RADIO FREQUENCY RADIATION EXPOSURE

FCC KDB 447498 D03

47CFR§§1.1307(b)(1) &§2.1091-RF EXPOSURE

1. Applicable Standard

According to FCC§part 1.1310 and §Part 2.1091 (Mobile Devices)RF exposure is calculated.

2. Limits

2.1. Limits for Maximum Permissible Exposure(MPE)

Table 1 Limits for General Population/Uncontrolled Exposure

Frequency Range (MHz)	Electric Field (V/m rms)	Magnetic Field (A/m rms)	Power Density (W/m_2)	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	($180/f_2$)*	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

3. Prediction of MPE limit at given distance, equations from OET Bulletin 65, Edition 97‐01:

$S = (P * G) / (4 * \pi * R^2)$ (where PG = EIRP) Where:

S = power density

P= power input to antenna

G= numeric gain of the antenna

R= distance to the center of radiation of the antenna

Devices that operate under CFR47 Part 90 are subject to routine environmental evaluation for RF exposure prior to equipment authorization or use if they operate at frequencies of 1.5 GHz or below and limit for power density for general population/uncontrolled exposure is f/1500 mW/cm^2. The output power range by Manufacturer statement is 33±1dBm for Downlink and 27±1dBm for Uplink, therefore the maximum effective radiated power is 34dBm for Downlink and 28 dBm for Uplink:

3.1 700MHz Band:

3.1.1 Frequency range: 758MHz~768MHz/788MHz ~798MHz

(1) Downlink(758MHz~768MHz)

Prediction frequency (MHz):	763
Maximum peak output power at antenna input terminal (dBm):	34.0
Maximum peak output power at antenna input terminal (W):	2.5119
Maximum antenna gain (dBi):	10.0
Maximum antenna gain (dBd):	7.85
Maximum antenna gain (numeric):	6.09
Maximum RF output power (W):	15.2974
MPE limit for uncontrolled exposure at predication frequency (W/ m²): S= f/1500=763/1500	0.509
R1= $\sqrt{\frac{PG}{4\pi S}}=\sqrt{\frac{2.5119*6.09}{0.509*4*3.14}}\approx 1.547$m	

(2) Uplink(788MHz ~798MHz)

Prediction frequency (MHz):	793
Maximum peak output power at antenna input terminal (dBm):	28.0
Maximum peak output power at antenna input terminal (W):	0.5012
Maximum antenna gain (dBi):	10.0
Maximum antenna gain (dBd):	7.85
Maximum antenna gain (numeric):	6.09
Maximum RF output power (W):	3.05231
MPE limit for uncontrolled exposure at predication frequency (W/ m²): S= f/1500=793/1500	0.529
R1= $\sqrt{\frac{PG}{4\pi S}}=\sqrt{\frac{0.5012*6.09}{0.529*4*3.14}}\approx 0.678$m	

Therefore, Prediction total distance (m) : $R_{total} = R_{Downlink} + R_{Uplink} = 1.547+0.678=2.225$

3.1.2 Frequency range: 769MHz~775MHz/799MHz ~805MHz

(3) Downlink(769MHz~775MHz)

Prediction frequency (MHz):	769
Maximum peak output power at antenna input terminal (dBm):	34.0
Maximum peak output power at antenna input terminal (W):	2.5119
Maximum antenna gain (dBi):	10.0
Maximum antenna gain (dBd):	7.85
Maximum antenna gain (numeric):	6.09

Maximum RF output power (W):	15.2974
MPE limit for uncontrolled exposure at predication frequency (W/ m²): S= f/1500=769/1500	0.513
R1= $\sqrt{\frac{PG}{4\pi S}}=\sqrt{\frac{2.5119*6.09}{0.513*4*3.14}}\approx 1.540$m	

(4) Uplink(799MHz ~805MHz)

Prediction frequency (MHz):	799
Maximum peak output power at antenna input terminal (dBm):	28.0
Maximum peak output power at antenna input terminal (W):	0.5012
Maximum antenna gain (dBi):	10.0
Maximum antenna gain (dBd):	7.85
Maximum antenna gain (numeric):	6.09
Maximum RF output power (W):	3.05231
MPE limit for uncontrolled exposure at predication frequency (W/ m²): S= f/1500=799/1500	0.533
R1= $\sqrt{\frac{PG}{4\pi S}}=\sqrt{\frac{0.5012*6.09}{0.533*4*3.14}}\approx 0.675$m	

Therefore, Prediction total distance (m) : $R_{total} = R_{Downlink} + R_{Uplink} = 1.547+0.675=2.222$

3.2 800MHz Band:

(1) Downlink(851MHz~862MHz)

Prediction frequency (MHz):	851
Maximum peak output power at antenna input terminal (dBm):	34.0
Maximum peak output power at antenna input terminal (W):	2.5119
Maximum antenna gain (dBi):	10.0
Maximum antenna gain (dBd):	7.85
Maximum antenna gain (numeric):	6.09
Maximum RF output power (W):	15.2974
MPE limit for uncontrolled exposure at predication frequency (W/ m²): S= f/1500=851/1500	0.567
R1= $\sqrt{\frac{PG}{4\pi S}}=\sqrt{\frac{2.5119*6.09}{0.567*4*3.14}}\approx 1.466$m	

(2) Uplink(806MHz~817MHz)

Prediction frequency (MHz):	806
Maximum peak output power at antenna input terminal (dBm):	28.0
Maximum peak output power at antenna input terminal (W):	0.5012
Maximum antenna gain (dBi):	10.0
Maximum antenna gain (dBd):	7.85
Maximum antenna gain (numeric):	6.09
Maximum RF output power (W):	3.05231
MPE limit for uncontrolled exposure at predication frequency (W/ m²): S= f/1500=806/1500	0.537
$R1= \sqrt{\frac{PG}{4\pi S}} = \sqrt{\frac{0.3981*6.09}{0.537*4*3.14}} \approx 0.672m$	

Therefore, Prediction total distance (m) : $R_{total} = R_{Downlink} + R_{Uplink} = 1.466+0.672=2.139$

4. Test Results

The above all ,when the Maximum antenna gain is 10dBi and the shortest distance from the human specific is 2.225m, the device is compliant with the requirement MPE limit for uncontrolled exposure.