



FCC 47 CFR MPE REPORT

Wacebo USA INC

WIFI Module

Model Number: RK3588.3_004

FCC ID: 2BKOR-DCT85

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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, $d=0.2\text{m}$, as well as the gain of the used antenna, the RF power density can be obtained

2. Conducted Power Result

Mode	Frequency (MHz)	Antenna	Peak output power (dBm)	Peak output power (mW)	
GFSK	2402	ant 1	4.88	3.076	
	2441	ant 1	4.71	2.958	
	2480	ant 1	4.66	2.924	
$\pi/4$ -DQPSK	2402	ant 1	7.40	5.495	
	2441	ant 1	7.20	5.248	
	2480	ant 1	7.07	5.093	
8-DPSK	2402	ant 1	7.78	5.998	
	2441	ant 1	7.53	5.662	
	2480	ant 1	7.41	5.508	
BLE 1M	2402	ant 1	4.85	3.055	
	2440	ant 1	4.85	3.055	
	2480	ant 1	4.63	2.904	
IEEE 802.11b	2412	ant 1	18.9	77.625	
		ant 2	18.18	65.766	
	2437	ant 1	19.07	80.724	
		ant 2	18.70	74.131	
	2462	ant 1	19.12	81.658	
		ant 2	19.05	80.353	
IEEE 802.11g	2412	ant 1	23.67	232.809	
		ant 2	23.39	218.273	
	2437	ant 1	23.95	248.313	
		ant 2	23.71	234.963	
	2462	ant 1	24.00	251.189	
		ant 2	23.82	240.991	
	IEEE 802.11n HT20	2412	ant 1	19.15	82.224
			ant 2	18.82	76.208
2437		ant 1	19.48	88.716	
		ant 2	19.20	83.176	
2462		ant 1	19.46	88.308	
		ant 2	19.53	89.743	
IEEE 802.11n HT40	2422	ant 1	19.36	86.298	
		ant 2	18.97	78.886	
	2437	ant 1	19.49	88.920	

Mode	Frequency (MHz)	Antena	Peak output power		
			(dBm)	(mW)	
2452		ant 2	19.32	85.507	
		ant 1	19.50	89.125	
		ant 2	19.53	89.743	
IEEE 802.11a	5180	ant 1	16.50	44.668	
		ant 2	18.18	65.766	
	5200	ant 1	16.05	40.272	
		ant 2	18.28	67.298	
	5240	ant 1	15.90	38.905	
		ant 2	18.13	65.013	
	5745	ant 1	16.93	49.317	
		ant 2	16.58	45.499	
	5785	ant 1	16.54	45.082	
		ant 2	16.35	43.152	
	5825	ant 1	16.47	44.361	
		ant 2	16.20	41.687	
	IEEE 802.11n20	5180	ant 1	14.68	29.376
			ant 2	16.15	41.210
5200		ant 1	14.19	26.242	
		ant 2	16.33	42.954	
5240		ant 1	14.01	25.177	
		ant 2	16.25	42.170	
5745		ant 1	15.15	32.734	
		ant 2	14.60	28.840	
5785		ant 1	14.73	29.717	
		ant 2	14.29	26.853	
5825		ant 1	14.73	29.717	
		ant 2	14.31	26.977	
IEEE 802.11ac VHT20	5180	ant 1	14.49	28.119	
		ant 2	13.61	22.961	
	5200	ant 1	14.24	26.546	
		ant 2	14.14	25.942	
	5240	ant 1	14.09	25.645	
		ant 2	15.36	34.356	
	5745	ant 1	14.97	31.405	
		ant 2	16.14	41.115	
5785	ant 1	14.62	28.973		

		ant 2	15.88	38.726
	5825	ant 1	14.67	29.309
		ant 2	15.8	38.019
Mode	Frequency (MHz)	Antena	Peak output power (dBm)	Peak output power (mW)
IEEE 802.11n HT40	5190	ant 1	14.36	27.290
		ant 2	14.04	25.351
	5230	ant 1	14.11	25.763
		ant 2	15.16	32.810
	5755	ant 1	14.81	30.269
		ant 2	15.92	39.084
	5795	ant 1	14.59	28.774
		ant 2	15.81	38.107
IEEE 802.11ac VHT40	5190	ant 1	14.61	28.907
		ant 2	14.38	27.416
	5230	ant 1	14.33	27.102
		ant 2	15.55	35.892
	5755	ant 1	15.05	31.989
		ant 2	16.01	39.902
	5795	ant 1	14.76	29.923
		ant 2	15.94	39.264
IEEE 802.11ac VHT80	5210	ant 1	14.72	29.648
		ant 2	16.23	41.976
	5775	ant 1	15.37	34.435
		ant 2	16.49	44.566

3. Calculated Result and Limit

3.1. SISO

The Worst Mode	Antenna	Peak output power (dBm)	Target power (dBm)	MAX Target power (dBm)	Antenna gain		Power Density (S) (mW /cm ²)	Limited of Power Density (S) (mW /cm ²)	Test Result
					(dBi)	(Linear)			
2.4G Band									
GFSK	ant 1	4.88	4±1	5	1.47	1.403	0.0009	1	Complies
π/4-DQPSK	ant 1	7.4	7 ±1	8	1.47	1.403	0.0018	1	Complies
8-DPSK	ant 1	7.78	7±1	8	1.47	1.403	0.0018	1	Complies
BLE	ant 1	4.85	4 ±1	5	1.47	1.403	0.0009	1	Complies
IEEE 802.11b	ant 1	19.12	19 ±1	20	1.47	1.403	0.0279	1	Complies
	ant 2	19.05	19 ±1	20	1.47	1.403	0.0279	1	Complies
IEEE 802.11g	ant 1	24	24 ±1	25	1.47	1.403	0.0883	1	Complies
	ant 2	23.82	23±1	24	1.47	1.403	0.0701	1	Complies
IEEE 802.11n HT20	ant 1	19.48	19±1	20	1.47	1.403	0.0279	1	Complies
	ant 2	19.53	19±1	20	1.47	1.403	0.0279	1	Complies
IEEE 802.11n HT40	ant 1	19.5	19 ±1	20	1.47	1.403	0.0279	1	Complies
	ant 2	19.53	19 ±1	20	1.47	1.403	0.0279	1	Complies
5G Band									
IEEE 802.11a	ant 1	16.93	16 ±1	17	2.75	1.8836	0.0188	1	Complies
	ant 2	18.28	18 ±1	19	2.75	1.8836	0.0298	1	Complies
IEEE 802.11n HT20	ant 1	15.15	15 ±1	16	2.75	1.8836	0.0149	1	Complies
	ant 2	16.33	16 ±1	17	2.75	1.8836	0.0188	1	Complies
IEEE 802.11ac VHT20	ant 1	14.97	14 ±1	15	2.75	1.8836	0.0119	1	Complies
	ant 2	16.14	16 ±1	17	2.75	1.8836	0.0188	1	Complies
IEEE 802.11n HT40	ant 1	14.81	14 ±1	15	2.75	1.8836	0.0119	1	Complies
	ant 2	15.92	15 ±1	16	2.75	1.8836	0.0149	1	Complies
IEEE 802.11ac VHT40	ant 1	15.05	15±1	16	2.75	1.8836	0.0149	1	Complies
	ant 2	16.01	16 ±1	17	2.75	1.8836	0.0188	1	Complies
IEEE 802.11ac VHT80	ant 1	15.37	15 ±1	16	2.75	1.8836	0.0149	1	Complies
	ant 2	16.49	16 ±1	17	2.75	1.8836	0.0188	1	Complies

3.2. MIMIO

Mode	Power Density (S) (mW/cm ²) Antenna 0	Power Density (S) (mW/cm ²) Antenna 1	Power Density (S) (mW/cm ²) Total	Limited of Power Density (S) (mW/cm ²)	Test Result
2.4G Band					
IEEE 802.11n HT20	0.0279	0.0279	0.0558	1	Complies
IEEE 802.11n HT40	0.0279	0.0279	0.0558	1	Complies
5G Band					
IEEE 802.11n HT20	0.0149	0.0188	0.0337	1	Complies
IEEE 802.11ac VHT20	0.0119	0.0188	0.0306	1	Complies
IEEE 802.11n HT40	0.0119	0.0149	0.0268	1	Complies
IEEE 802.11ac VHT40	0.0149	0.0188	0.0337	1	Complies
IEEE 802.11ac VHT80	0.0149	0.0188	0.0337	1	Complies

3.3. BT+WIFI

MAX Power Density (S) (mW/cm ²) Bluetooth	MAX Power Density (S) (mW/cm ²) WiFi	Total Ratio	Limit Ratio	Test Result
0.0018	0.0558	0.0576	1	Complies

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

End of Test Report