

## 4 FCC §15.247(i), §2.1091 & IC RSS-102 - RF Exposure Information

### 4.1 Applicable Standard

According to FCC §15.247(i) 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 <sup>2</sup> )	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 <sup>2</sup> )	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 IC RSS-102 must be followed concerning the exposure of humans to RF fields.

According to RSS-102 Issue 4 section 4.2, RF limits used for general public will be applied to the EUT.

Frequency Range (MHz)	Electric Field (V/m rms)	Magnetic Field (A/m rms)	Power Density (W/m <sup>2</sup> )	Time Averaging (min)
0.003 - 1	280	2.19	-	6
1 - 10	280 / f	2.19 / f	-	6
10 - 30	28	2.19 / f	-	6
30 - 300	28	0.073	2*	6
300 - 1 500	1.585 f <sup>0.5</sup>	0.0042 f <sup>0.5</sup>	f / 150	6
1 500 - 15 000	61.4	0.163	10	6
15 000 - 150 000	61.4	0.163	10	616000 / f <sup>1.2</sup>
150 000- 300 000	0.158 f <sup>0.5</sup>	4.21 x 10 <sup>-4</sup> f <sup>0.5</sup>	6.67 x 10 <sup>-5</sup> f	616000 / f <sup>1.2</sup>

**Note:** f is frequency in MHz

\* Power density limit is applicable at frequencies greater than 100 MHz

## 4.2 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

## 4.3 MPE Results

2.4 GHz Band, Worst case Legacy mode 4 correlated signal with 14.48 dBm output, and the direction antenna gain is 14 dBi + 10\*Log (4) dBi = 20 dBi, so the MPE result will be:

Maximum peak output power at antenna input terminal (dBm):	14.48
Maximum peak output power at antenna input terminal (mW):	28.05
Prediction distance (cm):	20
Prediction frequency (MHz):	2412
Maximum Antenna Gain, typical (dBi):	20
Maximum Antenna Gain (numeric):	100
Power density of prediction frequency at 20.0 cm (mW/cm <sup>2</sup> , W/m <sup>2</sup> ):	0.5580/5.580
MPE limit for uncontrolled exposure at prediction frequency (mW/cm <sup>2</sup> , W/m <sup>2</sup> ):	1.0/10

2.4 GHz Band, Worst case 4xMIMO with 21.5 dBm output, and the direction antenna gain is 14 dBi + 10\*Log (4/4) dBi = 14 dBi, so the MPE result will be:

Maximum peak output power at antenna input terminal (dBm):	21.50
Maximum peak output power at antenna input terminal (mW):	141.25
Prediction distance (cm):	20
Prediction frequency (MHz):	2412
Maximum Antenna Gain, typical (dBi):	14
Maximum Antenna Gain (numeric):	25.12
Power density of prediction frequency at 20.0 cm (mW/cm <sup>2</sup> , W/m <sup>2</sup> ):	0.7059/7.059
MPE limit for uncontrolled exposure at prediction frequency (mW/cm <sup>2</sup> , W/m <sup>2</sup> ):	1.0/10

5.8 GHz Band, Worst case Legacy mode 4 correlated signal with 16.41 dBm output, and the direction antenna gain is  $12 \text{ dBi} + 10 \cdot \log(4) \text{ dBi} = 18 \text{ dBi}$ , so the MPE result will be:

Maximum peak output power at antenna input terminal (dBm):	16.41
Maximum peak output power at antenna input terminal (mW):	43.75
Prediction distance (cm):	20
Prediction frequency (MHz):	5725
Maximum Antenna Gain, typical (dBi):	18
Maximum Antenna Gain (numeric):	63.10
Power density of prediction frequency at 20.0 cm ( $\text{mW}/\text{cm}^2$ , $\text{W}/\text{m}^2$ ):	0.5492/5.492
MPE limit for uncontrolled exposure at prediction frequency ( $\text{mW}/\text{cm}^2$ , $\text{W}/\text{m}^2$ ):	1.0/10

5.8 GHz Band, Worst case 4xMIMO with 22.17 dBm output, and the direction antenna gain is  $12 \text{ dBi} + 10 \cdot \log(4/4) \text{ dBi} = 12 \text{ dBi}$ , so the MPE result will be:

Maximum peak output power at antenna input terminal (dBm):	22.17
Maximum peak output power at antenna input terminal (mW):	164.82
Prediction distance (cm):	20
Prediction frequency (MHz):	5725
Maximum Antenna Gain, typical (dBi):	12
Maximum Antenna Gain (numeric):	15.85
Power density of prediction frequency at 20.0 cm ( $\text{mW}/\text{cm}^2$ , $\text{W}/\text{m}^2$ ):	0.5197/5.197
MPE limit for uncontrolled exposure at prediction frequency ( $\text{mW}/\text{cm}^2$ , $\text{W}/\text{m}^2$ ):	1.0/10

The device is compliant with the requirement MPE limit for uncontrolled exposure.