

TEST REPORT

of

FCC CFR 47 part 1, 1.1307(b), 1.1310

FCC ID: 2AP7FRMCUM5

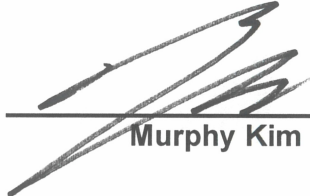
Equipment Under Test : RMCU
Model Name : RMCU M5
Variant Model Name(s) : -
Applicant : TAEHA MECHATRONICS Co., Ltd.
Manufacturer : TAEHA MECHATRONICS Co., Ltd.
Date of Receipt : 2023.12.06
Date of Test(s) : 2023.12.11 ~ 2024.01.31
Date of Issue : 2024.01.31

In the configuration tested, the EUT complied with the standards specified above. This test report does not assure KOLAS accreditation.


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Tested by:


Murphy Kim

**Technical
Manager:**


Jinhyoung Cho

SGS Korea Co., Ltd. Gunpo Laboratory



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1. General Information

1.1. Testing Laboratory

SGS Korea Co., Ltd. (Gunpo Laboratory)

- 10-2, LS-ro 182beon-gil, Gunpo-si, Gyeonggi-do, Korea, 15807
- 4, LS-ro 182beon-gil, Gunpo-si, Gyeonggi-do, Korea, 15807
- Designation number: KR0150

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Telephone : +82 31 688 0901
 FAX : +82 31 688 0921

1.2. Details of Applicant

Applicant : TAEHA MECHATRONICS Co., Ltd.
 Address : 421, Bakdal-ro, Manan-gu, Anyang-si, Gyeonggi-do, Republic of Korea, 13798
 Contact Person : Lee, Kang-il
 Phone No. : +82 31 463 7291

1.3. Details of Manufacturer

Company : Same as applicant
 Address : Same as applicant

1.4. Description of EUT

Kind of Product	RMCU	
Model Name	RMCU M5	
Approved Module	FCC ID: XMR202212EG25GL	
Serial Number	001	
Serial Number	005	
Power Supply	DC 12 ~ 24 V	
Frequency Range	WCDMA II : 1 850 MHz ~ 1 910 MHz WCDMA V : 824 MHz ~ 849 MHz LTE Band 2: 1 850 MHz ~ 1 910 MHz LTE Band 4: 1 710 MHz ~ 1 755 MHz LTE Band 5: 824 MHz ~ 849 MHz LTE Band 7: 2 500 MHz ~ 2 570 MHz	LTE Band 12: 699 MHz ~ 716 MHz LTE Band 13: 777 MHz ~ 787 MHz LTE Band 26(Part 90): 814 MHz ~ 824 MHz LTE Band 26(Part 22): 824 MHz ~ 849 MHz LTE Band 41: 2 496 MHz ~ 2 690 MHz
Modulation Technique	QPSK, 16QAM	
Antenna Type	Shark Antenna	
Antenna Gain*	699 MHz ~ 716 MHz: 4.28 dB i 777 MHz ~ 787 MHz: 3.63 dB i 814 MHz ~ 849 MHz: 3.17 dB i 1 710 MHz ~ 1 755 MHz: 2.35 dB i 1 850 MHz ~ 1 910 MHz: 2.75 dB i 2 496 MHz ~ 2 690 MHz: 5.80 dB	
H/W Version	REV.A.02	
S/W Version	V1.0.0.0	

1.5. Summary of Test Results

The EUT has been tested according to the following specifications:

APPLIED STANDARD: FCC Part 1		
Section	Test Item(s)	Result
1.1307(b)(3)	RF Exposure Evaluation	Complied

1.6. Test Report Revision

Revision	Report Number	Date of Issue	Description
0	F690501-RF-RTL004793	2024.01.31	Initial

2. RF Exposure Evaluation

Test exemptions apply for devices used in general population/uncontrolled exposure environments, according to the SAR-based, or MPE-based exemption thresholds.

2.1. Blanket 1 mW Blanket Exemption

The 1 mW Blanket Exemption of § 1.1307(b)(3)(i)(A) applies for single fixed, mobile, and portable RF sources with available maximum time-averaged power of no more than 1 mW, regardless of separation distance.

The 1 mW blanket exemption applies at separation distances less than 0.5 cm, including where there is no separation. This exemption shall not be used in conjunction with other exemption criteria other than those for multiple RF sources in paragraph § 1.1307(b)(3)(ii)(A).

The 1 mW exemption is independent of service type and covers the full range of 100 kHz to 100 GHz, but it shall not be used in conjunction with other exemption criteria or in devices with higher-power transmitters operating in the same time-averaging period. Exposure from such higher-power transmitters would invalidate the underlying assumption that exposure from the lower-power transmitter is the only contributor to SAR in the relevant volume of tissue.

2.2. MPE-based Exemption

General frequency and separation-distance dependent MPE-based effective radiated power (ERP) thresholds are in Table B.1 [Table 1 of § 1.1307(b)(1)(i)(C)] to support an exemption from further evaluation from 300 kHz through 100 GHz.

**Table 1: THRESHOLDS FOR SINGLE RF SOURCES
 SUBJECT TO ROUTINE ENVIRONMENTAL EVALUATION**

RF Source Frequency			Minimum Distance			Threshold ERP
f_L (MHz)		f_H (MHz)	$\lambda_L / 2\pi$		$\lambda_H / 2\pi$	W
0.3	-	1.34	159 m	-	35.6 m	1 920 R ²
1.34	-	30	35.6 m	-	1.6 m	3 450 R ² /f ²
30	-	300	1.6 m	-	159 mm	3.83 R ²
300	-	1 500	159 mm	-	31.8 mm	0.012 8 R ² f
1 500	-	100 000	31.8 mm	-	0.5 mm	19.2 R ²

Subscripts L and H are low and high; λ is wavelength.
 From § 1.1307(b)(3)(i)(C), modified by adding Minimum Distance columns.

The table applies to any RF source (i.e., single fixed, mobile, and portable transmitters) and specifies power and distance criteria for each of the five frequency ranges used for the MPE limits. These criteria apply at separation distances from any part of the radiating structure of at least $\lambda/2\pi$. The thresholds are based on the general population MPE limits with a single perfect reflection, outside of the reactive near-field, and in the main beam of the radiator.

For mobile devices that are not exempt per Table B.1 [Table 1 of § 1.1307(b)(1)(i)(C)] at distances from 20 cm to 40 cm and in 0.3 GHz to 6 GHz, evaluation of compliance with the exposure limits in § 1.1310 is necessary if the ERP of the device is greater than ERP 20 cm in Formula (B.1) [repeated from § 2.1091(c)(1) and § 1.1307(b)(1)(i)(B)].

$$P_{th} \text{ (mW)} = ERP_{20 \text{ cm}} \text{ (mW)} = \begin{cases} 2040f & 0.3 \text{ GHz} \leq f < 1.5 \text{ GHz} \\ 3060 & 1.5 \text{ GHz} \leq f \leq 6 \text{ GHz} \end{cases} \quad (\text{B. 1})$$

If the ERP is not easily obtained, then the available maximum time-averaged power may be used (i.e., without consideration of ERP only if the physical dimensions of the radiating structure(s) do not exceed the electrical length of $\lambda/4$ or if the antenna gain is less than that of a half-wave dipole.

SAR-based exemptions are constant at separation distances between 20 cm and 40 cm to avoid discontinuities in the threshold when transitioning between SAR-based and MPE-based exemption criteria at 40 cm, considering the importance of reflections.

2.3. SAR-based Exemption

SAR-based thresholds are derived based on frequency, power, and separation distance of the RF source. The formula defines the thresholds in general for either available maximum time-averaged power or maximum time-averaged ERP, whichever is greater.

If the ERP of a device is not easily determined, such as for a portable device with a small form factor, the applicant may use the available maximum time-averaged power exclusively if the device antenna or radiating structure does not exceed an electrical length of $\lambda/4$.

As for devices with antennas of length greater than $\lambda/4$ where the gain is not well defined, but always less than that of a half-wave dipole (length $\lambda/2$), the available maximum time-averaged power generated by the device may be used in place of the maximum time-averaged ERP, where that value is not known.

The separation distance is the smallest distance from any part of the antenna or radiating structure for all persons, during operation at the applicable ERP. In the case of mobile or portable devices, the separation distance is from the outer housing of the device where it is closest to the antenna.

The SAR-based exemption formula of § 1.1307(b)(3)(i)(B), repeated here as Formula (B.2), applies for single fixed, mobile, and portable RF sources with available maximum time-averaged power or effective radiated power (ERP), whichever is greater, of less than or equal to the threshold P_{th} (mW).

This method shall only be used at separation distances from 0.5 cm to 40 cm and at frequencies from 0.3 GHz to 6 GHz (inclusive). P_{th} is given by Formula (B.2).

$$P_{th} \text{ (mW)} = \begin{cases} ERP_{20 \text{ cm}}(d/20 \text{ cm})^x & d \leq 20 \text{ cm} \\ ERP_{20 \text{ cm}} & 20 \text{ cm} < d \leq 40 \text{ cm} \end{cases} \quad (\text{B. 2})$$

where

$$x = -\log_{10} \left(\frac{60}{ERP_{20 \text{ cm}} \sqrt{f}} \right)$$

and f is in GHz, d is the separation distance (cm), and $ERP_{20 \text{ cm}}$ is per Formula (B.1).

2.4. Simultaneous Transmission SAR Test Exemption with Respect to Multiple Exemption Criteria

Either SAR-based or MPE-based exemption may be considered for test exemption for fixed, mobile, or portable device exposure conditions; therefore, the contributions from each exemption in conjunction with the measured SAR (Evaluated_k term) shall be used to determine exemption for simultaneous transmission according to Formula (C.1) [repeated from § 1.1307(b)(3)(ii)(B)].

$$\sum_{i=1}^a \frac{P_i}{P_{th,i}} + \sum_{j=1}^b \frac{ERP_j}{ERP_{th,j}} + \sum_{k=1}^c \frac{Evaluated_k}{Exposure Limit_k} \leq 1$$

3. Test Result

3.1. SAR-based Exemption

Mode	Frequency Range (MHz)	Maximum Average Target Power (dB m)	Maximum Tune up (dB)	Antenna Gain (dB i)	Minimum Separation Distance (cm)	Maximum Average Output Power		ERP		Limits P _{th} (mW)	Ratio ¹⁾	Result
						(dB m)	(mW)	(dB m)	(mW)			
WCMDA II	1 850 ~ 1 910	23	2	2.75	20	25	316.23	25.60	363.08	3 060	0.12	pass
WCMDA V	824 ~ 849	23	2	3.17	20	25	316.23	26.02	399.94	1 680.96	0.24	pass
LTE Band 2	1 850 ~ 1 910	23	2	2.75	20	25	316.23	25.60	363.08	3 060	0.12	pass
LTE Band 4	1710 ~ 1755	23	2	2.35	20	25	316.23	25.20	331.13	3 060	0.11	pass
LTE Band 7	2 500 ~ 2 570	23	2	5.80	20	25	316.23	28.65	732.82	3 060	0.24	pass
LTE Band 12	699 ~ 716	23	2	4.28	20	25	316.23	27.13	516.42	1 425.96	0.36	pass
LTE Band 13	777 ~ 787	23	2	3.63	20	25	316.23	26.48	444.63	1 585.08	0.28	pass
LTE Band 26	814 ~ 824	23	2	3.17	20	25	316.23	26.02	399.94	1 660.56	0.24	pass
LTE Band 26/5	824 ~ 849	23	2	3.17	20	25	316.23	26.02	399.94	1 680.96	0.24	pass
LTE Band 41	2 496 ~ 2 690	23	2	5.80	20	25	316.23	28.65	732.82	3 060	0.24	pass

Note;

- Maximum average target power is the manufacturer's declared rated power.
- Maximum average output power (dB m) = Maximum average target power (dB m) + Maximum tune up (dB).
- ERP (dB m) = Maximum average output power (dB m) + Antenna gain (dB i) - 2.15 (dB)

1) A greater value between the ERP(dB m) and the Maximum average output power(dB m) is applied.

3.2. Conclusion: No SAR is required.

- End of the Test Report -