

## FCC 47 CFR MPE REPORT

Guangzhou Shikun Electronics Co., Ltd

IEEE802.11a/b/g/n/ac 2T2R USB Wi-Fi Module Integrated Bluetooth  
2.1/3.0/4.2/5.0

Model Number: SKI.WB822CU.2

FCC ID: 2AR82-SKIWB822CU2

|                          |                                                                     |
|--------------------------|---------------------------------------------------------------------|
| Applicant:               | Guangzhou Shikun Electronics Co., Ltd                               |
| Address:                 | NO.6 Liankun Road, Huangpu District, Guangzhou, China               |
|                          |                                                                     |
| Prepared By:             | EST Technology Co., Ltd.                                            |
|                          | Chilingxiang, Qishantou, Santun, Houjie, Dongguan, Guangdong, China |
| Tel: 86-769-83081888-808 |                                                                     |

|                 |                  |
|-----------------|------------------|
| Report Number:  | ESTE-R2112277    |
| Date of Test:   | Dec. 01-24, 2021 |
| Date of Report: | Dec. 29, 2021    |



## Maximum Permissible Exposure

### 1. Applicable Standards

Systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy level in excess limit for maximum permissible exposure. In accordance with 47 CFR FCC Part 2 Subpart J, section 2.1091 this device has been defined as a mobile device whereby a distance of 0.2m normally can be maintained between the user and the device.

#### 1.1. Limits for Maximum Permissible Exposure (MPE)

##### (a) Limits for Occupational/Controlled Exposure

| Frequency Range (MHz) | Electric Field Strength (E) (V/m) | Magnetic Field Strength (H) (A/m) | Power Density (S) (mW/cm <sup>2</sup> ) | Averaging Times   E   <sup>2</sup> ,   H   <sup>2</sup> or S (minutes) |
|-----------------------|-----------------------------------|-----------------------------------|-----------------------------------------|------------------------------------------------------------------------|
| 0.3-3.0               | 614                               | 1.63                              | (100)*                                  | 6                                                                      |
| 3.0-30                | 1842/f                            | 4.89/f                            | (900/f)*                                | 6                                                                      |
| 30-300                | 61.4                              | 0.163                             | 1.0                                     | 6                                                                      |
| 300-1500              |                                   |                                   | F/300                                   | 6                                                                      |
| 1500-10000            |                                   |                                   | 5                                       | 6                                                                      |

##### (b) Limits for General Population / Uncontrolled Exposure

| Frequency Range (MHz) | Electric Field Strength (E) (V/m) | Magnetic Field Strength (H) (A/m) | Power Density (S) (mW/cm <sup>2</sup> ) | Averaging Times   E   <sup>2</sup> ,   H   <sup>2</sup> or S (minutes) |
|-----------------------|-----------------------------------|-----------------------------------|-----------------------------------------|------------------------------------------------------------------------|
| 0.3-1.34              | 614                               | 1.63                              | (100)*                                  | 30                                                                     |
| 1.34-30               | 824/f                             | 2.19/f                            | (180/f)*                                | 30                                                                     |
| 30-300                | 27.5                              | 0.073                             | 0.2                                     | 30                                                                     |
| 300-1500              |                                   |                                   | F/1500                                  | 30                                                                     |
| 1500-10000            |                                   |                                   | 1.0                                     | 30                                                                     |

Note: f=frequency in MHz; \*Plane-wave equivalent power density

## 1.2. MPE Calculation Method

$$E \text{ (V/m)} = \frac{\sqrt{30 \times P \times G}}{d} \quad \text{Power Density: } Pd \text{ (W/m}^2\text{)} = \frac{E^2}{377}$$

E = Electric Field (V/m)

P = Peak RF output Power (W)

G = EUT Antenna numeric gain (numeric)

d = Separation distance between radiator and human body (m)

The formula can be changed to

$$Pd = \frac{30 \times P \times G}{377 \times d^2}$$

From the peak EUT RF output power, the minimum mobile separation distance, d=0.2m, as well as the gain of the used antenna, the RF power density can be obtained

## 2. Conducted Power Result

### Antenna 1

| Mode                              | Frequency<br>(MHz) | Peak output power<br>(dBm) | Peak output power<br>(mW) | Target power<br>(dBm) |
|-----------------------------------|--------------------|----------------------------|---------------------------|-----------------------|
| GFSK                              | 2402               | 3.60                       | 2.2909                    | 3±1                   |
|                                   | 2441               | 3.65                       | 2.3174                    | 3±1                   |
|                                   | 2480               | 4.43                       | 2.7733                    | 4±1                   |
| 8-DPSK                            | 2402               | 5.88                       | 3.8726                    | 5±1                   |
|                                   | 2441               | 6.55                       | 4.5186                    | 6±1                   |
|                                   | 2480               | 7.22                       | 5.2723                    | 7±1                   |
| GFSK 1M                           | 2402               | 2.93                       | 1.9634                    | 2±1                   |
|                                   | 2440               | 3.06                       | 2.0230                    | 3±1                   |
|                                   | 2480               | 4.31                       | 2.6977                    | 4±1                   |
| GFSK 2M                           | 2402               | 2.48                       | 1.7701                    | 2±1                   |
|                                   | 2440               | 2.99                       | 1.9907                    | 2±1                   |
|                                   | 2480               | 3.80                       | 2.3988                    | 3±1                   |
| IEEE<br>802.11b                   | 2412               | 11.93                      | 15.5955                   | 11±1                  |
|                                   | 2437               | 11.82                      | 15.2055                   | 11±1                  |
|                                   | 2462               | 11.72                      | 14.8594                   | 11±1                  |
| IEEE<br>802.11g                   | 2412               | 17.31                      | 53.8270                   | 17±1                  |
|                                   | 2437               | 17.01                      | 50.2343                   | 17±1                  |
|                                   | 2462               | 16.74                      | 47.2063                   | 16±1                  |
| IEEE<br>802.11n<br>HT20<br>(2.4G) | 2412               | 15.00                      | 31.6228                   | 15±1                  |
|                                   | 2437               | 14.68                      | 29.3765                   | 14±1                  |
|                                   | 2462               | 14.45                      | 27.8612                   | 14±1                  |
| IEEE<br>802.11n<br>HT40<br>(2.4G) | 2422               | 15.55                      | 35.8922                   | 15±1                  |
|                                   | 2437               | 15.61                      | 36.3915                   | 15±1                  |
|                                   | 2462               | 15.29                      | 33.8065                   | 15±1                  |
| IEEE<br>802.11a                   | 5180               | 7.989                      | 6.2936                    | 7±1                   |
|                                   | 5200               | 6.937                      | 4.9397                    | 6±1                   |
|                                   | 5240               | 6.474                      | 4.4402                    | 6±1                   |
|                                   | 5260               | 6.775                      | 4.7588                    | 6±1                   |
|                                   | 5300               | 5.359                      | 3.4348                    | 5±1                   |
|                                   | 5320               | 4.538                      | 2.8432                    | 4±1                   |

|                              |      |        |         |      |
|------------------------------|------|--------|---------|------|
|                              | 5500 | 7.702  | 5.8911  | 7±1  |
|                              | 5580 | 5.570  | 3.6058  | 5±1  |
|                              | 5700 | 4.129  | 2.5876  | 4±1  |
|                              | 5745 | 6.363  | 4.3281  | 6±1  |
|                              | 5785 | 7.938  | 6.2201  | 7±1  |
|                              | 5825 | 7.161  | 5.2012  | 7±1  |
| IEEE<br>802.11n<br>HT20 (5G) | 5180 | 7.217  | 5.2687  | 7±1  |
|                              | 5200 | 7.567  | 5.7108  | 7±1  |
|                              | 5240 | 6.692  | 4.6687  | 6±1  |
|                              | 5260 | 6.981  | 4.9900  | 6±1  |
|                              | 5300 | 5.647  | 3.6703  | 5±1  |
|                              | 5320 | 4.783  | 3.0082  | 4±1  |
|                              | 5500 | 7.799  | 6.0242  | 7±1  |
|                              | 5580 | 6.038  | 4.0161  | 6±1  |
|                              | 5700 | 4.453  | 2.7880  | 4±1  |
|                              | 5745 | 6.642  | 4.6153  | 6±1  |
|                              | 5785 | 7.218  | 5.2699  | 7±1  |
|                              | 5825 | 6.714  | 4.6925  | 6±1  |
| IEEE<br>802.11ac<br>VHT20    | 5180 | 6.967  | 4.9739  | 6±1  |
|                              | 5200 | 7.428  | 5.5310  | 7±1  |
|                              | 5240 | 6.953  | 4.9579  | 6±1  |
|                              | 5260 | 7.101  | 5.1298  | 7±1  |
|                              | 5300 | 5.767  | 3.7731  | 5±1  |
|                              | 5320 | 4.574  | 2.8668  | 4±1  |
|                              | 5500 | 7.725  | 5.9224  | 7±1  |
|                              | 5580 | 6.022  | 4.0013  | 6±1  |
|                              | 5700 | 4.494  | 2.8145  | 4±1  |
|                              | 5745 | 6.647  | 4.6206  | 6±1  |
|                              | 5785 | 7.254  | 5.3137  | 7±1  |
|                              | 5825 | 6.707  | 4.6849  | 6±1  |
| IEEE<br>802.11n<br>HT40 (5G) | 5190 | 9.193  | 8.3042  | 9±1  |
|                              | 5230 | 9.329  | 8.5684  | 9±1  |
|                              | 5270 | 9.224  | 8.3637  | 9±1  |
|                              | 5310 | 7.500  | 5.6234  | 7±1  |
|                              | 5510 | 10.159 | 10.3729 | 10±1 |
|                              | 5590 | 8.045  | 6.3753  | 8±1  |
|                              | 5670 | 7.148  | 5.1856  | 7±1  |
|                              | 5755 | 9.093  | 8.1152  | 9±1  |

|                           |      |        |         |      |
|---------------------------|------|--------|---------|------|
|                           | 5795 | 9.111  | 8.1489  | 9±1  |
| IEEE<br>802.11ac<br>VHT40 | 5190 | 10.170 | 10.3992 | 10±1 |
|                           | 5230 | 9.890  | 9.7499  | 9±1  |
|                           | 5270 | 9.215  | 8.3464  | 9±1  |
|                           | 5310 | 7.482  | 5.6002  | 7±1  |
|                           | 5510 | 10.151 | 10.3538 | 10±1 |
|                           | 5590 | 8.052  | 6.3856  | 8±1  |
|                           | 5670 | 7.069  | 5.0921  | 7±1  |
|                           | 5755 | 8.981  | 7.9086  | 8±1  |
|                           | 5795 | 9.062  | 8.0575  | 9±1  |
| IEEE<br>802.11ac<br>VHT80 | 5210 | 5.361  | 3.4364  | 5±1  |
|                           | 5290 | 6.648  | 4.6217  | 6±1  |
|                           | 5530 | 8.189  | 6.5902  | 8±1  |
|                           | 5610 | 6.125  | 4.0973  | 6±1  |
|                           | 5775 | 6.605  | 4.5761  | 6±1  |

**Antenna 2**

| Mode                              | Frequency<br>(MHz) | Peak output power<br>(dBm) | Peak output power<br>(mW) | Target power<br>(dBm) |
|-----------------------------------|--------------------|----------------------------|---------------------------|-----------------------|
| IEEE<br>802.11b                   | 2412               | 11.30                      | 13.4896                   | 11±1                  |
|                                   | 2437               | 12.00                      | 15.8489                   | 12±1                  |
|                                   | 2462               | 11.88                      | 15.4170                   | 11±1                  |
| IEEE<br>802.11g                   | 2412               | 17.17                      | 52.1195                   | 17±1                  |
|                                   | 2437               | 16.73                      | 47.0977                   | 16±1                  |
|                                   | 2462               | 16.48                      | 44.4631                   | 16±1                  |
| IEEE<br>802.11n<br>HT20<br>(2.4G) | 2412               | 14.27                      | 26.7301                   | 14±1                  |
|                                   | 2437               | 13.99                      | 25.0611                   | 13±1                  |
|                                   | 2462               | 13.80                      | 23.9883                   | 13±1                  |
| IEEE<br>802.11n<br>HT40<br>(2.4G) | 2422               | 15.53                      | 35.7273                   | 15±1                  |
|                                   | 2437               | 15.43                      | 34.9140                   | 15±1                  |
|                                   | 2452               | 14.96                      | 31.3329                   | 14±1                  |
| IEEE<br>802.11a                   | 5180               | 9.389                      | 8.6876                    | 9±1                   |
|                                   | 5200               | 7.669                      | 5.8466                    | 7±1                   |
|                                   | 5240               | 5.661                      | 3.6821                    | 5±1                   |
|                                   | 5260               | 5.800                      | 3.8019                    | 5±1                   |
|                                   | 5300               | 4.093                      | 2.5663                    | 4±1                   |
|                                   | 5320               | 3.351                      | 2.1632                    | 3±1                   |
|                                   | 5500               | 8.344                      | 6.8297                    | 8±1                   |
|                                   | 5580               | 5.633                      | 3.6585                    | 5±1                   |
|                                   | 5700               | 5.866                      | 3.8601                    | 5±1                   |
|                                   | 5745               | 6.985                      | 4.9946                    | 6±1                   |
|                                   | 5785               | 6.996                      | 5.0073                    | 6±1                   |
|                                   | 5825               | 6.362                      | 4.3271                    | 6±1                   |
| IEEE<br>802.11n<br>HT20 (5G)      | 5180               | 9.969                      | 9.9289                    | 9±1                   |
|                                   | 5200               | 7.840                      | 6.0814                    | 7±1                   |
|                                   | 5240               | 5.791                      | 3.7940                    | 5±1                   |
|                                   | 5260               | 7.006                      | 5.0188                    | 7±1                   |
|                                   | 5300               | 4.286                      | 2.6829                    | 4±1                   |
|                                   | 5320               | 3.636                      | 2.3099                    | 3±1                   |
|                                   | 5500               | 8.524                      | 7.1187                    | 8±1                   |
|                                   | 5580               | 6.903                      | 4.9012                    | 6±1                   |

|                              |      |       |        |      |
|------------------------------|------|-------|--------|------|
|                              | 5700 | 5.800 | 3.8019 | 5±1  |
|                              | 5745 | 6.901 | 4.8989 | 6±1  |
|                              | 5785 | 7.076 | 5.1004 | 7±1  |
|                              | 5825 | 6.471 | 4.4371 | 6±1  |
| IEEE<br>802.11ac<br>VHT20    | 5180 | 8.158 | 6.5433 | 8±1  |
|                              | 5200 | 7.567 | 5.7108 | 7±1  |
|                              | 5240 | 5.534 | 3.5760 | 5±1  |
|                              | 5260 | 5.830 | 3.8282 | 5±1  |
|                              | 5300 | 4.053 | 2.5427 | 4±1  |
|                              | 5320 | 3.535 | 2.2568 | 3±1  |
|                              | 5500 | 8.236 | 6.6619 | 8±1  |
|                              | 5580 | 5.712 | 3.7256 | 5±1  |
|                              | 5700 | 5.108 | 3.2419 | 5±1  |
|                              | 5745 | 6.558 | 4.5269 | 6±1  |
|                              | 5785 | 6.924 | 4.9249 | 6±1  |
|                              | 5825 | 6.404 | 4.3692 | 6±1  |
| IEEE<br>802.11n<br>HT40 (5G) | 5190 | 9.998 | 9.9954 | 10±1 |
|                              | 5230 | 8.274 | 6.7205 | 8±1  |
|                              | 5270 | 7.106 | 5.1357 | 7±1  |
|                              | 5310 | 5.203 | 3.3136 | 5±1  |
|                              | 5510 | 9.584 | 9.0866 | 9±1  |
|                              | 5590 | 8.341 | 6.8250 | 8±1  |
|                              | 5670 | 6.688 | 4.6644 | 6±1  |
|                              | 5755 | 7.882 | 6.1404 | 7±1  |
|                              | 5795 | 7.847 | 6.0912 | 7±1  |
| IEEE<br>802.11ac<br>VHT40    | 5190 | 8.895 | 7.7535 | 8±1  |
|                              | 5230 | 7.160 | 5.2000 | 7±1  |
|                              | 5270 | 6.333 | 4.2983 | 6±1  |
|                              | 5310 | 4.760 | 2.9923 | 4±1  |
|                              | 5510 | 9.318 | 8.5467 | 9±1  |
|                              | 5590 | 6.569 | 4.5384 | 6±1  |
|                              | 5670 | 6.454 | 4.4198 | 6±1  |
|                              | 5755 | 7.792 | 6.0145 | 7±1  |
|                              | 5795 | 7.937 | 6.2187 | 7±1  |
| IEEE<br>802.11ac<br>VHT80    | 5210 | 8.438 | 6.9791 | 8±1  |
|                              | 5290 | 6.043 | 4.0207 | 6±1  |
|                              | 5530 | 8.965 | 7.8795 | 8±1  |

|  |      |       |        |     |
|--|------|-------|--------|-----|
|  | 5610 | 6.542 | 4.5102 | 6±1 |
|  | 5775 | 8.262 | 6.7019 | 8±1 |

### 3. Calculated Result and Limit

#### Bluetooth

| Antenna | MODE   | Channel | MAX<br>Target<br>power<br>(dBm) | Antenna gain |          | Power<br>Density<br>(S)<br>(mW/cm <sup>2</sup> ) | Limited of<br>Power<br>Density<br>(S)<br>(mW/cm <sup>2</sup> ) | Test<br>Result |
|---------|--------|---------|---------------------------------|--------------|----------|--------------------------------------------------|----------------------------------------------------------------|----------------|
|         |        |         |                                 | (dBi)        | (Linear) |                                                  |                                                                |                |
| 1       | 8-DPSK | 2480    | 8                               | 3            | 1.995    | 0.0025                                           | 1                                                              | Complies       |

#### WLAN 2.4G SISO

| Antenna | MODE            | Channel | MAX<br>Target<br>power<br>(dBm) | Antenna gain |          | Power<br>Density<br>(S)<br>(mW/cm <sup>2</sup> ) | Limited of<br>Power<br>Density<br>(S)<br>(mW/cm <sup>2</sup> ) | Test<br>Result |
|---------|-----------------|---------|---------------------------------|--------------|----------|--------------------------------------------------|----------------------------------------------------------------|----------------|
|         |                 |         |                                 | (dBi)        | (Linear) |                                                  |                                                                |                |
| 1       | IEEE<br>802.11g | 2412    | 18                              | 3            | 1.995    | 0.025                                            | 1                                                              | Complies       |
| 2       |                 | 2412    | 18                              | 3            | 1.995    | 0.025                                            | 1                                                              | Complies       |

#### WLAN 2.4G MIMO

| Worst<br>case           | Channel | Target<br>power<br>(dBm) | Target<br>power<br>(dBm) | Power<br>Density<br>(S)<br>(mW/cm <sup>2</sup> ) | Power<br>Density<br>(S)<br>(mW/cm <sup>2</sup> ) | Total<br>Ratio | Limit<br>Ratio | Test<br>Result |
|-------------------------|---------|--------------------------|--------------------------|--------------------------------------------------|--------------------------------------------------|----------------|----------------|----------------|
|                         |         | Antenna 1                | Antenna 2                | Antenna 1                                        | Antenna 2                                        |                |                |                |
| IEEE<br>802.11n<br>HT40 | 2422    | 16                       | 16                       | 0.0158                                           | 0.0158                                           | 0.0316         | 1              | Complies       |
|                         | 2437    | 16                       | 16                       | 0.0158                                           | 0.0158                                           | 0.0316         | 1              | Complies       |
|                         | 2452    | 16                       | 15                       | 0.0158                                           | 0.0126                                           | 0.0284         | 1              | Complies       |

**WLAN 5G SISO**

| Antenna | Channel | MAX<br>Target<br>power<br>(dBm) | Antenna gain |          | Power<br>Density<br>(S)<br>(mW/cm <sup>2</sup> ) | Limited of<br>Power<br>Density<br>(S)<br>(mW/cm <sup>2</sup> ) | Test<br>Result |
|---------|---------|---------------------------------|--------------|----------|--------------------------------------------------|----------------------------------------------------------------|----------------|
|         |         |                                 | (dBi)        | (Linear) |                                                  |                                                                |                |
| 1       | 5180    | 8                               | 3.5          | 2.239    | 0.0028                                           | 1                                                              | Complies       |
| 2       | 5180    | 9                               | 3.5          | 2.239    | 0.0035                                           | 1                                                              | Complies       |

**WLAN 5G MIMO**

| Worst case             | Channel | Target<br>power<br>(dBm) | Target<br>power<br>(dBm) | Power<br>Density<br>(S)            | Power<br>Density<br>(S)            | Total<br>Ratio | Limit<br>Ratio | Test<br>Result |
|------------------------|---------|--------------------------|--------------------------|------------------------------------|------------------------------------|----------------|----------------|----------------|
|                        |         | Antenna<br>1             | Antenna<br>2             | (mW/cm <sup>2</sup> )<br>Antenna 1 | (mW/cm <sup>2</sup> )<br>Antenna 2 |                |                |                |
| IEEE802.11n<br>HT 40   | 5190    | 10                       | 10                       | 0.0045                             | 0.0045                             | 0.0090         | 1              | Complies       |
| IEEE802.11ac<br>VHT 40 | 5190    | 11                       | 9                        | 0.0056                             | 0.0035                             | 0.0091         | 1              | Complies       |

**Bluetooth+ WLAN**

| MAX<br>Power Density<br>(S)<br>(mW/cm <sup>2</sup> )<br>Bluetooth | MAX<br>Power Density<br>(S)<br>(mW/cm <sup>2</sup> )<br>WiFi | Total Ratio | Limit Ratio | Test Result |
|-------------------------------------------------------------------|--------------------------------------------------------------|-------------|-------------|-------------|
| 0.0025                                                            | 0.0316                                                       | 0.0341      | 1           | Complies    |

Note: 2.4 and 5GHz bands are share an antenna, Can't both the 2.4 and 5 GHz bands operate simultaneously.

**End of Test Report**