RF EXPOSURE REPORT

Applicant:	Guangzhou Shikun Electronics Co., Ltd
Address:	NO.6 Liankun Road, Huangpu District, Guangzhou, China
Manufacturer:	Guangzhou Shikun Electronics Co., Ltd
Address:	NO.6 Liankun Road, Huangpu District, Guangzhou, China
Product Description:	IEEE 802.11a/b/g/n/ac 2T2R Wi-Fi Module Integrated BT 2.1/3.0/4.2/5.0
Brand Name:	N/A
Tested Model:	SKI.WB822CU.5
FCC ID:	2AR82-SKIWB822CU5
Report No.:	JCF231222208-005
Received Date:	Dec. 22, 2023
Tested Date:	Dec. 22, 2023 - Jan. 20, 2024
Issued Date:	Jan. 23, 2024
Test Standards:	FCC Part 2(Section 2.1091) 447498 D04 Interim General RF Exposure Guidance v01
Test Result:	Pass

Prepared By:

Kennys Zhang

Kennys Zhang/Engineer   **Date:** Jan. 23, 2024

Reviewed By:

Roger Li

Roger Li/Engineer   **Date:** Jan. 23, 2024

Approved By:

Talent Zhang

Talent Zhang/Engineer   **Date:** Jan. 23, 2024

Note: The test results in this report apply exclusively to the tested model / sample. Without written approval of Guangzhou Jingce Testing Technology Co., Ltd. the test report shall not be reproduced except in full.

Report Revise Record

Report Version	Revise Time	Issued Date	Valid Version	Notes
V1.0	/	Jan. 23, 2024	Original Report	/

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1. Test Report Declare

Applicant:	Guangzhou Shikun Electronics Co., Ltd
Address:	NO.6 Liankun Road, Huangpu District, Guangzhou, China
Manufacturer:	Guangzhou Shikun Electronics Co., Ltd
Address:	NO.6 Liankun Road, Huangpu District, Guangzhou, China
Product Name	IEEE 802.11a/b/g/n/ac 2T2R Wi-Fi Module Integrated BT 2.1/3.0/4.2/5.0
Brand Name:	N/A
Model Name:	SKI.WB822CU.5

We Declare:

The equipment described above is tested by Guangzhou Jingce Testing Technology Co., Ltd. and in the configuration tested the equipment complied with the standards specified above. The test results are contained in this test report and Guangzhou Jingce Testing Technology Co., Ltd. is assumed of full responsibility for the accuracy and completeness of these tests except as provided information by clients.

2. Equipment Under Test
2.1. Description of EUT

EUT* Name:	IEEE 802.11a/b/g/n/ac 2T2R Wi-Fi Module Integrated BT 2.1/3.0/4.2/5.0
Model Number:	SKI.WB822CU.5
EUT Function Description:	Refer to user manual
Power Supply:	DC 3.3V±0.3
Hardware Version:	N/A
Software Version:	N/A
Radio Specification:	Bluetooth V5.0, IEEE802.11b/g/n/a/ac
Operation Frequency:	Bluetooth: 2402MHz-2480MHz IEEE802.11b/g/n/a/ac: 2412MHz-2462MHz, 5180MHz—5825MHz
Modulation:	Bluetooth: GFSK, π/4-DQPSK, 8DPSK IEEE 802.11b: DSSS (CCK, QPSK, BPSK) IEEE 802.11g: OFDM (64QAM, 16QAM, QPSK, BPSK) IEEE 802.11n HT20, HT40: OFDM (64QAM, 16QAM, QPSK, BPSK) IEEE 802.11a: OFDM (64QAM, 16QAM, QPSK, BPSK) IEEE 802.11n HT20, HT40: OFDM (64QAM, 16QAM, QPSK, BPSK) IEEE 802.11ac (HT20/40/80): OFDM (256QAM, 64QAM, 16QAM, QPSK, BPSK)
Data Rate:	Bluetooth: 1Mbps, 2Mbps, 3Mbps IEEE 802.11b: 1, 2, 5.5, 11Mbps IEEE 802.11g: 6, 9, 12, 18, 24, 36, 48, 54 Mbps IEEE 802.11n HT20: 14.4, 28.9, 43.3, 57.8, 86.7, 115.6, 130.0, 144.4Mbps IEEE 802.11n HT40: 30.0, 60.0, 90.0, 120.0, 180.0, 240.0, 270.0, 300.0 Mbps IEEE 802.11a: 6, 9, 12, 18, 24, 36, 48, 54Mbps IEEE 802.11n HT20: 14.4, 28.9, 43.3, 57.8, 86.7, 115.6, 130, 144.4 Mbps IEEE 802.11n HT40: 30, 60, 90, 120, 180, 240, 270, 300 Mbps IEEE 802.11ac VHT20: 14.4, 28.9, 43.3, 57.8, 86.7, 115.6, 130, 144.4, 173.3 Mbps IEEE 802.11ac VHT40: 30, 60, 90, 120, 180, 240, 270, 300, 360, 400 Mbps IEEE 802.11ac VHT80: 65, 130, 195, 260, 390, 520, 585, 650, 780, 866.7 Mbps
Antenna Type:	BT&BLE: Shrapnel Antenna, MAX. Gain: 1.72 dBi, 2.4G WLAN: PCB Antenna0, MAX. Gain: 3.99 dBi, 2.4G WLAN: PCB Antenna1, MAX. Gain: 3.42 dBi, 5GHz RLAN: PCB Antenna0, MAX. Gain: 4.94 dBi, 5GHz RLAN: PCB Antenna1, MAX. Gain: 4.08 dBi
Product Type:	☐Portable device ☑Mobile device ☐Fixed device

Note 1: EUT is the ab. of equipment under test.

Note 2: The antenna gain is declared by the customer and the laboratory is not responsible for the accuracy of the antenna gain.

2.2. Description of Available Antennas

Test Mode	Transmit and Receive Mode	Description
BT&BLE	⊠ 1TX, 1RX	ANT 1 can be used as transmitting/receiving antenna.
2.4G WIFI	⊠ 2TX, 2RX	ANT 1 and ANT2 can be used as transmitting/receiving antenna.
5G WIFI	⊠ 2TX, 2RX	ANT 1 and ANT2 can be used as transmitting/receiving antenna.

3. Test Laboratory

Guangzhou Jingce Testing Technology Co., Ltd.

Add.: No.192, Kezhu Road, Huangpu District, Guangzhou, Guangdong, China

Association for Laboratory Accreditation(A2LA). Certificate Number: 6594.01

FCC Designation Number: CN1331. Test Firm Registration Number: 360543

IC Test Firm Registration Number: 28796

Conformity Assessment Body identifier: CN0138

4. FCC Radio Frequency Radiation Exposure Limits

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

4.1. 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.

4.2. 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 B.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	0.0128 $R^2 f$
1,500	–	100,000	31.8 mm	–	0.5 mm	19.2R^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 λ/2π. 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 ERP20cm in Formula (B.1) [repeated from § 2.1091(c)(1) and § 1.1307(b)(1)(i)(B)].

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

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 λ/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.

Limit calculation:

Frequency range(GHz)	Frequency(GHz)	R(λ/2π)(m)	P_{th}/ERP$_{20cm}$(mW)
0.3~1.5	NA	NA	NA
1.5~6	NA	NA	NA

4.3. 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 timeaveraged 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 λ/4.

As for devices with antennas of length greater than λ/4 where the gain is not well defined, but always less than that of a half-wave dipole (length λ/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 Pth (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). Pth is given by Formula (B.2).

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

where

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

and f is in GHz, d is the separation distance (cm), and ERP_{20cm} is per Formula (B.1).
The example values shown in Table B.2 are for illustration only.

Table B.2—Example Power Thresholds (mW)

Frequency (MHz)	Distance (mm)									
	5	10	15	20	25	30	35	40	45	50
300	39	65	88	110	129	148	166	184	201	217
450	22	44	67	89	112	135	158	180	203	226
835	9	25	44	66	90	116	145	175	207	240
1900	3	12	26	44	66	92	122	157	195	236
2450	3	10	22	38	59	83	111	143	179	219
3600	2	8	18	32	49	71	96	125	158	195
5800	1	6	14	25	40	58	80	106	136	169

Limit calculation:

Frquency range(GHz)	Frequency(GHz)	X	Distance(cm)	P_{th}(mW)
0.3~1.5	NA	NA	NA	NA
1.5~6	NA	NA	NA	NA

Note:If RF exposure testing requirements for a specific device are covered in a KDB publication, those requirements must be satisfied before applying any SAR test exemption provisions. For example, this is the case for handheld PTT two-way radios, handsets, laptops, and tablets, etc.9

Finally, when 10-g extremity SAR applies, SAR test exemption may be considered by applying a factor of 2.5 to the SAR-based exemption thresholds.

4.4. Simultaneous Transmission with both SAR-based and MPE-Based Test Exemptions

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 (Evaluatedk term) shall be used to determine exemption for simultaneous transmission according to Formula (C.1) [repeated from § 1.1307(b)(3)(ii)(B)].

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

Remark:

    a: number of fixed, mobile, or portable RF sources claiming exemption using the § 1.1307(b)(3)(i)(B) formula for Pth, including existing exempt transmitters and those being added.

    b: number of fixed, mobile, or portable RF sources claiming exemption using the applicable § 1.1307(b)(3)(i)(C) Table 1 formula for Threshold ERP, including existing exempt transmitters and those being added.

    c: number of existing fixed, mobile, or portable RF sources with known evaluation for the specified minimum distance.

    P_i: the available maximum time-averaged power or the ERP, whichever is greater, for fixed, mobile, or portable RF source i at a distance between 0.5 cm and 40 cm (inclusive).

    $P_{th,i}$: the exemption threshold power (Pth) according to the § 1.1307(b)(3)(i)(B) formula for fixed, mobile, or portable RF source i.

    ERP_j: the available maximum time-averaged power or the ERP, whichever is greater, of fixed, mobile, or portable RF source j.

    $ERP_{th,j}$: exemption threshold ERP for fixed, mobile, or portable RF source j, at a distance of at least $\lambda/2\pi$, according to the applicable § 1.1307(b)(3)(i)(C) Table 1 formula at the location in question.

    $Evaluated_k$: the maximum reported SAR or MPE of fixed, mobile, or portable RF source k either in the device or at the transmitter site from an existing evaluation.

    Exposure $Limit_k$: either the general population/uncontrolled maximum permissible exposure (MPE) or specific absorption rate (SAR) limit for each fixed, mobile, or portable sources, as applicable

5. RF Exposure Calculation

We used the maximum power between the conducted power and ERP/EIRP to perform RF exposure exemption evaluation.

TEST MODE	CONDECTED POWER (dBm)	ANTENNA GAIN (dBi)	EIRP (mW)	CONDECTED POWER (mW)	Exempt Limit (mW)	PASS/FAIL
BT&BLE	10.2	1.72	15.56	10.47	3060	PASS
2.4G WIFI	19.57	3.99	226.99	90.57	3060	PASS
5G WIFI	15.39	4.94	107.89	34.59	3060	PASS

Conclusion of simultaneous transmitter

The sum of the ratios=15.56mW+226.99mW+107.89mW=350.44mW

Therefore the worst-case situation is to qualify for simultaneous transmission SAR test exemption, the exemption report is in lieu of the SAR report.

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