

TEST REPORT

of

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

FCC ID: 2AVZC-A000010007A

1. Equipment Under Test : BT/Wi-Fi Combo Module Gen6
2. Model Name : A000010007A
3. Variant Model Name(s) : -
4. Applicant : Markone technology CO., Ltd.
5. Manufacturer : Markone technology CO., Ltd.
6. Date of Receipt : 2020.01.21
7. Date of Test(s) : 2020.02.01 ~ 2020.06.08
8. Date of Issue : 2020.06.08

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

- 1) The results of this test report are effective only to the items tested.
- 2) The SGS Korea is not responsible for the sampling, the results of this test report apply to the sample as received.

Tested by:



Murphy Kim

Technical
Manager:



Jungmin Yang

SGS Korea Co., Ltd. Gunpo Laboratory



SGS Korea Co., Ltd.

4, LS-ro 182beon-gil, Gunpo-si, Gyeonggi-do, Korea, 15807
Tel. +82 31 428 5700 / Fax. +82 31 427 2370
<http://www.sgsgroup.kr>

Report Number: F690501-RF-RTL000461-1

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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 : Markone technology CO., Ltd.

Address : 232, Yeongudanji-ro, Ochang-eup, Cheongwon-gu, Cheongju-si,
Chungcheongbuk-do, South Korea, 28119

Contact Person : Lee, James

Phone No. : +82 10 9916 2536

1.3. Details of Manufacturer

Company : Same as applicant

Address : Same as applicant

1.4. Description of EUT

Kind of Product		BT/Wi-Fi Combo Module Gen6
Model Name		A000010007A
Power Supply		DC 3.3 V
Frequency Range		2 402 MHz ~ 2 480 MHz (Bluetooth) 2 402 MHz ~ 2 480 MHz (Bluetooth Low Energy) 2 412 MHz ~ 2 462 MHz (11b/g/n_HT20) 5 180 MHz ~ 5 240 MHz (Band 1: 11a/n_HT20, 11ac_VHT20) 5 190 MHz ~ 5 230 MHz (Band 1: 11n_HT40, 11ac_VHT40) 5 210 MHz (Band 1: 11ac_VHT80) 5 745 MHz ~ 5 825 MHz (Band 3: 11a/n_HT20, 11ac_VHT20) 5 755 MHz ~ 5 795 MHz (Band 3: 11n_HT40, 11ac_VHT40) 5 775 MHz (Band 3: 11ac_VHT80)
Modulation Technique		DSSS, OFDM, GFSK, $\pi/4$ DQPSK, 8DPSK
Number of Channels		79 channels (Bluetooth) 40 channels (Bluetooth Low Energy) 11 channels (11b/g/n_HT20) 4 channels (Band 1: 11a/n_HT20, 11ac_VHT20) 2 channels (Band 1: 11n_HT40, 11ac_VHT40) 1 channel (Band 1: 11ac_VHT80) 5 channels (Band 3: 11a/n_HT20, 11ac_VHT20) 2 channels (Band 3: 11n_HT40, 11ac_VHT40) 1 channel (Band 3: 11ac_VHT80)
Antenna Type		PCB & Cable Assembly antenna
Antenna Gain	ANT 1	2 400 MHz ~ 2 483.5 MHz: 1.65 dB i (Bluetooth) 2 400 MHz ~ 2 483.5 MHz: 1.65 dB i (Bluetooth Low Energy) 5 150 MHz ~ 5 250 MHz: 2.84 dB i (WLAN 5 G) 5 725 MHz ~ 5 850 MHz: 2.73 dB i (WLAN 5 G)
	ANT 2	2 400 MHz ~ 2 483.5 MHz: 1.63 dB i (WLAN 2.4 G) 5 150 MHz ~ 5 250 MHz: 2.54 dB i (WLAN 5 G) 5 725 MHz ~ 5 850 MHz: 2.45 dB i (WLAN 5 G)

1.5. Test Report Revision

Revision	Report Number	Date of Issue	Description
0	F690501-RF-RTL000461	2020.03.25	Initial
1	F690501-RF-RTL000461-1	2020.06.08	Revised the output average power to antenna

2. RF Exposure Evaluation

2.1. Environmental evaluation and exposure limit according to FCC CFR 47 part 1, 1.1307(b), 1.1310

LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm ²)	Average Time
(A) Limits for Occupational/Controlled Exposure				
0.3-3.0	614	1.63	*100	6
3.0-30	1842/f	4.89/f	*900/f ²	6
30-300	61.4	0.163	1.0	6
300-1 500	-	-	f/300	6
1 500-100 000	-	-	5	6
(B) Limits for General Population/Uncontrolled Exposure				
0.3-1.34	614	1.63	*100	30
1.34-30	824/f	2.19/f	*180/f ²	30
30-300	27.5	0.073	0.2	30
300-1 500	-	-	f/1500	30
<u>1 500-100 000</u>	-	-	<u>1.0</u>	<u>30</u>

2.1.1. Friis transmission formula: $P_d = (P_{out} \cdot G) / (4 \cdot \pi \cdot R^2)$

Where P_d = power density in mW/cm²

P_{out} = output power to antenna in mW

G = gain of antenna in linear scale

π = 3.1416

R = distance between observation point and center of the radiator in cm

P_d the limit of MPE, 1 mW/cm². If we know the maximum gain of the antenna and the total power input to the antenna, through the calculation, we will know the distance where the MPE limit is reached.

2.1.2. Test Result of RF Exposure Evaluation

Test Item : RF Exposure Evaluation Data

Test Mode : Normal Operation

2.1.3. Output Power into Antenna & RF Exposure Evaluation Distance

Bluetooth

- Maximum tune up tolerance

Frequency (MHz)	Output Average Power to Antenna (dB m)	Antenna Gain (dB i)	Power Density at 20 cm (mW/cm ²)	Limits (mW/cm ²)
2 400 ~ 2 483.5	2	1.65	0.000 461	1

Bluetooth Low Energy

- Maximum tune up tolerance

Frequency (MHz)	Output Average Power to Antenna (dB m)	Antenna Gain (dB i)	Power Density at 20 cm (mW/cm ²)	Limits (mW/cm ²)
2 400 ~ 2 483.5	4	1.65	0.000 731	1

WLAN (2.4G)

- Maximum tune up tolerance

Frequency (MHz)	Output Average Power to Antenna (dB m)	Antenna Gain (dB i)	Power Density at 20 cm (mW/cm ²)	Limits (mW/cm ²)
2 400 ~ 2 483.5	19	1.63	0.023 000	1

WLAN (5G)

- Maximum tune up tolerance

Frequency (MHz)	Output Average Power to Antenna (dB m)	Antenna Gain (dB i)	Power Density at 20 cm (mW/cm ²)	Limits (mW/cm ²)
5 150 ~ 5 250	11	5.70	0.009 305	1
5 725 ~ 5 850	13	5.60	0.014 412	1

Note;

- For antenna gain in WLAN (5G), ANT 1 and ANT 2 are combined. Because WLAN (5G) operates with MIMO function.
- The power density Pd (5th column) at a distance of 20 cm calculated from the Friis transmission formula is far below the limit of 1 mW/cm².
- This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment.
- This equipment should be installed and operated with minimum 20 cm between the radiator and your body.
- The antenna gain of this transmitter is less than 6 dBi and must not be collocated or operating in conjunction with any other antenna or transmitter unless authorized to do so by the FCC.
- According to KDB 447498 D01 RF Exposure Guidance 4.1.

Simultaneous transmission of RF Exposure test exclusion for worst case configuration.

Bluetooth: the ratio is 0.000 731 / 1

WLAN: the ratio is 0.023 000 / 1

Confirm the sum result of individual MPEs ratio is ≤ 1.0 ;

Bluetooth + WLAN: $(0.000\ 731 / 1) + (0.023\ 000 / 1) = 0.023\ 731 \leq 1.0$

- End of the Test Report -