FCC §1.1310 & §2.1091- MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Applicable Standard

According to subpart 1.1310, 2.1091 systems operating under the provisions of this section shall be operated in a manner that ensures the public is not exposed to RF energy level in excess of the communication 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)**
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

Calculated Formulary:

Predication of MPE limit at a given distance

$S = PG/4\pi R^2$ = power density (in appropriate units, e.g. mW/cm^2);
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, the power gain factor, is normally numeric gain;
R = distance to the center of radiation of the antenna (appropriate units, e.g., cm);

For simultaneously transmit system, the calculated power density should comply with:

$$\sum_i \frac{S_i}{S_{Limit,i}} \leq 1$$

Calculated Data:

Mode	Frequency Range (MHz)	Antenna Gain		Tune-up Output Power		Evaluation Distance (cm)	Power Density (mW/cm^2)	MPE Limit (mW/cm^2)
		(dBi)	(numeric)	(dBm)	(mW)			
BLE	2402-2480	1.0	1.26	6.50	4.47	20	0.0011	1.00
GPRS/EGPRS 850	824.2-848.8	0.6	1.15	27.00	501.19	20	0.1145	0.55
GPRS/EGPRS 1900	1850.2-1909.8	0.6	1.15	23.50	223.87	20	0.0512	1.00
LTE Band 5	824.2-848.8	0.6	1.15	22.50	177.83	20	0.0406	0.55
LTE Band 41	2498.5-2687.5	3.7	2.34	23.50	223.87	20	0.1045	1.00

Note:

GPRS 850: Tune-up maximum output power with 4 slot is 30.00 dBm, so the tune-up time based Ave. power compared to sloted Ave. power is 27.00 dBm.
GPRS 1900: Tune-up Maximum output power with 4 slot is 26.50 dBm, so the tune-up time based Ave. power compared to sloted Ave. power is 23.50 dBm.
EGPRS 850: Tune-up maximum output power with 4 slot is 26.00 dBm, so the tune-up time based Ave. power compared to sloted Ave. power is 23.00 dBm.
EGPRS 1900: Tune-up Maximum output power with 4 slot is 23.00 dBm, so the tune-up time based Ave. power compared to sloted Ave. power is 20.00 dBm.

Number of Time slot	1	2	3	4
Duty Cycle	1:8	1:4	1:2.66	1:2
Time based Ave. power compared to slotted Ave. power	-9 dB	-6 dB	-4.26 dB	-3 dB

Note: GPRS/EGPRS/LTE and BLE can transmit simultaneously; the worst condition is below:

$$\sum_i \frac{S_i}{S_{Limit,i}} = 0.1145/0.55+0.0011/1.00=0.2093< 1.0$$

Result: The device meet FCC MPE at 20 cm distance.