

5. RF EXPOSURE EVALUATION

5.1 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/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;

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

Calculation formula:

Prediction of power density at the distance of the applicable MPE limit

$S = PG/4\pi R^2$ = power density (in appropriate units, e.g. mW/cm²);

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:

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

5.2 EUT WWAN Information ▲:

Operation Modes	Operation Frequency (MHz)	Maximum Conducted Power including Tune-up Tolerance (dBm)	Antenna Gain (dBi)	ERP or EIRP (dBm)	ERP or EIRP Limit (dBm)	Conducted Power Limit (dBm)
LTE/NR B2	1850-1910	25	2.23	27.23	33	/
LTE B4	1710-1755	25	3.27	28.27	30	/
LTE/NR B5	824-849	25	-0.24	22.61	38.45	/
LTE/NR B7	2500-2570	25	4.02	/	/	33
LTE/NR B12	699-716	25	-0.55	22.3	44.77	/
LTE/NR B13	777-787	25	0.64	23.49	44.77	/
LTE/NR B14	788-798	25	0.54	23.39	44.77	/
LTE B17	704-716	25	-0.55	22.3	44.77	/
LTE/NR B25	1850-1915	25	2.23	27.23	33	/
LTE/NR B26	814-849	25	-0.11	24.89	38.45	/
LTE/NR B30	2305-2315	25	2.68	27.68	33	/
LTE/NR B38	2570-2620	28	3.15	31.15	33	/
LTE B41	2496-2690	28	4.02	/	/	33
NR B41	2496-2690	31	4.02	/	/	33
LTE/NR B66	1710-1780	25	3.27	28.27	30	/
LTE/NR B71	663-698	25	-0.81	22.04	44.77	/
NR B77	3450-3550 3700-3980	31	4.43	35.43	62.15	/
NR B78	3300-3800	31	2.95	33.95	62.15	/

Note:

The devices contain certified WWAN Module, FCC ID: XMR2023RG520NNA.

The device was used for fixed application.

5.3 Measurement Result

Operation Modes	Frequency (MHz)	Antenna Gain		Conducted output power including Tune-up Tolerance		Evaluation Distance (cm)	Power Density (mW/cm ²)	MPE Limit (mW/cm ²)
		(dBi)	(numeric)	(dBm)	(mW)			
BLE	2402-2480	2.66	1.85	3	2.00	20	0.0007	1
LTE/NR B2	1850-1910	2.23	1.67	25	316.23	20	0.1051	1
LTE B4	1710-1755	3.27	2.12	25	316.23	20	0.1334	1
LTE/NR B5	824-849	-0.24	0.95	25	316.23	20	0.0598	0.549
LTE/NR B7	2500-2570	4.02	2.52	25	316.23	20	0.1585	1
LTE/NR B12	699-716	-0.55	0.88	25	316.23	20	0.0554	0.466
LTE/NR B13	777-787	0.64	1.16	25	316.23	20	0.0730	0.518
LTE/NR B14	788-798	0.54	1.13	25	316.23	20	0.0711	0.525
LTE B17	704-716	-0.55	0.88	25	316.23	20	0.0554	0.469
LTE/NR B25	1850-1915	2.23	1.67	25	316.23	20	0.1051	1
LTE/NR B26	814-849	-0.11	0.97	25	316.23	20	0.0610	0.543
LTE/NR B30	2305-2315	2.68	1.85	25	316.23	20	0.1164	1
LTE/NR B38	2570-2620	3.15	2.07	28	630.96	20	0.2598	1
LTE B41	2496-2690	4.02	2.52	28	630.96	20	0.3163	1
NR B41	2496-2690	4.02	2.52	31	1258.93	20	0.6311	1
LTE/NR B66	1710-1780	3.27	2.12	25	316.23	20	0.1334	1
LTE/NR B71	663-698	-0.81	0.83	25	316.23	20	0.0522	0.442
NR B77	3450-3550 3700-3980	4.43	2.77	31	1258.93	20	0.6938	1
NR B78	3300-3800	2.95	1.97	31	1258.93	20	0.4934	1

The WWAN and BLE can transmit simultaneously, the worst case as below::

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

$$=S_{WWAN}/S_{limit-WWAN} + S_{BLE}/S_{limit-BLE}$$

$$=0.6938/1+0.0007/1$$

$$=0.69$$

$$< 1.0$$

Result: The device compliant the Exemption at 20cm distances.

==== END OF REPORT ====