

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

4.1 Applicable Standards

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 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 5:

2.5.2 Exemption Limits for Routine Evaluation — RF Exposure Evaluation

RF 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, except when the device operates as follows:

- below 20 MHzFootnote6 and the source-based, time-averaged maximum e.i.r.p. 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 e.i.r.p. of the device is equal to or less than $4.49/f^{0.5}$ 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 e.i.r.p. 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 e.i.r.p. of the device is equal to or less than $1.31 \times 10^{-2} f^{0.6834}$ W (adjusted for tune-up tolerance), where f is in MHz;
- at or above 6 GHz and the source-based, time-averaged maximum e.i.r.p. 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 e.i.r.p. 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

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 RF Exposure Evaluation Exemption for FCC

NOTE: separation distance is declared to be 25cm based on minimum separation distance of RFID module.

Worst Case Co-location MPE Calculation: BT(I28- WYSBHVDXP) and RFID(UZ7RE40)

Radio	Max EIRP (dBm)	Evaluated Distance (cm)	Worst-Case Exposure Level	Limit	Worst-Case Ratios	Sum of Ratios	Limit
Worst Case							
BT	15.8	20	0.0076 mW/cm ²	1.0 mW/cm ²	0.76%	17.4%	100%
RFID*	27	20	0.0997 mW/cm ²	0.602 mW/cm ²	16.6%		

Note: Output Power is 12.0 dBm, antenna gain is 3.8dBi

Worst Case Co-location MPE Calculation: 2.4 Wi-Fi(I28- WYSBHVDXP) and RFID(UZ7RE40)

Radio	Max EIRP (dBm)	Evaluated Distance (cm)	Worst-Case Exposure Level	Limit	Worst-Case Ratios	Sum of Ratios	Limit
Worst Case							
Wi-Fi	20.5	20	0.022 mW/cm ²	1.0 mW/cm ²	2.2%	18.8%	100%
RFID*	27	20	0.0997 mW/cm ²	0.602 mW/cm ²	16.6%		

Note: Output Power is 17.0 dBm, antenna gain is 3.5dBi

Worst Case Co-location MPE Calculation: 5 Wi-Fi(I28- WYSBHVDXP) and RFID(UZ7RE40)

Radio	Max EIRP (dBm)	Evaluated Distance (cm)	Worst-Case Exposure Level	Limit	Worst-Case Ratios	Sum of Ratios	Limit
Worst Case							
Wi-Fi	18.7	20	0.015 mW/cm ²	1.0 mW/cm ²	1.5%	18.1%	100%
RFID*	27	20	0.0997 mW/cm ²	0.602 mW/cm ²	16.6%		

Note: Output Power is 15.0 dBm, antenna gain is 3.7dBi

Note: worst case of output power and eirp used for RFID for calculations*

4.4 RF Exposure Evaluation Exemption for IC

BT

Maximum EIRP power = $12 \text{ dBm} + 3.8 \text{ dBi} = 15.8 \text{ dBm}$ which is lesser than $1.31 \times 10^{-2} f^{0.6834} = 2.67 \text{ W} = 34.26 \text{ dBm}$.

2.4GHz WiFi

Maximum EIRP power = $17 \text{ dBm} + 3.5 \text{ dBi} = 20.5 \text{ dBm}$ which is lesser than $1.31 \times 10^{-2} f^{0.6834} = 2.68 \text{ W} = 34.28 \text{ dBm}$.

5GHz WiFi

Maximum EIRP power = $15 \text{ dBm} + 3.7 \text{ dBi} = 18.7 \text{ dBm}$ which is lesser than $1.31 \times 10^{-2} f^{0.6834} = 4.52 \text{ W} = 36.55 \text{ dBm}$.

RFID

Maximum EIRP power = $27.00 \text{ dBm} - 30 \text{ dBi} = -3.00 \text{ dBm}$ which is lesser than $1.31 \times 10^{-2} f^{0.6834} = 1.371 \text{ W} = 31.37 \text{ dBm}$.

Therefore, the RF exposure Evaluation is exempt.

NOTE: for WIFI/BT, please refer to report number FA0D2423-05 issued by Sporton Lab on 8/28/2023.

NOTE: for RFID, please refer to report number FA051819 issued by Sporton Lab on 7/15/2020.

NOTE: Wifi Antenna models are B53023-30 and B53025-30. BT Antenna model is B53026-90.