

## 7. RADIO FREQUENCY EXPOSURE

### 7.1. 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 <sup>2</sup> )
0.3–1.34	*(100)
1.34–30	*(180/f <sup>2</sup> )
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 for BLE & Zigbee is 0dBi(Max.), Wi-Fi is 2dBi.
2. Manufacturer declared that the nearest distance between human and the EUT is 20cm.
3. Only record worst case data.

Test Mode	Channel	Frequency (MHz)	Power (dBm, Peak)	Power Tune Up (dBm)
BLE 4.0	Low	2402	-3.55	$-3.5 \pm 1.5$
	Middle	2440	-2.16	$-3.5 \pm 1.5$
	High	2480	-4.86	$-3.5 \pm 1.5$
802.11b	Low	2412	12.53	$12.0 \pm 1.0$
	Middle	2437	12.87	$12.0 \pm 1.0$
	High	2462	12.07	$12.0 \pm 1.0$
802.11g	Low	2412	11.27	$11.0 \pm 1.0$
	Middle	2437	11.91	$11.0 \pm 1.0$
	High	2462	11.31	$11.0 \pm 1.0$
802.11n HT20	Low	2412	11.25	$11.0 \pm 1.0$
	Middle	2437	11.99	$11.0 \pm 1.0$
	High	2462	11.15	$11.0 \pm 1.0$
802.11n HT40	Low	2422	11.67	$11.0 \pm 1.0$
	Middle	2437	11.42	$11.0 \pm 1.0$
	High	2452	11.03	$11.0 \pm 1.0$
Zigbee	Low	2405	9.83	$10.0 \pm 1.0$
	Middle	2440	9.64	$10.0 \pm 1.0$
	High	2480	9.24	$10.0 \pm 1.0$

## 7.2 Test Results

Test Mode	Channel	Max. Tune Up Power (dBm, Peak)	Max. Tune Up Power (mW)	MPE (mW/cm <sup>2</sup> )	Limit (mW/cm <sup>2</sup> )
BLE 4.0	Low	-2.0	0.63	0.0001	1.0
	Middle	-2.0	0.63	0.0001	1.0
	High	-2.0	0.63	0.0001	1.0
802.11b	Low	13.0	19.95	0.0063	1.0
	Middle	13.0	19.95	0.0063	1.0
	High	13.0	19.95	0.0063	1.0
802.11g	Low	12.0	15.85	0.0050	1.0
	Middle	12.0	15.85	0.0050	1.0
	High	12.0	15.85	0.0050	1.0
802.11n HT20	Low	12.0	15.85	0.0050	1.0
	Middle	12.0	15.85	0.0050	1.0
	High	12.0	15.85	0.0050	1.0
802.11n HT40	Low	12.0	15.85	0.0050	1.0
	Middle	12.0	15.85	0.0050	1.0
	High	12.0	15.85	0.0050	1.0
Zigbee	Low	11.0	12.59	0.0025	1.0
	Middle	11.0	12.59	0.0025	1.0
	High	11.0	12.59	0.0025	1.0

Antenna Gain (typical): BLE & Zigbee: 0dBi, 1 (numeric)

Wi-Fi: 2dBi, 1.58(numeric)

Prediction distance:  $\geq 20$ cm

The power density level worst case at 20 cm is below the uncontrolled exposure limit.