

FCC 47 CFR MPE REPORT

CTOUCH Europe B.V.

WIFI MODULE

Model Number: 00WIMRA

FCC ID: 2APQQ-00WIMRA

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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)	Antenna gain	
					(dBi)	(Linear)
GFSK	2402	5.98	3.9628	5 ± 1	2	1.58489
	2441	5.44	3.4995	5 ± 1	2	1.58489
	2480	4.79	3.0130	4 ± 1	2	1.58489
8-DPSK	2402	7.70	5.8884	7 ± 1	2	1.58489
	2441	7.04	5.0582	7 ± 1	2	1.58489
	2480	6.54	4.5082	6 ± 1	2	1.58489
BLE	2402	9.78	9.5060	9 ± 1	2	1.58489
	2440	8.88	7.7268	8 ± 1	2	1.58489
	2480	8.20	6.6069	8 ± 1	2	1.58489
IEEE 802.11b	2412	15.00	31.6228	15 ± 1	2	1.58489
	2437	14.78	30.0608	14 ± 1	2	1.58489
	2462	14.80	30.1995	14 ± 1	2	1.58489
IEEE 802.11g	2412	18.12	64.8634	18 ± 1	2	1.58489
	2437	17.89	61.5177	17 ± 1	2	1.58489
	2462	17.91	61.8016	17 ± 1	2	1.58489
IEEE 802.11n HT20 (2.4G)	2412	16.81	47.9733	16 ± 1	2	1.58489
	2437	16.79	47.7529	16 ± 1	2	1.58489
	2462	16.74	47.2063	16 ± 1	2	1.58489
IEEE 802.11n HT40 (2.4G)	2422	16.02	39.9945	16 ± 1	2	1.58489
	2437	16.01	39.9025	16 ± 1	2	1.58489
	2452	16.01	39.9025	16 ± 1	2	1.58489
IEEE 802.11a	5180	11.74	14.9279	11 ± 1	2	1.58489
	5200	12.10	16.2181	12 ± 1	2	1.58489
	5240	11.46	13.9959	11 ± 1	2	1.58489
	5745	12.02	15.9221	12 ± 1	2	1.58489
	5785	12.72	18.7068	12 ± 1	2	1.58489
	5825	12.57	18.0717	12 ± 1	2	1.58489

Mode	Frequency (MHz)	Peak output power (dBm)	Peak output power (mW)	Target power (dBm)	Antenna gain	
					(dBi)	(Linear)
IEEE 802.11n HT20 (5G)	5180	10.73	11.8304	10 ± 1	2	1.58489
	5200	11.32	13.5519	11 ± 1	2	1.58489
	5240	10.84	12.1339	10 ± 1	2	1.58489
	5745	11.66	14.6555	11 ± 1	2	1.58489
	5785	12.30	16.9824	12 ± 1	2	1.58489
	5825	12.05	16.0325	12 ± 1	2	1.58489
IEEE 802.11ac VHT20	5180	10.93	12.3880	10 ± 1	2	1.58489
	5200	11.33	13.5831	11 ± 1	2	1.58489
	5240	10.73	11.8304	10 ± 1	2	1.58489
	5745	11.74	14.9279	11 ± 1	2	1.58489
	5785	12.17	16.4816	12 ± 1	2	1.58489
	5825	11.83	15.2405	11 ± 1	2	1.58489
IEEE 802.11n HT40 (5G)	5190	10.71	11.7761	10 ± 1	2	1.58489
	5230	10.52	11.2720	10 ± 1	2	1.58489
	5755	11.27	13.3968	11 ± 1	2	1.58489
	5795	11.96	15.7036	11 ± 1	2	1.58489
IEEE 802.11ac VHT40	5190	10.60	11.4815	10 ± 1	2	1.58489
	5230	10.22	10.5196	10 ± 1	2	1.58489
	5755	11.64	14.5881	11 ± 1	2	1.58489
	5795	11.75	14.9624	11 ± 1	2	1.58489
IEEE 802.11ac VHT80	5210	11.21	13.2130	11 ± 1	2	1.58489
	5775	11.23	13.2739	11 ± 1	2	1.58489

Antenna 2

Mode	Frequency (MHz)	Peak output power (dBm)	Peak output power (mW)	Target power (dBm)	Antenna gain	
					(dBi)	(Linear)
IEEE 802.11b	2412	15.97	39.5367	15 ± 1	2	1.58489
	2437	15.91	38.9942	15 ± 1	2	1.58489
	2462	15.88	38.7258	15 ± 1	2	1.58489
IEEE 802.11g	2412	19.29	84.9180	19 ± 1	2	1.58489
	2437	19.20	83.1764	19 ± 1	2	1.58489
	2462	19.26	84.3335	19 ± 1	2	1.58489
IEEE 802.11n HT20 (2.4G)	2412	18.07	64.1210	18 ± 1	2	1.58489
	2437	18.12	64.8634	18 ± 1	2	1.58489
	2462	18.06	63.9735	18 ± 1	2	1.58489
IEEE 802.11n HT40 (2.4G)	2422	17.18	52.2396	17 ± 1	2	1.58489
	2437	17.36	54.4503	17 ± 1	2	1.58489
	2452	17.74	59.4292	17 ± 1	2	1.58489
IEEE 802.11a	5180	9.65	9.2257	9 ± 1	2	1.58489
	5200	9.93	9.8401	9 ± 1	2	1.58489
	5240	9.25	8.4140	9 ± 1	2	1.58489
	5745	9.56	9.0365	9 ± 1	2	1.58489
	5785	9.26	8.4333	9 ± 1	2	1.58489
	5825	10.21	10.4954	10 ± 1	2	1.58489
IEEE 802.11n HT20 (5G)	5180	9.22	8.3560	9 ± 1	2	1.58489
	5200	9.61	9.1411	9 ± 1	2	1.58489
	5240	8.98	7.9068	8 ± 1	2	1.58489
	5745	9.61	9.1411	9 ± 1	2	1.58489
	5785	9.20	8.3176	9 ± 1	2	1.58489
	5825	10.15	10.3514	10 ± 1	2	1.58489
IEEE 802.11ac VHT20	5180	9.14	8.2035	9 ± 1	2	1.58489
	5200	9.52	8.9536	9 ± 1	2	1.58489
	5240	8.97	7.8886	8 ± 1	2	1.58489
	5745	9.58	9.0782	9 ± 1	2	1.58489
	5785	8.98	7.9068	8 ± 1	2	1.58489
	5825	9.87	9.7051	9 ± 1	2	1.58489

Mode	Frequency (MHz)	Peak output power (dBm)	Peak output power (mW)	Target power (dBm)	Antenna gain	
					(dBi)	(Linear)
IEEE 802.11n HT40 (5G)	8.98	7.9068	8 ± 1	2	1.58489	8.98
	9.10	8.1283	9 ± 1	2	1.58489	9.10
	9.55	9.0157	9 ± 1	2	1.58489	9.55
	8.65	7.3282	8 ± 1	2	1.58489	8.65
	8.98	7.9068	8 ± 1	2	1.58489	8.98
	9.10	8.1283	9 ± 1	2	1.58489	9.10
IEEE 802.11ac VHT40	5190	8.92	7.7983	8 ± 1	2	1.58489
	5230	8.99	7.9250	8 ± 1	2	1.58489
	5755	9.60	9.1201	9 ± 1	2	1.58489
	5795	8.41	6.9343	8 ± 1	2	1.58489
IEEE 802.11ac VHT80	5210	9.24	8.3946	9 ± 1	2	1.58489
	5775	9.60	9.1201	9 ± 1	2	1.58489

3. Calculated Result and Limit

Antenna 1

Mode	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	6	2	1.58489	0.00126	1	Compiles
8-DPSK	8	2	1.58489	0.00199	1	Compiles
BLE	10	2	1.58489	0.00315	1	Compiles
IEEE 802.11b	16	2	1.58489	0.01255	1	Compiles
IEEE 802.11g	19	2	1.58489	0.02505	1	Compiles
IEEE 802.11n HT20	17	2	1.58489	0.01580	1	Compiles
IEEE 802.11n HT40	17	2	1.58489	0.01580	1	Compiles
5G Band						
IEEE 802.11a	13	2	1.58489	0.00629	1	Compiles
IEEE 802.11n HT20	13	2	1.58489	0.00629	1	Compiles
IEEE 802.11ac VHT20	13	2	1.58489	0.00629	1	Compiles
IEEE 802.11n HT40	12	2	1.58489	0.00500	1	Compiles
IEEE 802.11ac VHT40	12	2	1.58489	0.00500	1	Compiles
IEEE 802.11ac VHT80	12	2	1.58489	0.00500	1	Compiles

Antenna 2

Mode	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						
IEEE 802.11b	16	2	1.58489	0.01255	1	Compiles
IEEE 802.11g	20	2	1.58489	0.03153	1	Compiles
IEEE 802.11n HT20	19	2	1.58489	0.02505	1	Compiles
IEEE 802.11n HT40	18	2	1.58489	0.01989	1	Compiles
5G Band						
IEEE 802.11a	11	2	1.58489	0.00397	1	Compiles
IEEE 802.11n HT20	11	2	1.58489	0.00397	1	Compiles
IEEE 802.11ac VHT20	10	2	1.58489	0.00315	1	Compiles
IEEE 802.11n HT40	10	2	1.58489	0.00315	1	Compiles
IEEE 802.11ac VHT40	10	2	1.58489	0.00315	1	Compiles
IEEE 802.11ac VHT80	10	2	1.58489	0.00315	1	Compiles

Antenna 1+2

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	3.170 (5.01dBi)	112.6	0.03550	1	Compiles
IEEE 802.11n HT40	3.170 (5.01dBi)	95.0	0.02995	1	Compiles
5G Band					
IEEE 802.11n HT20	3.170 (5.01dBi)	26.4	0.00832	1	Compiles
IEEE 802.11ac VHT20	3.170 (5.01dBi)	25.0	0.00788	1	Compiles
IEEE 802.11n HT40	3.170 (5.01dBi)	23.1	0.00728	1	Compiles
IEEE 802.11ac VHT40	3.170 (5.01dBi)	23.7	0.00747	1	Compiles
IEEE 802.11ac VHT80	3.170 (5.01dBi)	22.4	0.00706	1	Compiles

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

End of Test Report