FCC §15.407 (f) , §1.1310 , §2.1091& RSS-102 § 4- MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Applicable Standard

According to subpart 15.407(f)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.

According to RSS-102 § 4Table 4, RF Field Strength Limits for Devices Used by the General Public (Uncontrolled Environment)

Table 4: RF Field Strength Limits for Devices Used by the General Public (Uncontrolled Environment)

Frequency Range (MHz)	Electric Field (V/m rms)	Magnetic Field (A/m rms)	Power Density (W/m^2)	Reference Period (minutes)
$0.003\text{-}10^{21}$	83	90	-	Instantaneous*
0.1-10	-	$0.73/f$	-	6**
1.1-10	$87/f^{0.5}$	-	-	6**
10-20	27.46	0.0728	2	6
20-48	$58.07/f^{0.25}$	$0.1540/f^{0.25}$	$8.944/f^{0.5}$	6
48-300	22.06	0.05852	1.291	6
300-6000	$3.142f^{0.3417}$	$0.008335f^{0.3417}$	$0.02619f^{0.6834}$	6
6000-15000	61.4	0.163	10	6
15000-150000	61.4	0.163	10	$616000/f^{1.2}$
150000-300000	$0.158f^{0.5}$	$4.21 \times 10^{-4}f^{0.5}$	$6.67 \times 10^{-5}f$	$616000/f^{1.2}$

Note: f is frequency in MHz.
*Based on nerve stimulation (NS).
** Based on specific absorption rate (SAR).

Calculation Formula:

Prediction of power density at the distance of the applicable MPE limit:
$S = PG/4\pi R^2$ = 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:

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

Calculated Data:

Mode	Frequency (MHz)	Antenna Gain		Tune-up Power		Evaluation Distance (cm)	Power Density		MPE Limit	
		(dBi)	(numeric)	(dBm)	(mW)		(mW/cm^2)	(W/m^2)	FCC (mW/cm^2)	RSS-102 (W/m2)
2.4G FHSS	2408-2475.5	2.81	1.91	21	125.89	20.00	0.0479	0.479	1.0	5.36
5.8G NII	5727-5845	4.59	2.88	17	50.12	20.00	0.0287	0.287	1.0	9.69
BLE	2402-2480	3.12	2.05	7	5.01	20.00	0.0020	0.02	1.0	5.35

Note: User may catch the hand-held loop to use, in this use condition, the radio antenna to the hand is more than 20cm(please refer to the EUT external photo), and the user body should keep more than 20cm from the radio antenna.

The 2.4G FHSS or 5.8G NII can transmit simultaneously with BLE, but 2.4G FHSS and 5.8G NII can`t transmit simultaneously. So, the maximum ratio was 2.4G FHSS+ BLE:

For FCC:

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

$=S_{FHSS}/S_{limit\text{-}FHSS} + S_{BLE}/S_{limit\text{-}BLE}$
$=0.0479/1+0.002/1$
$=0.0499$
< 1.0

For RSS-102:

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

$=S_{FHSS}/S_{limit\text{-}FHSS} + S_{BLE}/S_{limit\text{-}BLE}$
$=0.479/5.36+0.02/5.35$
$=0.0931$
< 1.0

Result: Compliance, The device meets MPE requirement for Devices Used by the General Public (Uncontrolled Environment) at distance ≥20 cm.