSIBLE EXPOSURE

4.1 RF Exposure Calculation

According to the FCC rule §1.1310, the limit for General Population/Uncontrolled exposure is 1 mW/cm² for the device operating 1 500 ~ 100 000 MHz.

4.2 EUT Description

Kind of EUT	Car Navigation	
Operating Frequency Band	☐ Wireless Microphone: 494.000 MHz ~ 501.000 MHz and 498.200 MHz ~ 505.200 MHz ☒ WLAN: 2 412 MHz ~ 2 462 MHz ☐ WLAN: 2 422 MHz ~ 2 452 MHz ☒ WLAN: 5 180 MHz ~ 5 240 MHz ☒ WLAN: 5 190 MHz ~ 5 230 MHz ☒ WLAN: 5 210 MHz ☒ WLAN: 5 745 MHz ~ 5 825 MHz ☒ WLAN: 5 755 MHz ~ 5 795 MHz ☒ WLAN: 5 775 MHz ☒ BlueTooth : 2 402 MHz ~ 2 480 MHz ☐ GFSK Modulation: 2403 MHz , 2443 MHz , 2478 MHz	
MAX. RF OUTPUT POWER	1 Mbps	-1.40 dBm
	2 Mbps	-0.61 dBm
	3 Mbps	-0.07 dBm
Antenna Gain	2.5 dBi	
Exposure Evaluation Applied	☒ MPE ☐ SAR ☐ N/A	

4.3 Calculated MPE Safe Distance

According to above equation, the following result was obtained.

Operating Freq. Band (MHz)	Operating Mode	Target Power W/tolerance	Max tune up power		Antenna Gain		Safe Distance (cm)	Power Density (mW/cm ²) @ 20 cm Separation	Limit (mW/cm ²)
		(dBm)	(dBm)	(mW)	Log	Linear			
2 402 ~ 2 480	1 Mbps	-1.90 ± 0.5	-1.40	0.72	2.5	1.778	0.32	0.000 256	1.00
	2 Mbps	-1.11 ± 0.5	-0.61	0.87			0.35	0.000 307	1.00
	3 Mbps	-0.57 ± 0.5	-0.07	0.98			0.37	0.000 348	1.00

According to above table, for 2 400 ~ 2 483.5 MHz Band, safe distance,

$$D = 0.282 * \sqrt{(0.72 * 1.778)/1.00} = 0.32 \text{ cm}$$

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

$$S = P * G / (4\pi * R^2) = 0.72 * 1.778 / (4 * 3.14 * 20^2) = 0.000 256$$

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



Tested by: Ha-Ram Lee / Assistant Manager

4.4 Calculation Result Of Maximum Conducted Power

Operating Freq. Band	Operating Mode	Target Power W/tolerance	Max tune up power		Antenna Gain		Safe Distance (cm)	Power Density (mW/cm ²) @ 20 cm Separation	Limit (mW/cm ²)
		(dBm)	(dBm)	(mW)	Log	Linear			
2.4G WLAN	802.11g	16.76 ± 0.5	17.26	53.21	2.90	1.950	2.87	0.020 6	1.00
BT	3 Mbps	-0.57 ± 0.5	-0.07	0.98	2.50	1.778	0.37	0.000 348	1.00
5 150 ~ 5 250	802.11n(HT20)	12.74 ± 0.5	13.24	21.09	5.78	3.784	2.52	0.015 9	1.00
5 725 ~5 850	802.11n(HT20)	12.34 ± 0.5	12.84	19.23	7.10	5.129	2.80	0.019 6	1.00

- Bluetooth transmit simultaneously with 2.4 GHz and 5 GHz WiFi.

2.4 GHz band + Bluetooth + 5 GHz band =

$(0.025\ 4 / 1) + (0.000\ 348 / 1) + (0.015\ 9 / 1) + (0.019\ 6 / 1) = 0.061\ 248$

- Therefore the maximum calculations of above situations are less than the “1” limit.



Tested by: Ha-Ram Lee / Assistant Manager