

**47 C.F.R. Part 1, Subpart I, Section 1.1310
47 C.F.R. Part 2, Subpart J, Section 2.1091
Maximum Permissible Exposure Calculations**

For FCC ID: 2AB8I-GW4

EUT Device Category = General Population/Uncontrolled Exposure

EUT consists of one BLE transceiver operating from 2402 MHz to 2480 MHz, one transceiver using 2 diverse antennas operating over a range of 910.2 MHz to 920 MHz, a WiFi transceiver operating from 2412 MHz to 2462 MHz and 5150 MHz to 5825 MHz, and one cellular transceiver operating in the LTE bands between 699 MHz and 1915 MHz.

MPE Summary:

According subpart 1.1307 (b)(1) and 2.1091 systems operating under the provisions of this section shall be operated in a manner that ensures the public is not exposed to RF energy level in excess of the communication guidelines.

Limits for General Population/Uncontrolled Exposure

Limits for General Population/Uncontrolled Exposure						
Frequency Range (MHz)	Electric Strength (V/m)	Field Magnetic Strength (A/m)	Field Power Density (mW/cm ²)	Averaging Time (Minutes)		
0.3-1.34	614	1.63	*(100)	30		
1.34-30	824/f	2.19/f	*(180/f ²)	30		
30-300	27.5	0.073	0.2	30		
300-1500	/	/	f/1500	30		
1500-100,000	/	/	1.0	30		

f = frequency in MHz; * = Plane-wave equivalent power density

Calculated Formulary:

Predication of MPE limit at a given distance

$$S = \frac{PG}{4\pi R^2}$$

S = power density (in appropriate units, e.g. mW/cm²)

R = distance to the center of radiation of the antenna (appropriate units, e.g., cm)

PG = EIRP

MPE and Limit are calculated for this device as follows:

BLE Transceiver								
Freq (MHz)	Field Strength (dBuV/m)	Max Antenna Gain (dBi)	Max EIRP (dBm)	Max EIRP (mW)	Power Density at 20 cm (mW/cm ²)	Limit (mW/cm ²)	Margin (mW)	Ratio
2402	100.7	0.0	4.84	3.05	0.0006	1.000	0.9994	0.0006
2440	99.51	0.0	4.28	2.68	0.0005	1.000	0.9995	0.0005
2480	99.34	0.0	4.11	2.58	0.0005	1.000	0.9995	0.0005

910.2 MHz to 920.0 MHz Transceiver								
Freq (MHz) (Ant 1 & 2)	Output Power (dBm)	Max Antenna Gain (dBi)	Max EIRP (dBm)	Max EIRP (mW)	Power Density at 20 cm (mW/cm ²)	Limit (mW)	Margin (mW)	Ratio
910.2	29.81	0.0	29.81	957.2	0.190	0.607	0.417	0.313
920.0	29.24	0.0	29.24	839.5	0.167	0.613	0.446	0.272
910.2	29.96	0.0	29.96	990.8	0.197	0.607	0.410	0.325
920.0	29.40	0.0	29.40	871.0	0.173	0.613	0.440	0.282

WiFi Transceiver								
Freq (GHz)	Maximum Output Power (dBm)	Max Antenna Gain (dBi)	Max EIRP (dBm)	Max EIRP (mW)	Power Density at 20 cm (mW/cm ²)	Limit (mW)	Margin (mW)	Ratio
2.4 – 2.4835	17.50	0	17.50	56.23	0.011	1.000	0.989	0.011
5.15 – 5.825	16.50	0	16.50	44.67	0.009	1.000	0.991	0.009

Cell Transceiver									
LTE Band	Freq (MHz)	Output Power (dBm)	Max Antenna Gain (dBi)	Max EIRP (dBm)	Max EIRP (mW)	Power Density at 20 cm (mW/cm ²)	Limit (mW)	Margin (mW)	Ratio
2	1850 – 1910	24.5	3.6	28.1	645.7	0.128	1.000	0.872	0.128
4	1710 – 1755	24.5	3.6	28.1	645.7	0.128	1.000	0.872	0.128
5	824 – 849	24.5	2.6	27.1	512.9	0.102	0.549	0.447	0.233
12	699 – 716	24.5	2.6	27.1	512.9	0.102	0.466	0.364	0.219
13	777 – 787	24.5	2.6	27.1	512.9	0.102	0.518	0.416	0.197
25	1850 – 1915	24.5	3.6	28.1	645.7	0.128	1.000	0.872	0.128
26	814 – 849	24.5	2.6	27.1	512.9	0.102	0.543	0.441	0.188
66	1710 – 1780	24.5	3.6	28.1	645.7	0.128	1.000	0.872	0.128

Summing the maximum ratios together (0.0006 + 0.325 + 0.011 + 0.233), the total (0.5696) is less than 1.0

Result: The device meets FCC MPE limit at 20 cm for General Population/Uncontrolled Exposure as specified in 47 CRF §1.1310 and §2.1091.