FCC §1.1310 & §2.1091 - MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Applicable Standard

According to subpart §2.1091 and subpart §1.1310, 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 Maximum Permissible Exposure (MPE) (§1.1310, §2.1091)

(B) 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)**
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;

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

Calculated Formulary

Predication of MPE limit at a given distance
$S = PG/4\pi R^2$ = power density (in appropriate units, e.g. mW/cm^2);
P = power input to the antenna (in appropriate units, e.g., mW);
G = power gain of the antenna in the direction of interest relative to an isotropic radiator, the power gain factor, is normally numeric gain;
R = distance to the center of radiation of the antenna (appropriate units, e.g., cm);

For simultaneously transmit system, the calculated power density should comply with:

$$\sum_i \frac{S_i}{S_{Limit,i}} \leq 1$$

Calculated Data:

Mode	Frequency Range (MHz)	Antenna Gain		Tune-up Output Power★		Evaluation Distance (cm)	Power Density (mW/cm^2)	MPE Limit (mW/cm^2)
		(dBi)	(numeric)	(dBm)	(mW)			
802.11b	2412-2462	3.96	2.49	20	100.00	20	0.0495	1.0
802.11g		3.96	2.49	19	79.43	20	0.0393	1.0
802.11n-HT20		3.96	2.49	19	79.43	20	0.0393	1.0
802.11n-HT40	2422-2452	3.96	2.49	18.5	70.79	20	0.0351	1.0
BLE-1M	2402-2480	3.96	2.49	7.0	5.01	20	0.0025	1.0
BLE-2M		3.96	2.49	7.0	5.01	20	0.0025	1.0

Mode	Frequency Range (MHz)	Tune-up EIRP★		Evaluation Distance (cm)	Power Density (mW/cm^2)	MPE Limit (mW/cm^2)
		(dBm)	(mW)			
SRD	433.92	-20	0.01	20	<0.0001	0.3

Note:
1. For the above tune up power were declared by the manufacturer.
2. The EUT contains a module which exactly the same as FCC ID: 2AC7Z-ESPC3MINI1 (Grant on: 06/16/2021) without any modifications
3. The SRD EIRP = 74.98 dBμV/m -95.2 = -20.22 dBm.
4. The worst condition of transmit simultaneously (WiFi&SRD) is as below:

$$\sum_i \frac{S_i}{S_{Limit,i}} = 0.0495+0.0003=0.0498 < 1.0$$

Conclusion: The device meets MPE at distance 20cm.