FCC §2.1091, §15.407(f), LP0002-2018 §5.20.2 - RF Exposure

1.1 Applicable Standards

According to FCC §15.247(i), §15.407(f) and §1.1307(b)(1), 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 of the Commission's guidelines.

Limits for General Population/Uncontrolled Exposure

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm^2)	Averaging Time (minutes)
Limits for General Population/Uncontrolled Exposure				
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

Before equipment certification is granted, the procedure of ISED RSS-102 must be followed concerning the exposure of humans to RF field

1.2 MPE Prediction

Predication of MPE limit at a given distance, Equation from OET Bulletin 65, Edition 97-01

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

Where: 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

1.3 MPE Results

BLE:

Maximum average output power at antenna input terminal (dBm):	4.21
Maximum average output power at antenna input terminal (mW):	2.64
Prediction distance (cm):	30
Prediction frequency (MHz):	2402
Maximum Antenna Gain, typical (dBi):	2
Maximum Antenna Gain (numeric):	1.58
Power density of prediction frequency at 30.0 cm (mW/cm^2):	0.0004
FCC MPE limit for uncontrolled exposure at prediction frequency (mW/cm^2):	1.0

2.4 GHz Wi-Fi:

Maximum average output power at antenna input terminal (dBm):	24.3
Maximum average output power at antenna input terminal (mW):	269.15
Prediction distance (cm):	30
Prediction frequency (MHz):	2437
Maximum Antenna Gain, typical (dBi):	10
Maximum Antenna Gain (numeric):	10
Power density of prediction frequency at 30.0 cm (mW/cm^2):	0.238
FCC MPE limit for uncontrolled exposure at prediction frequency (mW/cm^2):	1.0

5.2 GHz band:

Maximum average output power at antenna input terminal (dBm):	21.04
Maximum average output power at antenna input terminal (mW):	127.06
Prediction distance (cm):	30
Prediction frequency (MHz):	5200
Maximum Antenna Gain, typical (dBi):	14.45
Maximum Antenna Gain (numeric):	27.86
Power density of prediction frequency at 30.0 cm (mW/cm^2):	0.313
FCC MPE limit for uncontrolled exposure at prediction frequency (mW/cm^2):	1.0

Radio Co-location

BLE + 2.4 GHz Wi-Fi + 5 GHz Wi-Fi:

$0.0004/1 + 0.238/1 + 0.313/1 = 0.551 < 1$

Conclusion

The device is compliant with the requirement MPE limit for uncontrolled exposure. All transceiver modules must be installed with a separation distance of no less than **30** cm from all persons.