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

Applicable Standard

According to subpart §1.1310, 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 Maximum Permissible Exposure (MPE) (§1.1310, §2.1091)

(B) 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/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;

Calculation Formula:

Prediction of power density at the distance of the applicable MPE limit:
S = PG/4πR² = 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:

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

Calculated Data:

Mode	Frequency (MHz)	Antenna Gain		Tune-up Power Source Based Time Average Power		Evaluation Distance (cm)	Power Density	MPE Limit
		(dBi)	(numeric)	(dBm)	(mW)		(mW/cm^2)	(mW/cm^2)
GSM850	824-849	2.5	1.78	24.5	281.84	20.00	0.10	0.55
GSM1900	1850-1910	3	2.00	21.5	141.25	20.00	0.06	1.00

Note:
The antenna gain is 2.5dBi for Cellular band and 3.0 dBi for PCS band.
The maximum Source based time average power including tune-up tolerance is 24.5dBm for GSM850 and 21.5 dBm for GSM1900 band.

4 module may transmit simultaneously. Maximum rate should be 4 modules work on Cellular band at difference channel:

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

=4* 0.1/0.55=0.73<1

Result: Compliance, The device meets MPE requirement for Devices Used by the General Public (Uncontrolled Environment) at distance ≥20 cm.