

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

Test Report No. : W159R-D026
AGR No. : A158A-145
Applicant : LG Innotek Co., Ltd.
Address : 978-1, Jangduk-dong, Gwangsan-gu, Gwangju, 506-731 Korea
Manufacturer : LG Innotek Co., Ltd.
Address : 978-1, Jangduk-dong, Gwangsan-gu, Gwangju, 506-731 Korea
Type of Equipment : Bluetooth/WLAN Combo Module for Automotive
FCC ID. : YZP-RBHAC213B
Model Name : RBHA-C213B
Serial number : N/A
Total page of Report : 7 pages (including this page)
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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: 

Ki-Hong, Nam / Asst, Chief Engineer
ONETECH Corp.

Approved by: 

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ONETECH Corp.

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4.3 Test Result for BLUETOOTH	오류! 책갈피가 정의되어 있지 않습니다.

Revision History

Issued Report No.	Issued Date	Revisions	Effect Section
W159R-D026	September 14, 2015	Initial Issue	All

1. VERIFICATION OF COMPLIANCE

Applicant : LG Innotek Co., Ltd.
 Address : 978-1, Jangduk-dong, Gwangsan-gu, Gwangju, 506-731 Korea
 Contact Person : Inchang, Jeong / Director
 Telephone No. : +82-62-950-0332
 FCC ID : YZP-RBHAC213B
 Model Name : RBHA-C213B
 Serial Number : N/A
 Date : September 14, 2015

EQUIPMENT CLASS	DSS – PART 15 SPREAD SPECTRUM TRANSMITTER
E.U.T. DESCRIPTION	Modular Transmitter, Bluetooth/WLAN Combo Module for Automotive
THIS REPORT CONCERNS	Original Grant
MEASUREMENT PROCEDURES	ANSI C63.10: 2013
TYPE OF EQUIPMENT TESTED	Pre-Production
KIND OF EQUIPMENT AUTHORIZATION REQUESTED	Certification, Modular Approval
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 Innotek Co., Ltd., Model RBHA-C213B (referred to as the EUT in this report) is a Bluetooth/WLAN Combo Module for Automotive. Product specification information described herein was obtained from product data sheet or user's manual.

DEVICE TYPE	Bluetooth/WLAN Combo Module for Automotive		
OPERATING FREQUENCY	WLAN	2 412 MHz ~ 2 462 MHz (802.11b/g/n(HT20))	
	Bluetooth	2 402 MHz ~ 2 480 MHz	
	Bluetooth LE	2 402 MHz ~ 2 480 MHz	
MAX. RF OUTPUT POWER	WLAN	Wi-Fi 802.11b (11.25 dBm)	
		Wi-Fi 802.11g (10.31 dBm)	
		Wi-Fi 802.11n_20 MHz (10.20 dBm)	
	Bluetooth	1 Mbps	6.70 dBm
		2 Mbps	5.15 dBm
		3 Mbps	5.43 dBm
	Bluetooth LE	2.63 dBm	
MODULATION TYPE	WLAN	DSSS Modulation(DBPSK/DQPSK/CCK)	
	Bluetooth	GFSK for 1 Mbps, DQPSK for 2 Mbps, 8-DPSK for 3 Mbps	
	Bluetooth LE	GFSK	
ANTENNA TYPE	Dipole Antenna		
ANTENNA GAIN	2.41 dBi		
List of each Osc. or crystal Freq.(Freq. >= 1 MHz)	26 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 $f/1500 \text{ mW/cm}^2$ for the frequency range between 300 MHz and 1 500 MHz and 1.0 mW/cm^2 for the frequency range between 1 500 MHz and 100 000 MHz.

The electric field generated for a 1 mW/cm^2 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^2 , Z = Impedance of free space, 377Ω

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 $P (\text{mW}) = P (\text{W}) / 1 000$, $d (\text{cm}) = 0.01 * d (\text{m})$

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

Where

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

4.2 EUT Description

Kind of EUT	Bluetooth/WLAN Combo Module for Automotive		
Operating Frequency Band	<input type="checkbox"/> Wireless Microphone: 494.000 MHz ~ 501.000 MHz and 498.200 MHz ~ 505.200 MHz <input checked="" type="checkbox"/> WLAN: 2 412 MHz ~ 2 462 MHz <input checked="" type="checkbox"/> Bluetooth: 2 402 MHz ~ 2 480 MHz <input checked="" type="checkbox"/> Bluetooth BLE: 2 402 MHz ~ 2 480 MHz		
Device Category	<input type="checkbox"/> Portable (< 20 cm separation) <input type="checkbox"/> Mobile (> 20 cm separation) <input checked="" type="checkbox"/> Others		
MAX. RF OUTPUT POWER	WLAN	Wi-Fi 802.11b (11.25 dBm)	
		Wi-Fi 802.11g (10.31 dBm)	
		Wi-Fi 802.11n_20 MHz (10.20 dBm)	
	Bluetooth	1 Mbps	6.70 dBm
		2 Mbps	5.15 dBm
3 Mbps		5.43 dBm	
Bluetooth LE	2.63 dBm		
Used Antenna Gain	2.41 dBi		
Exposure Evaluation Applied	<input checked="" type="checkbox"/> MPE <input type="checkbox"/> SAR <input type="checkbox"/> N/A		

2.4GHz can not transmit at the same time.

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 (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	6.0 ± 1.0	7.00	5.01	2.41	1.74	0.83	0.0017	1.00
	2 Mbps	4.5 ± 1.0	5.50	3.55			0.70	0.0012	1.00
	3 Mbps	5.0 ± 1.0	6.00	3.98			0.74	0.0014	1.00