5   FCC §2.1093, §1.1310(d) (3) & ISEDC RSS-102 - RF Exposure

5.1   Applicable Standards

As per FCC §1.1310(d) (3), At operating frequencies above 6 GHz, the MPE limits listed in Table 1 in paragraph (e)(1) of this section shall be used in all cases to evaluate the environmental impact of human exposure to RF radiation as specified in §1.1307(b) of this part.

TABLE 1 TO §1.1310(E)(1)—LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm²)	Averaging time (minutes)
(i) Limits for Occupational/Controlled Exposure				
0.3-3.0	614	1.63	*(100)	≤6
3.0-30	1842/f	4.89/f	*(900/f²)	<6
30-300	61.4	0.163	1.0	<6
300-1,500			f/300	<6
1,500-100,000			5	<6
(ii) Limits for General Population/Uncontrolled Exposure				
0.3-1.34	614	1.63	*(100)	<30
1.34-30	824/f	2.19/f	*(180/f²)	<30
30-300	27.5	0.073	0.2	<30
300-1,500			f/1500	<30
1,500-100,000			1.0	<30

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

According to ISED RSS-102 Issue 5 Section 3, devices operating above 6 GHz regardless of the separation distance shall undergo an RF exposure evaluation.

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)
0.003-10	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	3.142 $f^{0.3417}$	0.008335 $f^{0.3417}$	0.02619 $f^{0.6834}$	6
6000-15000	61.4	0.163	10	6
15000-150000	61.4	0.163	10	616000/ $f^{1.2}$
150000-300000	0.158 $f^{0.5}$	4.21 x 10^{-4} $f^{0.5}$	6.67 x 10^{-5} f	616000/$f^{1.2}$

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

5.2   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

5.3   MPE Results

UWB Standalone

Maximum output power at antenna input terminal (dBm):	-46.058
Maximum output power at antenna input terminal (mW):	0.0000248
Prediction distance (cm):	0.5
Prediction frequency (MHz):	7987.2
Maximum Antenna Gain, typical (dBi):	4.4
Maximum Antenna Gain (numeric):	2.75
Power density of prediction frequency at 0.5 cm (mW/cm^2):	0.000022
FCC MPE limit for uncontrolled exposure at prediction frequency (mW/cm^2):	1.0
Power density of prediction frequency at 0.5 cm (W/m^2):	0.00022
IC MPE limit for uncontrolled exposure at prediction frequency (W/m^2):	10

The device is compliant with the FCC requirement MPE limit for uncontrolled exposure. The maximum power density at the distance of 0.5 cm is 0.000022 mW/cm^2. Limit is 1.0 mW/cm^2.

The device is compliant with the IC requirement MPE limit for uncontrolled exposure. The maximum power density at the distance of 0.5 cm is 0.00022 W/m^2. Limit is 10 W/m^2.

Worst Case Colocation MPE Calculation: BLE and UWB:

	Radio	Max Conducted Power (dBm)	Evaluated Distance (cm)	Worst-Case Exposure Level	Limit	Worst-Case Ratios	Sum of Ratios	Limit
				Worst Case				
FCC	BLE	3.98	0.5	0.1033 W/kg	1.6 W/kg	6.46%	6.46%	100%
	UWB	-46.058	0.5	0.000022mW/cm^2	1.0 mW/cm^2	0.00002%		
IC	BLE	3.98	0.5	0.1033 W/kg	1.6 W/kg	6.46%	6.46%	100%
	UWB	-46.058	0.5	0.00022W/m^2	10 W/m^2	0.00002%		

Note: The BLE calculation for Colocation evaluation was determined using the standalone SAR value estimation defined in section 4.3.2.b.1 of KDB 447498 D01 General RF Exposure Guidance v06.