

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

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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 ²)	Averaging Times E ² , H ² 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 ²)	Averaging Times E ² , H ² 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 (MHz)	Peak output power (dBm)	Peak output power (mW)	Target power (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 802.11b	2412	11.93	15.5955	11±1
	2437	11.82	15.2055	11±1
	2462	11.72	14.8594	11±1
IEEE 802.11g	2412	17.31	53.8270	17±1
	2437	17.01	50.2343	17±1
	2462	16.74	47.2063	16±1
IEEE 802.11n HT20 (2.4G)	2412	15.00	31.6228	15±1
	2437	14.68	29.3765	14±1
	2462	14.45	27.8612	14±1
IEEE 802.11n HT40 (2.4G)	2422	15.55	35.8922	15±1
	2437	15.61	36.3915	15±1
	2462	15.29	33.8065	15±1
IEEE 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 802.11n 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 802.11ac 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 802.11n 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 802.11ac 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 802.11ac 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 (MHz)	Peak output power (dBm)	Peak output power (mW)	Target power (dBm)
IEEE 802.11b	2412	11.30	13.4896	11±1
	2437	12.00	15.8489	12±1
	2462	11.88	15.4170	11±1
IEEE 802.11g	2412	17.17	52.1195	17±1
	2437	16.73	47.0977	16±1
	2462	16.48	44.4631	16±1
IEEE 802.11n HT20 (2.4G)	2412	14.27	26.7301	14±1
	2437	13.99	25.0611	13±1
	2462	13.80	23.9883	13±1
IEEE 802.11n HT40 (2.4G)	2422	15.53	35.7273	15±1
	2437	15.43	34.9140	15±1
	2452	14.96	31.3329	14±1
IEEE 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 802.11n 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 802.11ac 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 802.11n 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 802.11ac 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 802.11ac 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 Target power (dBm)	Antenna gain		Power Density (S) (mW/cm ²)	Limited of Power Density (S) (mW/cm ²)	Test Result
				(dBi)	(Linear)			
1	8-DPSK	2480	8	3	1.995	0.0025	1	Complies

WLAN 2.4G SISO

Antenna	MODE	Channel	MAX Target power (dBm)	Antenna gain		Power Density (S) (mW/cm ²)	Limited of Power Density (S) (mW/cm ²)	Test Result
				(dBi)	(Linear)			
1	IEEE 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 case	Channel	Target power (dBm)	Target power (dBm)	Power Density (S) (mW/cm ²)	Power Density (S) (mW/cm ²)	Total Ratio	Limit Ratio	Test Result
		Antenna 1	Antenna 2	Antenna 1	Antenna 2			
IEEE 802.11n 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 Target power (dBm)	Antenna gain		Power Density (S) (mW/cm ²)	Limited of Power Density (S) (mW/cm ²)	Test 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 power (dBm)	Target power (dBm)	Power Density (S)	Power Density (S)	Total Ratio	Limit Ratio	Test Result
		Antenna 1	Antenna 2	(mW/cm ²) Antenna 1	(mW/cm ²) Antenna 2			
IEEE802.11n HT 40	5190	10	10	0.0045	0.0045	0.0090	1	Complies
IEEE802.11ac VHT 40	5190	11	9	0.0056	0.0035	0.0091	1	Complies

Bluetooth+ WLAN

MAX Power Density (S) (mW/cm ²) Bluetooth	MAX Power Density (S) (mW/cm ²) 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