4 FCC §1.1307(b) (1), §2.1091 &§90.223 & ISEDC RSS-102 - RF Exposure

4.1 Applicable Standards

FCC §2.1091, (a) Requirements of this section are a consequence of Commission responsibilities under the National Environmental Policy Act to evaluate the environmental significance of its actions. See subpart I of part 1 of this chapter, in particular §1.1307(b).

According to §1.1310 and §2.1091 RF exposure is calculated.

Limits for Occupational/Controlled Exposure

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm^2)	Averaging Time (minute)
(A) Limits for Occupational/Controlled Exposure				
0.3-3.0	614	1.63	*(100)	≤6
3.0-30	1842/f	4.89/f	*($900/f^2$)	<6
30-300	61.4	0.163	1.0	<6
300-1,500			f/300	<6
1,500-100,000			5	<6
(B) Limits for General Population/Uncontrolled Exposure				
0.3-3.0	614	1.63	*(100)	<30
3.0-30	824/f	2.19/f	*($900/f^2$)	<30
30-300	27.5	0.073	1.0	<30
300-1,500			f/1500	<30
1,500-100,000			1.0	<30

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

According to ISED RSS-102:

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 $4.49/f^{0.5} W$ (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 $1.31 \times 10^{-2} f^{0.6834} W$ (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
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 and Exemption for FCC and IC

FCC:

Maximum tune up power at antenna input terminal (dBm):	6.64
Maximum tune up power at antenna input terminal (mW):	4.613
Prediction frequency (MHz):	4955
Antenna Gain, maximum (dBi):	15
Maximum Antenna Gain (numeric):	31.62
Prediction distance (cm):	40
Power density of prediction frequency at 40 cm (mW/cm^2):	0.0726
FCC MPE limit for uncontrolled exposure at prediction frequency (mW/cm^2):	1.0

IC:

Maximum EIRP power = 6.64 dBm + 15 dBi = 21.64 dBm which is lesser than $1.31\times10^{-2}f^{0.6834}$ = 4.36 W = 36.42 dBm.

Simultaneous Transmission Evaluation

Total Power Densities (Percentages) = 5GHz Radio 2 Power Density % + 5GHz Radio 1 Power Density % + BLE Power Density % + 4.9GHz Radio 2

Total Relative Power Densities (Percentages) = (0.106/1.0) *100 + (0.197/1.0) *100 + (0.001/1)*100 + (0.056/1.0)*100= 10.6 % + 19.7 % + 1% + 5.6 % = 36.9%

Note: above power density percentages are referenced from *Maximum Permissible Exposure Study – Engineering Analysis EDCS#11556830* issued by *Cisco Systems, Inc*..

4.4 Conclusion

FCC: The device is compliant with the requirement FCC MPE limit for uncontrolled exposure. The maximum power density at the distance of 40 cm is 0.0726 mW/cm^2. The Limit is 1.0 mW/cm^2. Therefore, SAR testing for this device is exempted.

IC: The maximum EIRP power of 21.64 dBm is less than calculated 36.42 dBm source-based, time-averaged maximum EIRP exemption limit. Therefore, SAR testing is not required.