

4 FCC §2.1091, FCC §15.225, FCC §15.247(i) & ISED RSS-102 – RF Exposure

4.1 Applicable Standards

According to FCC §15.247(i), Radio frequency devices operating under the provisions of this part are subject to the radio frequency radiation exposure requirements specified in §§ 1.1307(b), 1.1310, 2.1091, and 2.1093 of this chapter, as appropriate. Applications for equipment authorization of mobile or portable devices operating under this section must contain a statement confirming compliance with these requirements. Technical information showing the basis for this statement must be submitted to the Commission upon request.

According to FCC §2.1091, 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 ²)	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 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 ISED RSS-102 Issue 6

6.6 Field reference level exposure exemption limits

Field reference level (FRL) exposure evaluation is required if the separation distance between the user and/or bystander and the device's radiating element is greater than 20 cm (i.e. mobile devices), except when the device operates as follows:

- below 20 MHz and the source-based, time-averaged maximum EIRP of the device is equal to or less than 1 W (adjusted for tune-up tolerance)
- at or above 20 MHz and below 48 MHz and the source-based, time-averaged maximum EIRP of the device is equal to or less than $4.49/f^{0.5} \text{ W}$ (adjusted for tune-up tolerance), where f is in MHz
- at or above 48 MHz and below 300 MHz and the source-based, time-averaged maximum EIRP of the device is equal to or less than 0.6 W (adjusted for tune-up tolerance)
- at or above 300 MHz and below 6 GHz and the source-based, time-averaged maximum EIRP of the device is equal to or less than $1.31 \times 10^{-2} f^{0.6834} \text{ W}$ (adjusted for tune-up tolerance), where f is in MHz
- at or above 6 GHz and the source-based, time-averaged maximum EIRP of the device is equal to or less than 5 W (adjusted for tune-up tolerance)

In these cases, the information contained in the RF exposure technical brief may be limited to information that demonstrates how the EIRP was derived.

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 (in appropriate units, e.g. mW/cm²)

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

R = distance to the center of radiation of the antenna (appropriate units, e.g., cm)

4.3 MPE Results for FCC

Band	Frequency (MHz)	Antenna Gain (dBi)	Maximum Power (dBm)	Maximum EIRP (dBm)	Maximum EIRP (mW)	Power Density at 20cm (mW/cm ²)	Limit (mW/cm ²)
2.4 GHz Wi-Fi	2412	4.0	19.0	23.0	199.53	0.0397	1.0
5 GHz Wi-Fi	5180	3.3	18.5	21.8	151.36	0.03011	1.0
BLE	2402	4.0	6.5	10.5	11.22	0.0022	1.0
BT Classic	2402	4.0	7.0	11.0	12.59	0.0025	1.0
RFID	13.56	N/A	N/A	68 dBuV/m @ 3m	0.001	0.0000002031	0.979

Band	Frequency (MHz)	Antenna Gain (dBi)	Maximum Power (dBm)	Maximum EIRP (dBm)	Maximum EIRP (mW)	Power Density at 20cm (mW/cm ²)	Limit (mW/cm ²)
LTE GSM/GPRS Cell	824.2 - 848.8	1.531	27.5	29.031	800.01844	0.159	0.549

The simultaneous transmission result:

2.4GHz Wi-Fi, LTE, and RFID:

$$(0.0397 / 1.0) + (0.0000002031 / 0.979) + (0.159 / 0.549) = 0.32932 < 1$$

5GHz Wi-Fi, LTE, and RFID:

$$(0.03011 / 1.0) + (0.0000002031 / 0.979) + (0.159 / 0.549) = 0.31973 < 1$$

BLE, LTE, and RFID:

$$(0.0022 / 1.0) + (0.0000002031 / 0.979) + (0.159 / 0.549) = 0.29182 < 1$$

BT Classic, LTE, and RFID:

$$(0.0025 / 1.0) + (0.0000002031 / 0.979) + (0.159 / 0.549) = 0.29212 < 1$$

Note: 2.4 GHz Wi-Fi, 5GHz Wi-Fi, BLE, and BT Classic Power (dBm) are referenced from report with FCC ID: W38-LB2AE.

Note: LTE Power (dBm) is referenced from report with FCC ID: RI7LE910CXWWX.

4.4 MPE Results for IC

Band	Frequency (MHz)	Antenna Gain (dBi)	Maximum Power (dBm)	Maximum EIRP (dBm)	Maximum EIRP (W)	EIRP Limit (W)
2.4 GHz Wi-Fi	2412	4.0	19.0	23.0	0.1995	2.68403
5 GHz Wi-Fi	5180	3.3	18.5	21.8	0.1513	4.52526
BLE	2402	4.0	6.5	10.5	0.0112	2.67642
BT Classic	2402	4.0	7.0	11.0	0.0125	2.67642
RFID	13.56	N/A	N/A	68 dBuV/m @ 3m	0.000001	1

Band	Frequency (MHz)	Antenna Gain (dBi)	Maximum Power (dBm)	Maximum EIRP (dBm)	Maximum EIRP (W)	EIRP Limit (W)
LTE GSM/GPRS Cell	824.2 - 848.8	1.531	27.5	29.031	0.80001	1.28851

The simultaneous transmission result:

2.4GHz Wi-Fi, RFID, and LTE:

Total EIRP (Percentages) = $(0.1995/2.68403) + (0.000001/1) + (0.80001/1.28851) = 0.69521 < 1$

5GHz Wi-Fi, RFID, and LTE:

Total EIRP (Percentages) = $(0.1513/4.52526) + (0.000001/1) + (0.80001/1.28851) = 0.65431 < 1$

BLE, RFID, and LTE:

Total EIRP (Percentages) = $(0.0112/2.67642) + (0.000001/1) + (0.80001/1.28851) = 0.62506 < 1$

BT Classic, RFID, and LTE:

Total EIRP (Percentages) = $(0.0125/2.67642) + (0.000001/1) + (0.80001/1.28851) = 0.62555 < 1$

The device is compliant with the requirement IC MPE limit for uncontrolled exposure. Limit is <100%.

Note: 2.4 GHz Wi-Fi, 5GHz Wi-Fi, BLE, and BT Classic Power (dBm) are referenced from report with FCC ID: W38-LB2AE.

Note: LTE Power (dBm) is referenced from report with FCC ID: RI7LE910CXWWX.

Note: LTE limit determined from the worst case margin per the original report.