FCC §15.247 (I) & §1.1310 & §2.1091- MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Applicable Standard

According to subpart 15.247(i) and 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;

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

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);

MPE Results

The device was build in two WWAN modules(FCC: RI7GC864Q2), which supports GSM/GPRS 850 band and 1900 Band, The Tune-up power including tolerance as below:

Frequency Band	**Tune-Up Power Including Tolerance**
824-849MHz	**33 dBm**
1850-1910MHz	**30 dBm**

Calculated Data:

Frequency Range (MHz)	Antenna Gain		Tune-up Power		Evaluation Distance (cm)	Power Density (mW/cm^2)	MPE Limit (mW/cm^2)	S_i/S_{limi}
	(dBi)	(numeric)	(dBm)	(mW)				
2412-2462	2	1.58	22	158.49	35	0.016	1.0	0.016
824-849	2	1.58	33	1995.26	35	0.205	0.55	0.374
1850-1910	2	1.58	30	1000.00	35	0.103	1.0	0.103

Note: The wlan tune-up power and tolerance is 21±1.0dBm, and max antenna gain is 2 dBi.

The two WWAN modules can transmit simultaneously with WLAN, the maximum Ratio for WWAN in 824-849MHz band, and:

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

$=S_{WWAN}/S_{limit\_WWA}*2+ S_{WLAN}/S_{limit\_WLAN}$

=0.374*2+0.016
=0.764

< 1.0

Result: The device meet FCC MPE at 35 cm distance.