



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=0.2m, 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

		ant 2	19.32	85.507
	2452	ant 1	19.50	89.125
		ant 2	19.53	89.743
Mode	Frequency	Antena	Peak output power (dBm)	Peak output power (mW)
	(MHz)			
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 /cm2)	Limited of Power Density (S) (mW /cm2)	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