

# EMF TEST REPORT

**Test Report No.**

**: OT-21D-RWD-024**

**Reception No.**

**: 2110004403**

**Applicant**

**: CERAGEM CO., LTD.**

**Address**

**: 10, Jeongja-1-gil, Seonggeo-eup, Seobuk-gu, Cheonan-si, Chungcheongnam-do,  
Republic of Korea**

**Manufacturer**

**: CERAGEM CO., LTD.**

**Address**

**: 10, Jeongja-1-gil, Seonggeo-eup, Seobuk-gu, Cheonan-si, Chungcheongnam-do,  
Republic of Korea**

**Type of Equipment**

**: Bluetooth module**

**FCC ID.**

**: 2A3VY-SQ310**

**Model Name**

**: SQ310**

**Serial number**

**: N/A**

**Total page of Report**

**: 7 pages (including this page)**

**Date of Incoming**

**: November 11, 2021**

**Date of issue**

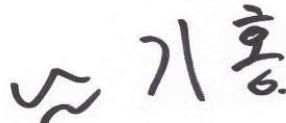
**: December 13, 2021**

## 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.



**Tested by**

**Ju Yun Park / Manager  
ONETECH Corp.**

**Reviewed by**

**Tae-Ho, Kim / Senior Manager  
ONETECH Corp.**

**Approved by**

**Ki-Hong, Nam / General Manager  
ONETECH Corp.**

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**Revision History**

Rev. No.	Issue Report No.	Issued Date	Revisions	Section Affected
0	OT-21D-RWD-024	December 13, 2021	Initial Release	All

## 1. VERIFICATION OF COMPLIANCE

Applicant : CERAGEM CO., LTD.

Address : 10, Jeongja-1-gil, Seonggeo-eup, Seobuk-gu, Cheonan-si, Chungcheongnam-do, Republic of Korea

Contact Person : HYEONGGEUN HWANG / Manager

Telephone No. : 041-529-4359

FCC ID : 2A3VY-SQ310

Model Name : SQ310

Brand Name : N/A

Serial Number : N/A

Date : December 13, 2021

EQUIPMENT CLASS	DSS – PART 15 SPREAD SPECTRUM TRANSMITTER
E.U.T. DESCRIPTION	Bluetooth module
THIS REPORT CONCERNS	Original Grant
MEASUREMENT PROCEDURES	ANSI C63.10: 2013
TYPE OF EQUIPMENT TESTED	Pre-Production
KIND OF EQUIPMENT	Certification
AUTHORIZATION REQUESTED	
EQUIPMENT WILL BE OPERATED UNDER FCC RULES PART(S)	FCC PART 15 SUBPART C Section 15.247 KDB 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 CERAGEM CO., LTD., Model SQ310 (referred to as the EUT in this report) is a Bluetooth module. The product specification described herein was obtained from product data sheet or user's manual.

Device Type	Bluetooth module	
Temperature Range	-20 °C ~ 70 °C	
Operating Frequency	2 402 MHz ~ 2 480 MHz	
MAX. RF OUTPUT POWER	1 Mbps	6.93 dBm
	2 Mbps	5.59 dBm
	3 Mbps	5.64 dBm
Number of Channel	79 Channels	
Modulation Type	GFSK for 1 Mbps, $\pi/4$ -DQPSK for 2 Mbps, 8-DPSK for 3 Mbps	
Antenna Type	PCB Antenna	
Antenna Gain	2.25 dBi	
List of each Osc. or crystal Freq.(Freq. $\geq$ 1 MHz)	26 MHz	
Rated Supply Voltage	DC 5.0 V	

### 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  $1.0 \text{ mW/cm}^2$  for the frequency range between 1 500 MHz and 100 000 MHz.

The electric field generated for a  $1 \text{ mW/cm}^2$  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  $\text{mW/cm}^2$ ,  $Z$  = Impedance of free space,  $377 \Omega$

$E$  = Electric field strength in  $\text{V/m}$ ,  $G$  = 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  $\text{mW}$  and  $\text{cm}$ , using  $P (\text{mW}) = P (\text{W}) / 1000$ ,  $d (\text{cm}) = 0.01 * d (\text{m})$

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

Where

$d$  = distance in  $\text{cm}$ ,  $P$  = Power in  $\text{mW}$ ,  $G$  = Numeric antenna gain, and  $S$  = Power density in  $\text{mW/cm}^2$

### 4.2 EUT Description

Kind of EUT	Bluetooth module
Device Category	<input type="checkbox"/> Portable (< 20 cm separation) <input checked="" type="checkbox"/> Mobile (> 20 cm separation) <input type="checkbox"/> Others
Exposure	<input checked="" type="checkbox"/> MPE
Evaluation Applied	<input type="checkbox"/> SAR <input type="checkbox"/> N/A

#### 4.3.1 Calculated MPE Safe Distance for Bluetooth

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 <sup>2</sup> ) @ 20 cm Separation	Limit (mW/cm <sup>2</sup> )
			(dBm)	(mW)	Log	Linear			
2 402 ~ 2 480	1 Mbps	6.93 ± 1.0	7.93	6.21	2.25	1.68	0.91	0.002 1	1.00
	2 Mbps	5.59 ± 1.0	6.59	4.56			0.78	0.001 5	1.00
	3 Mbps	5.64 ± 1.0	6.64	4.61			0.78	0.001 5	1.00

According to above table, for 2 402 ~ 2480 MHz Band(1 Mbps), safe distance,

$$D = 0.282 * \sqrt{(6.21 * 1.68) / 1.00} = 0.91 \text{ cm.}$$

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

$$S = P * G / (4\pi * R^2) = 6.21 * 1.68 / (4 * \pi * 20^2) = 0.002 1$$

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