

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

Test Report No. : W159R-D012
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)
Date of Incoming : August 27, 2015
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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: 

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ONETECH Corp.

Approved by: 

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ONETECH Corp.

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Revision History

| Issued Report No. | Issued Date | Revisions | Effect Section |
|-------------------|--------------------|---------------|----------------|
| W159R-D012 | September 09, 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 09, 2015

| | |
|--|---|
| EQUIPMENT CLASS | DTS – DIGITAL TRNSMISSION SYSTEM |
| 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 $f/1500$ 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

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

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 | 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 | | | |
| 2 400 ~ 2 483.5 | 802.11b | 10.50 ± 1.0 | 11.50 | 14.13 | 2.41 | 1.74 | 1.40 | 0.0049 | 1.00 |
| | 802.11g | 10.00 ± 0.5 | 10.50 | 11.22 | | | 1.25 | 0.0039 | 1.00 |
| | 802.11n_HT20 | 9.50 ± 1.0 | 10.50 | 11.22 | | | 1.25 | 0.0039 | 1.00 |