RF Exposure Information

Prediction of MPE limit at a given distance

Equation from page 18 of OET Bulletin 65, Edition 97-01

$$S = \frac{PG}{4\pi R^2}$$

where: S = power density

P = power input to the 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

When all the antennas are at least 20cm away from the user's body (excluding hands and wrists during normal operation of the device), but individual antennas <u>can not</u> be separated by more than 20cm from each other.

If

[Pd(1) / LPd(1)] + [Pd(2) / LPd(2)] + ….. + [Pd(n) / LPd(n)] < 1,

Then, the device complies with FCC's RF radiation exposure limit for general population as a mobile device (d>20cm).

Where;

Pd(n) = Power density of nth transmitter at 20cm
LPd(n) = Power density limit for the nth transmitter

§ 1.1310 Radiofrequency radiation exposure limits.

TABLE 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)
(A) Limits for Occupational/Controlled Exposures				
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
300–1500	....	....	f/300	6
1500–100,000	....	....	5	6
(B) 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
300–1500	....	....	f/1500	30
1500–100,000	....	....	1.0	30

f = frequency in MHz
* = Plane-wave equivalent power density
NOTE 1 TO TABLE 1: Occupational/controlled limits apply in situations in which persons are exposed as a consequence of their employment provided those persons are fully aware of the potential for exposure and can exercise control over their exposure. Limits for occupational/controlled exposure also apply in situations when an individual is transient through a location where occupational/controlled limits apply provided he or she is made aware of the potential for exposure.
NOTE 2 TO TABLE 1: General population/uncontrolled exposures apply in situations in which the general public may be exposed, or in which persons that are exposed as a consequence of their employment may not be fully aware of the potential for exposure or can not exercise control over their exposure.

Examples for General Population/Uncontrolled Exposure
2.4GHz   LPd = 1mW/cm2
1.9GHz   LPd = 1mW/cm2
824.2MHz   LPd = f(MHz)/1500 = 824.2/1500 = 0.549mW/cm2

Evaluation:

S1 (IEEE 802.11b/g):
$EIRP/(4*Pi*D^2) = 0.0896/(4*Pi*0.2^2) = 0.178 \text{ W/m}^2 = 0.0178 \text{ mW/cm}^2$

S2 (Bluetooth LE):
$EIRP/(4*Pi*D^2) = 0.0037/(4*Pi*0.2^2) = 0.0073 \text{ W/m}^2 = 0.00073 \text{ mW/cm}^2$

FCC: $0.0178 \text{ mW/cm}^2 + 0.00073 \text{ mW/cm}^2 = 0.01853 \text{ mW/cm}^2 < 1$ Pass

IC: $0.178 \text{ W/m}^2 + 0.0073 \text{ W/m}^2 = 0.1853 \text{ W/m}^2 < 10$ Pass

Conclusion:

The device complies with FCC's and Industry Canada RF radiation exposure limits for general population as a mobile device (d>20cm) under the collocation conditions described above.