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

Applicable Standard

According to§15.247(i) and §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/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:

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

Calculated Data:

The device was build in a WWAN module PLS8-US, FCC ID: QIPPLS8-US, which supports GSM/GPRS/EDGE 850 band and 1900 Band, WCDMA Band 2,4,5, and LTE band 2,4, 5, 17. The Tune-up power including tolerance as below:

Frequency Band	Tune-Up Power Including Tolerance (dBm)				
	GSM	**GPRS**	**EDGE**	**WCDMA**	**LTE**
Band 5 (824-849MHz)	**33.5**	33.5	27.5	24.5	23.5
Band 2 (1850-1910MHz)	**30.5**	30.5	26.5	24.5	23.5
Band 4 (1710-1755MHz)	/	/	/	24.5	23.5
Band 17 (704-716MHz)	/	/	/	/	23.5

The stand-alone MPE for the worst bands and antenna chain as below:

Frequency (MHz)	Mode	Antenna Gain		Max. Target Power including Tolerance		Evaluation Distance (cm)	Power Density (W/m^2)	MPE Limit (W/m^2)	S_i/S_{limit}
		(dBi)	(numeric)	(dBm)	(mW)				
824-849	GSM	2.50	1.78	33.50	2238.72	40.00	0.20	0.55	0.36
1850-1910	GSM	2.50	1.78	30.50	1122.02	40.00	0.10	1.00	0.10
1710-1755	WCDMA	2.50	1.78	24.50	281.84	40.00	0.02	1.00	0.02
704-716	LTE	2.50	1.78	23.50	223.87	40.00	0.02	0.47	0.04
2412-2462	WLAN Chain 1	2.00	1.58	21.5	199.53	40.00	0.01	1.00	0.01
2412-2462	WLAN Chain 2	2.00	1.58	21.5	199.53	40.00	0.01	1.00	0.01

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

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

$= S_{WWAN}/S_{limit\_WWAN} + S_{WLAN1}/S_{limit\_WLAN1} + S_{WLAN2}/S_{limit\_WLAN2}$

$=0.36+0.01+0.01$

$=0.38$

< 1.0

Result: Compliance, The device meets MPE requirement for Devices Used by the General Public (Uncontrolled Environment) at distance $\geqslant$40 cm.