



§ 15.407(f)

Maximum Permissible Exposure

Test Requirement(s):

§15.407(f): U-NII devices are subject to the radio frequency radiation exposure requirements specified in §1.1307(b), §2.1091 and §2.1093 of this chapter, as appropriate. All equipment shall be considered to operate in a “general population/uncontrolled” environment.

RF Exposure Requirements:

§1.1307(b)(1) and §1.1307(b)(2): 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 levels in excess of the Commission’s guidelines.

RF Radiation Exposure Limit:

§1.1310: As specified in this section, the Maximum Permissible Exposure (MPE) Limit shall be used to evaluate the environmental impact of human exposure to radiofrequency (RF) radiation as specified in Sec. 1.1307(b), except in the case of portable devices which shall be evaluated according to the provisions of Sec. 2.1093 of this chapter.

MPE Limit: EUT’s operating frequencies @ BLE 2402 – 2480 MHz, WiFi 2412 – 2462, UNII-1 5180 – 5240 MHz, UNII-2a 5260 – 5335 MHz, UNII-2c 5485 – 5710 MHz, UNII-3 5745 – 5825 MHz **Limit for Uncontrolled exposure: 1 mW/cm² or 10 W/m²**

Equation from page 18 of OET 65, Edition 97-01

$$S = PG / 4\pi R^2 \quad \text{or} \quad R = \sqrt{PG / 4\pi S}$$

where, S = Power Density (mW/cm²)
P = Power Input to antenna (mW)
G = Antenna Gain (numeric value)
R = Distance (cm)

Test Results:

FCC									
Frequency (MHz)	Con. Pwr. (dBm)	Con. Pwr. (mW)	Ant. Gain (dBi)	Ant. Gain numeric	Pwr. Density (mW/cm ²)	Limit (mW/cm ²)	Margin	Distance (cm)	Result
2402*	12.28	16.90	1.8	1.51	0.01*	1.0	-0.99	20	Pass
2437*	24.73	297.17	3.5	2.24	0.13*	1.0	-0.87	20	Pass
5210*	26.58	454.99	4.5	2.82	0.26*	1.0	-0.74	20	
5250	23.88	244.34	4.5	2.82	0.14	1.0	-0.86	20	Pass
5610	23.83	241.55	4.5	2.82	0.14	1.0	-0.86	20	Pass
5825	25.75	375.84	4.5	2.82	0.21	1.0	-0.79	20	Pass
*Simultaneous Transmission (Worse case):					0.49	1.0	-0.51	20	Pass

The UX may have simultaneously transmission of the Bluetooth and WiFi, and U-NII-1 or U-NII-2a or U-NII-2c or U-NII-3. Asterisk notes the worst case of the possible simultaneously transmitter combinations.

Simultaneously Transmitters Summed:

+ 0.01 (2.4 MHz Bluetooth)
+ 0.13 (2.4 MHz WiFi)
+ 0.26 (5 GHz U-NII-1)
= 0.49
Limit of 1.0 – 0.49 (summed value) = -0.51 Margin

The safe distance for SWX-UX where Power Density is less than the MPE Limit listed above was found to be 20 cm.