

Appendix B. Maximum Permissible Exposure

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1. Maximum Permissible Exposure

1.1. Applicable Standard

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 levels in excess limit for maximum permissible exposure. In accordance with 47 CFR FCC Part 2 Subpart J, section 2.1091 this device has been defined as a mobile device whereby that distance of at least 0.25 m is normally maintained between the user and the device.

(A) Limits for Occupational / Controlled Exposure

Frequency Range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (H) (A/m)	Power Density (S) (mW/ cm²)	Averaging Time E ² , H ² or S (minutes)
0.3-3.0	614	1.63	(100)*	6
3.0-30	1842 / f	4.89 / f	(900 / f)*	6
30-300	61.4	0.163	1.0	6
300-1500			F/300	6
1500-100,000			5	6

(B) Limits for General Population / Uncontrolled Exposure

Frequency Range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (H) (A/m)	Power Density (S) (mW/ cm²)	Averaging Time E ² , H ² or S (minutes)
0.3-1.34	614	1.63	(100)*	30
1.34-30	824/f	2.19/f	(180/f)*	30
30-300	27.5	0.073	0.2	30
300-1500			F/1500	30
1500-100,000			1.0	30

Note: f = frequency in MHz; *Plane-wave equivalent power density

1.2. MPE Calculation Method

E (V/m) =
$$\frac{\sqrt{30 \times P \times G}}{d}$$
 Power Density: Pd (W/m²) = $\frac{E^2}{377}$

E = Electric field (V/m)

P = Average RF output power (W)

G = EUT Antenna numeric gain (numeric)

d = Separation distance between radiator and human body (m)

The formula can be changed to

$$Pd = \frac{30 \times P \times G}{377 \times d^2}$$

From the EUT RF output power, the minimum mobile separation distance, d=0.25m, as well as the gain of the used antenna, the RF power density can be obtained.

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1.3. Calculated Result and Limit

Exposure Environment: General Population / Uncontrolled Exposure

<For WLAN>

Antenna Type: PIFA Antenna

Conducted Power for IEEE 802.11g: 27.96 dBm

Distance (m)	Test Freq. (MHz)	Antenna Gain (dBi)	Antenna Gain (numeric)	The maximum combined Average Output Power		Power Density (S) (mW/cm²)	Limit of Power Density (S)	Test Result
			(Hullielic)	(dBm)	(mW)	(IIIW/CIII)	(mW/cm²)	
0.25	2437	4.20	2.6303	27.9638	625.7179	0.209657	1	Complies

<For Zigbee>

Antenna Type: PIFA Antenna

Conducted Power for Zigbee: 21.29 dBm / Chain 3

Distance (m)	Test Freq. (MHz)	Antenna Gain (dBi)	Antenna Gain (numeric)	The maximum combined Average Output Power		Power Density (\$) (mW/cm²)	Limit of Power Density (S)	Test Result
			(Hullielic)	(dBm)	(mW)	(IIIW/CIII)	(mW/cm²)	
0.25	2405	2.30	1.6982	21.2900	134.5860	0.029116	1	Complies

Antenna Type: PIFA Antenna

Conducted Power for Zigbee: 21.55 dBm / Chain 4

Distance (m)	Test Freq. (MHz)	Antenna Gain (dBi)	Antenna Gain (numeric)	The maximum combined Average Output Power		Power Density (S) (mW/cm²)	Limit of Power Density (S)	Test Result
			(Hullienc)	(dBm)	(mW)	(IIIIVV/CIII)	(mW/cm²)	
0.25	2405	4.80	3.0200	21.5500	142.8894	0.054971	1	Complies

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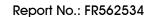
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<For WWAN>

FCC ID: RI7HE910 / Antenna Type: PIFA Antenna

				a Hz frequency b	and		
Distance (m)	Bands	Frequency (MHz)	Antenna Gain (dBi)	· · ·	Power Density (S) (mW/cm²)	Limit of Power Density (S) (mW/cm²)	Test Result
		824.2		32.70	0.327439	0.55	Complies
	GSM 850	836.4		32.60	0.319986	0.56	Complies
	000	848.8		32.60	0.319986	0.57	Complies
		824.2		33.00	0.350857	0.55	Complies
	GPRS 850	836.4		32.90	0.342871	0.56	Complies
0.25	000	848.8	1.4	32.90	0.342871	0.57	Complies
0.25		824.2	1.4	29.90	0.171842	0.55	Complies
	EGPRS 850	836.4		29.80	0.167931	0.56	Complies
	000	848.8		29.80	0.167931	0.57	Complies
		826.4		26.63	0.080934	0.55	Complies
	WCDMA Band V	836.4		26.43	0.077291	0.56	Complies
	bana v	846.4		26.47	0.078006	0.56	Complies
			1900 M	IHz frequency k	oand		
Distance	Bands	Frequency	Antenna Gain (dBi)	Output Power (dBm)	Power Density (S)	Limit of Power Density (S)	Test Result
(m)		(MHz)	(GDI)	(GBIII)	(mW/cm²)	(mW/cm²)	
(m)		1850.20	(аы)	29.70	(mW/cm²) 0.231809	(mW/cm²)	Complies
(m)	GSM 1900		(СБ)	, ,	,	(mW/cm²)	Complies Complies
(m)	GSM 1900	1850.20	(GDI)	29.70	0.231809	(mW/cm²)	
(m)	1900	1850.20 1880.00	(GDI)	29.70 29.60	0.231809 0.226532	(mW/cm²)	Complies
(m)	1900 GPRS	1850.20 1880.00 1909.80	(GDI)	29.70 29.60 29.30	0.231809 0.226532 0.211412	(mW/cm²)	Complies Complies
	1900	1850.20 1880.00 1909.80 1850.20		29.70 29.60 29.30 29.90	0.231809 0.226532 0.211412 0.242734		Complies Complies Complies
(m) 0.25	1900 GPRS 1900	1850.20 1880.00 1909.80 1850.20 1880.00	2.9	29.70 29.60 29.30 29.90 29.80	0.231809 0.226532 0.211412 0.242734 0.237209	(mW/cm²)	Complies Complies Complies
	GPRS 1900 EGPRS	1850.20 1880.00 1909.80 1850.20 1880.00 1909.80		29.70 29.60 29.30 29.90 29.80 29.50	0.231809 0.226532 0.211412 0.242734 0.237209 0.221376		Complies Complies Complies Complies Complies
	1900 GPRS 1900	1850.20 1880.00 1909.80 1850.20 1880.00 1909.80 1850.20		29.70 29.60 29.30 29.90 29.80 29.50 28.60	0.231809 0.226532 0.211412 0.242734 0.237209 0.221376 0.179971		Complies Complies Complies Complies Complies Complies
	GPRS 1900 EGPRS 1900	1850.20 1880.00 1909.80 1850.20 1880.00 1909.80 1850.20 1880.00		29.70 29.60 29.30 29.90 29.80 29.50 28.60 28.40	0.231809 0.226532 0.211412 0.242734 0.237209 0.221376 0.179971 0.171842		Complies Complies Complies Complies Complies Complies Complies Complies
	GPRS 1900 EGPRS 1900 WCDMA	1850.20 1880.00 1909.80 1850.20 1880.00 1909.80 1850.20 1880.00 1909.80		29.70 29.60 29.30 29.90 29.80 29.50 28.60 28.40 28.30	0.231809 0.226532 0.211412 0.242734 0.237209 0.221376 0.179971 0.171842 0.167931		Complies Complies Complies Complies Complies Complies Complies Complies Complies
	GPRS 1900 EGPRS 1900	1850.20 1880.00 1909.80 1850.20 1880.00 1909.80 1850.20 1880.00 1909.80 1852.40		29.70 29.60 29.30 29.90 29.80 29.50 28.60 28.40 28.30 26.39	0.231809 0.226532 0.211412 0.242734 0.237209 0.221376 0.179971 0.171842 0.167931 0.108176		Complies
	GPRS 1900 EGPRS 1900 WCDMA	1850.20 1880.00 1909.80 1850.20 1880.00 1909.80 1850.20 1880.00 1909.80 1852.40 1880.00	2.9	29.70 29.60 29.30 29.90 29.80 29.50 28.60 28.40 28.30 26.39 25.93	0.231809 0.226532 0.211412 0.242734 0.237209 0.221376 0.179971 0.171842 0.167931 0.108176 0.097304 0.089977		Complies
	GPRS 1900 EGPRS 1900 WCDMA	1850.20 1880.00 1909.80 1850.20 1880.00 1909.80 1850.20 1880.00 1909.80 1852.40 1880.00	2.9	29.70 29.60 29.30 29.90 29.80 29.50 28.60 28.40 28.30 26.39 25.93 25.93	0.231809 0.226532 0.211412 0.242734 0.237209 0.221376 0.179971 0.171842 0.167931 0.108176 0.097304 0.089977		Complies
0.25	GPRS 1900 EGPRS 1900 WCDMA Band II	1850.20 1880.00 1909.80 1850.20 1880.00 1909.80 1850.20 1880.00 1909.80 1852.40 1880.00 1907.60	2.9 1700 M	29.70 29.60 29.30 29.90 29.80 29.50 28.60 28.40 28.30 26.39 25.93 25.93 25.59	0.231809 0.226532 0.211412 0.242734 0.237209 0.221376 0.179971 0.171842 0.167931 0.108176 0.097304 0.089977 cand Power Density (S)	Limit of Power Density (S)	Complies
0.25	GPRS 1900 EGPRS 1900 WCDMA Band II	1850.20 1880.00 1909.80 1850.20 1880.00 1909.80 1850.20 1880.00 1909.80 1852.40 1880.00 1907.60 Frequency (MHz)	2.9 1700 M	29.70 29.60 29.30 29.90 29.80 29.50 28.60 28.40 28.30 26.39 25.93 25.59 IHz frequency to Coutput Power (dBm)	0.231809 0.226532 0.211412 0.242734 0.237209 0.221376 0.179971 0.171842 0.167931 0.108176 0.097304 0.089977 cand Power Density (S) (mW/cm²)	Limit of Power Density (S)	Complies Test Result

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FCC ID: XMR201312UC20 / Antenna Type: PIFA Antenna

Distance (m)	Bands	Frequency (MHz)	Antenna Gain (dBi)	Output Power (dBm)	Power Density (S) (mW/cm²)	Limit of Power Density (S) (mW/cm²)	Test Result
0.25	WCDMA Band V	826.4	1.4	23.50	0.039367	0.55	Complies
0.25	WCDMA Band II	1907.6	2.9	23.50	0.055607	1	Complies

Conclusion:

The transmit simultaneously mode as below:

Mode 1. WLAN + Zigbee (chain 3) + Zigbee (chain 4)+ WWAN (FCC ID: RI7HE910)

Mode 2. WLAN + Zigbee (chain 3) + Zigbee (chain 4)+ WWAN (FCC ID: XMR201312UC20)

The formula of calculated the MPE is:

CPD1 / LPD1 + CPD2 / LPD2 +etc. < 1

CPD = Calculation power density

LPD = Limit of power density

Mode 1. 0.209657 / 1 + 0.029116 / 1 + 0.054971 / 1 + 0.350857 / 0.55 = 0.931666

Mode 2. 0.209657 / 1 + 0.029116 / 1 + 0.054971 / 1 + 0.039367 / 0.55 = 0.365320

The result of all modes are less than "1". This confirmed that the device complies.

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