

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

Test Report No. : OT-196-RWD-035
AGR No. : A195A-013
Applicant : Samsung Electronics Co Ltd
Address : 1 Samsung-ro, Giheung-gu, Yongin-si Gyeonggi-do, South Korea
Manufacturer : Samsung Electronics Co Ltd
Address : 1 Samsung-ro, Giheung-gu, Yongin-si Gyeonggi-do, South Korea
Type of Equipment : IoT Module
FCC ID. : 2AR3A-ITM-D-BZ
Model Name : ITM-D-BZ
Serial number : N/A
Total page of Report : 8 pages (including this page)
Date of Incoming : June 05, 2019
Date of issue : June 17, 2019

SUMMARY

The equipment complies with the regulation; *FCC PART 15 SUBPART C Section 15.225, 15.247*

This test report only contains the result of a single test of the sample supplied for the examination.

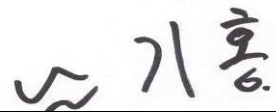
It is not a generally valid assessment of the features of the respective products of the mass-production.

Reviewed by:



Tae-Ho, Kim / Senior Manager
ONETECH Corp.

Approved by:



Ki-Hong, Nam / 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.....	5
3. EUT MODIFICATIONS.....	5
4. MAXIMUM PERMISSIBLE EXPOSURE	6
4.1 RF EXPOSURE CALCULATION	6
4.2 TEST RESULT FOR BLUETOOTH	7
4.3 TEST RESULT FOR ZIGBEE	8

Revision History

Rev. No.	Issue Report No.	Issued Date	Revisions	Section Affected
0	OT-196-RWD-035	June 17, 2019	Initial Release	All

1. VERIFICATION OF COMPLIANCE

Applicant : Samsung Electronics Co Ltd
Address : 1 Samsung-ro, Giheung-gu, Yongin-si Gyeonggi-do, South Korea
Contact Person : Mounghin, Jang / Staff Engineer
Telephone No. : +070-7142-1361
FCC ID : 2AR3A-ITM-D-BZ
Model Name : ITM-D-BZ
Brand Name : -
Serial Number : N/A
Date : June 17, 2019

EQUIPMENT CLASS	DTS – DIGITAL TRNSMISSION SYSTEM
E.U.T. DESCRIPTION	IoT 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 558074 D01 15.247 Meas Guidance v05r02
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 Samsung Electronics Co Ltd, Model ITM-D-BZ (referred to as the EUT in this report) is a IoT Module. The product specification described herein was obtained from product data sheet or user's manual.

DEVICE TYPE	IoT Module	
Temperature Range	-20 °C ~ 50 °C	
OPERATING FREQUENCY	Bluetooth	2 402 MHz ~ 2 480 MHz
	Zigbee	2 405 MHz ~ 2 480 MHz
MODULATION TYPE	Bluetooth	GFSK
	Zigbee	O-QPSK
RF OUTPUT POWER	Bluetooth	LE Coded_125 kbps: 8.75 dBm LE Coded_500 kbps: 8.50 dBm LE 1 M_1 Mbps: 8.75 dBm LE 2 M_2 Mbps: 7.85 dBm
	Zigbee	8.39 dBm
Number of Channel	Bluetooth	40 Channel
	Zigbee	16 Channel
ANTENNA TYPE		PCB Antenna
ANTENNA GAIN		3.6 dBi
List of each Osc. or crystal Freq.(Freq. >= 1 MHz)		32 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

Kind of EUT	IoT 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



Tested by: Hyung-Kwon, Oh / Assistant Manager

4.2 Test Result for Bluetooth

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	LE Coded_125 kbps	8.5 ± 0.5	9.00	7.94	3.60	2.29	1.20	0.003 6	1.00
	LE Coded_500 kbps	8.5 ± 0.5	9.00	7.94			1.20	0.003 6	1.00
	LE 1 M_1 Mbps	8.5 ± 0.5	9.00	7.94			1.20	0.003 6	1.00
	LE 2 M_2 Mbps	8.0 ± 0.5	8.50	7.08			1.14	0.003 2	1.00

According to above table, for 2 402 MHz ~ 2 480 MHz Band(LE Coded_125 kbps), safe distance,

$$D = 0.282 * \sqrt{(7.94 * 2.29)} / 1.00 = 1.20 \text{ cm}$$

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

$$S = P * G / (4\pi * R^2) = 7.94 * 2.29 / (4 * 3.14 * 20^2) = 0.003 6$$

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: Hyung-Kwon, Oh / Assistant Manager

4.3 Test Result for Zigbee

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			
2 405 ~ 2 480	Zigbee	8.5 ± 0.5	9.00	7.94	3.60	2.29	1.20	0.003 6	1.00

According to above table, for 2 400 ~ 2 483.5 MHz Band(802.11b), safe distance,

$$D = 0.282 * \sqrt{(7.94 * 2.29)/1.00} = 1.20 \text{ cm}$$

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

$$S = P * G / (4\pi * R^2) = 7.94 * 2.29 / (4 * 3.14 * 20^2) = 0.003 6$$

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: Hyung-Kwon, Oh / Assistant Manager