

RADIO FREQUENCY EXPOSURE

1. Limit

According to §1.1310 and §2.1091 RF exposure is calculated.

Table: Limits for General Population/Uncontrolled Exposure

Frequency Range (MHz)	Power Density (S) (mW/cm ²)
0.3–1.34	*(100)
1.34–30	*(180/f ²)
30–300	0.2
300–1500	f/1500
1500–100,000	1.0

F = frequency in MHz

* = Plane-wave equivalent power density

Maximum Permissible Exposure

The MPE was calculated at 20cm to show compliance with the power density limit.

$$S = PG/4\pi R^2$$

S = Power density

P = power input to antenna

G = power gain of the antenna in the direction of interest relative to an isotropic radiator

R = distance to the center of radiation of the antenna.

Note:

1. Manufacturer declared that the maximum antenna gain is 2.0dBi (Max.) for 2412~2462MHz, 5150-5250MHz and 5725-5850MHz when single antenna transmits.

Because signal is correlated, the maximum antenna gain when two antennas simultaneously transmit is 5.01dBi (Max.) for 2412~2462MHz, 5150-5250MHz and 5725-5850MHz by calculating.

2. Manufacturer declared that the nearest distance between human and the EUT is 20cm.

3. Only record worst case data.

2 Test Results

Standalone MPE for 2.4G WLAN

Test	Mode	Channel	ANT Power (dBm)	ANT Max. Tune Up Power (dBm)	ANT Max. Tune Up Power (mW)	ANT MPE (mW/cm ²)	Limit (mW/cm ²)
802.11b	Chain 0	1	17.65	17.0±1.0	63.0957	0.0198	1.0
		6	17.45	17.0±1.0	63.0957	0.0198	1.0
		11	17.59	17.0±1.0	63.0957	0.0198	1.0
	Chain 1	1	17.65	17.0±1.0	63.0957	0.0198	1.0
		6	17.48	17.0±1.0	63.0957	0.0198	1.0
		11	17.71	17.0±1.0	63.0957	0.0198	1.0
802.11g	Chain 0	1	16.65	16.0±1.0	50.1187	0.0158	1.0
		6	16.29	16.0±1.0	50.1187	0.0158	1.0
		11	16.85	16.0±1.0	50.1187	0.0158	1.0
	Chain 1	1	16.36	16.0±1.0	50.1187	0.0158	1.0
		6	16.35	16.0±1.0	50.1187	0.0158	1.0
		11	16.48	16.0±1.0	50.1187	0.0158	1.0
802.11n20	Chain 0	1	15.32	15.0±1.0	39.8107	0.0125	1.0
		6	15.45	15.0±1.0	39.8107	0.0125	1.0
		11	15.25	15.0±1.0	39.8107	0.0125	1.0
	Chain 1	1	15.32	15.0±1.0	39.8107	0.0125	1.0
		6	15.45	15.0±1.0	39.8107	0.0125	1.0
		11	15.19	15.0±1.0	39.8107	0.0125	1.0
802.11n40	Chain 0	3	14.61	14.0±1.0	31.6228	0.0099	1.0
		6	14.51	14.0±1.0	31.6228	0.0099	1.0
		9	14.20	14.0±1.0	31.6228	0.0099	1.0
	Chain 1	3	14.65	14.0±1.0	31.6228	0.0099	1.0
		6	14.26	14.0±1.0	31.6228	0.0099	1.0
		9	14.54	14.0±1.0	31.6228	0.0099	1.0

Standalone MPE for 5.2G WLAN

Test	Mode	Channel	ANT Power (dBm)	ANT Max. Tune Up Power (dBm)	ANT Max. Tune Up Power (mW)	ANT MPE (mW/cm ²)	Limit (mW/cm ²)
802.11a	Chain 0	36	12.63	12.0±1.0	19.9526	0.0063	1.0
		44	12.56	12.0±1.0	19.9526	0.0063	1.0
		48	12.85	12.0±1.0	19.9526	0.0063	1.0
	Chain 1	36	12.78	12.0±1.0	19.9526	0.0063	1.0
		44	12.87	12.0±1.0	19.9526	0.0063	1.0
		48	12.54	12.0±1.0	19.9526	0.0063	1.0
802.11n20	Chain 0	36	11.87	11.0±1.0	15.8489	0.0050	1.0
		44	11.79	11.0±1.0	15.8489	0.0050	1.0
		48	11.86	11.0±1.0	15.8489	0.0050	1.0
	Chain 1	36	11.90	11.0±1.0	15.8489	0.0050	1.0
		44	11.69	11.0±1.0	15.8489	0.0050	1.0
		48	11.78	11.0±1.0	15.8489	0.0050	1.0
802.11ac20	Chain 0	36	10.68	10.0±1.0	12.5893	0.0040	1.0
		44	10.82	10.0±1.0	12.5893	0.0040	1.0
		48	10.91	10.0±1.0	12.5893	0.0040	1.0
	Chain 1	36	10.85	10.0±1.0	12.5893	0.0040	1.0
		44	10.87	10.0±1.0	12.5893	0.0040	1.0
		48	10.65	10.0±1.0	12.5893	0.0040	1.0
802.11n40	Chain 0	38	10.84	10.0±1.0	12.5893	0.0040	1.0
		46	10.65	10.0±1.0	12.5893	0.0040	1.0
	Chain 1	38	10.54	10.0±1.0	12.5893	0.0040	1.0
		46	10.84	10.0±1.0	12.5893	0.0040	1.0
802.11ac40	Chain 0	38	10.48	10.0±1.0	12.5893	0.0040	1.0
		46	10.54	10.0±1.0	12.5893	0.0040	1.0
	Chain 1	38	10.54	10.0±1.0	12.5893	0.0040	1.0
		46	10.54	10.0±1.0	12.5893	0.0040	1.0
802.11ac80	Chain 0	42	10.62	10.0±1.0	12.5893	0.0040	1.0
	Chain 1	42	10.54	10.0±1.0	12.5893	0.0040	1.0

Standalone MPE for 5.8G WLAN

Test	Mode	Channel	ANT Power (dBm)	ANT Max. Tune Up Power (dBm)	ANT Max. Tune Up Power (mW)	ANT MPE (mW/cm ²)	Limit (mW/cm ²)
802.11a	Chain 0	149	13.78	13.0±1.0	25.1189	0.0079	1.0
		157	13.85	13.0±1.0	25.1189	0.0079	1.0
		165	13.79	13.0±1.0	25.1189	0.0079	1.0
	Chain 1	149	13.59	13.0±1.0	25.1189	0.0079	1.0
		157	13.84	13.0±1.0	25.1189	0.0079	1.0
		165	13.77	13.0±1.0	25.1189	0.0079	1.0
802.11n20	Chain 0	149	12.85	12.0±1.0	19.9526	0.0063	1.0
		157	12.62	12.0±1.0	19.9526	0.0063	1.0
		165	12.48	12.0±1.0	19.9526	0.0063	1.0
	Chain 1	149	12.69	12.0±1.0	19.9526	0.0063	1.0
		157	12.54	12.0±1.0	19.9526	0.0063	1.0
		165	12.45	12.0±1.0	19.9526	0.0063	1.0
802.11ac20	Chain 0	149	11.65	11.0±1.0	15.8489	0.0050	1.0
		157	11.48	11.0±1.0	15.8489	0.0050	1.0
		165	11.74	11.0±1.0	15.8489	0.0050	1.0
	Chain 1	149	11.26	11.0±1.0	15.8489	0.0050	1.0
		157	11.32	11.0±1.0	15.8489	0.0050	1.0
		165	11.54	11.0±1.0	15.8489	0.0050	1.0
802.11n40	Chain 0	151	10.54	10.0±1.0	12.5893	0.0040	1.0
		159	10.62	10.0±1.0	12.5893	0.0040	1.0
	Chain 1	151	10.44	10.0±1.0	12.5893	0.0040	1.0
		159	10.87	10.0±1.0	12.5893	0.0040	1.0
802.11ac40	Chain 0	151	10.59	10.0±1.0	12.5893	0.0040	1.0
		159	10.85	10.0±1.0	12.5893	0.0040	1.0
	Chain 1	151	10.65	10.0±1.0	12.5893	0.0040	1.0
		159	10.54	10.0±1.0	12.5893	0.0040	1.0
802.11ac80	Chain 0	155	10.45	10.0±1.0	12.5893	0.0040	1.0
	Chain 1	155	10.26	10.0±1.0	12.5893	0.0040	1.0

Simultaneous transmission MPE

According to KDB447498 for Transmitters used in mobile exposure conditions for simultaneous transmission operations;

$$\Sigma\Sigma \text{ of MPE ratios} \leq 1.0$$

Mode		Channel No.	Frequency (MHz)	Σ MPE ratios	Limit	Results
Chain 0+Chain 1						
2.4G WLAN	IEEE 802.11b	1	2412	N/A	1.000	Pass
		6	2442	N/A	1.000	Pass
		11	2462	N/A	1.000	Pass
	IEEE 802.11g	1	2412	N/A	1.000	Pass
		6	2442	N/A	1.000	Pass
		11	2462	N/A	1.000	Pass
	IEEE 802.11n HT20	1	2412	0.0250	1.000	Pass
		6	2442	0.0250	1.000	Pass
		11	2462	0.0250	1.000	Pass
	IEEE 802.11n HT40	3	2422	0.0198	1.000	Pass
		6	2442	0.0198	1.000	Pass
		9	2452	0.0198	1.000	Pass
5.2G WLAN	IEEE 802.11a	36	5180	N/A	1.000	Pass
		44	5220	N/A	1.000	Pass
		48	5240	N/A	1.000	Pass
	IEEE 802.11n HT20	36	5180	0.0100	1.000	Pass
		44	5220	0.0100	1.000	Pass
		48	5240	0.0100	1.000	Pass
	IEEE 802.11ac HT20	36	5180	0.0080	1.000	Pass
		44	5220	0.0080	1.000	Pass
		48	5240	0.0080	1.000	Pass
	IEEE 802.11n HT40	38	5190	0.0080	1.000	Pass
		46	5230	0.0080	1.000	Pass
	IEEE 802.11ac HT40	38	5190	0.0080	1.000	Pass
		46	5230	0.0080	1.000	Pass
	IEEE 802.11ac HT80	42	5210	0.0080	1.000	Pass

5.8G WLAN	IEEE 802.11a	149	5745	N/A	1.000	Pass
		157	5785	N/A	1.000	Pass
		165	5825	N/A	1.000	Pass
	IEEE 802.11n HT20	149	5745	0.0126	1.000	Pass
		157	5785	0.0126	1.000	Pass
		165	5825	0.0126	1.000	Pass
	IEEE 802.11ac HT20	149	5745	0.0100	1.000	Pass
		157	5785	0.0100	1.000	Pass
		165	5825	0.0100	1.000	Pass
	IEEE 802.11n HT40	151	5755	0.0080	1.000	Pass
		159	5795	0.0080	1.000	Pass
	IEEE 802.11ac HT40	151	5755	0.0080	1.000	Pass
		159	5795	0.0080	1.000	Pass
	IEEE 802.11ac HT80	155	5775	0.0080	1.000	Pass

Note: The estimation distance is 20cm.

Conclusion

The measurement results comply with the FCC Limit per 47 CFR 2.1091 for the uncontrolled RF Exposure of mobile device.