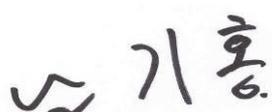


ELECTROMAGNETIC EMISSION COMPLIANCE REPORT FOR LOW-POWER, NON-LICENSED TRANSMITTER

Test Report No. : OT-18N-RWD-031
AGR No. : A180A-448
Applicant : LG Innotek Co., Ltd.
Address : 26, Hanamsandan 5beon-ro Gwangsan-gu, Gwangju, 506-731, South Korea
Manufacturer : LG Innotek Co., Ltd.
Address : 26, Hanamsandan 5beon-ro Gwangsan-gu, Gwangju, 506-731, South Korea
Type of Equipment : RF Module
FCC ID. : YZP-TWFMK305D
Model Name : TWFM-K305D
Serial number : N/A
Total page of Report : 7 pages (including this page)
Date of Incoming : October 15, 2018
Date of issue : November 20, 2018

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 / Chief Engineer
 ONETECH Corp.

Approved by: 

 Keun-Young, Choi / Vice President
 ONETECH Corp.

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Revision History

Rev. No.	Issue Report No.	Issued Date	Revisions	Section Affected
0	OT-18N-RWD-031	2018.11.20	Initial Release	All

1. VERIFICATION OF COMPLIANCE

Applicant : LG Innotek Co., Ltd.
 Address : 26, Hanamsandan 5beon-ro Gwangsan-gu, Gwangju, 506-731, South Korea
 Contact Person : Jeong, Inchang / Senior Research Engineer
 Telephone No. : +82-62-950-0332
 FCC ID : YZP-TWFMK305D
 Model Name : TWFM-K305D
 Brand Name : -
 Serial Number : N/A
 Date : November 20, 2018

EQUIPMENT CLASS	DTS – DIGITAL TRNSMISSION SYSTEM
E.U.T. DESCRIPTION	Modular Transmitter, RF Module
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 DTS Meas Guidance v05
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 TWFM-K305D (referred to as the EUT in this report) is a RF Module. The product specification described herein was obtained from product data sheet or user’s manual.

DEVICE TYPE	RF Module
Temperature Range	-20 °C ~ 80 °C
OPERATING FREQUENCY	2 412 MHz ~ 2 462 MHz (802.11b/g/n(HT20))
	2 422 MHz ~ 2 452 MHz (802.11n(HT40))
MODULATION TYPE	802.11b: DSSS Modulation(DBPSK/DQPSK/CCK) 802.11g/n(HT20)/n(HT40): OFDM Modulation(BPSK/QPSK/16QAM/64QAM)
RF OUTPUT POWER'	17.14 dBm(802.11b) 13.31 dBm(802.11g) 15.74 dBm(802.11n_HT20) 15.91 dBm(802.11n_HT40)
MODULATION TYPE	DSSS Modulation(DBPSK/DQPSK/CCK) OFDM Modulation(BPSK/QPSK/16QAM/64QAM)
ANTENNA TYPE	PCB Antenna
ANTENNA GAIN	1.50 dBi
List of each Osc. or crystal Freq.(Freq. >= 1 MHz)	40 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	RF Module
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 for WLAN

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			
2 400 ~ 2 483.5	802.11b	17.0 ± 0.5	17.50	56.23	1.50	1.41	2.51	0.015 8	1.00
	802.11g	13.5 ± 0.5	14.00	25.12			1.68	0.007 1	1.00
	802.11n_ HT20	16.0 ± 0.5	16.50	44.67			2.24	0.012 6	1.00
	802.11n_ HT40	16.0 ± 0.5	16.50	44.67			2.24	0.012 6	1.00

According to above table, for 2 400 ~ 2483.5 MHz Band, safe distance,

$$D = 0.282 * \sqrt{(56.23 * 1.41)/1.00} = 2.51 \text{ cm.}$$

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

$$S = P * G / (4\pi * R^2) = 56.23 * 1.41 / (4 * 3.14 * 20^2) = 0.015 8$$

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: Tae-Ho, Kim / Senior Manager