Maximum Permissible Exposure

According to FCC 1.1310: The criteria listed in the following table shall be used to evaluate the environment impact of human exposure to radio frequency (RF) Radiation as specified in §1.1307(b)

Limits for Maximum Permissible Exposure (MPE)

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm^2)	Averaging time (minutes)
(A) Limits for Occupational/Controlled Exposure				
0.3-3.0	614	1.63	*100	6
3.0-30	1842/f	4.89/f	*900/f^2	6
30-300	61.4	0.163	1.0	6
300-1,500			f/300	6
1,500-100,000			5	6
(B) Limits for General Population/Uncontrolled Exposure				
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
300-1,500			f/1500	30
1,500-100,000			1.0	30

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

MPE Calculation Method

Calculation

Given $E = \sqrt{\dfrac{30 \times P \times G}{d}}$ & $S = \dfrac{E^2}{3770}$

Where E − Field Strength in Volts / meter
P = Power in Watts
G = Numeric antenna gain
d = Distance in meters
S = Power Density in milliwatts / square centimeter

For 2.4G WIFI

1) The maximum output power for ANT 1(Module RTL8821CU) is 16.57 dBm (45.39mW) at 2437MHz, (with 2.5 dBi antenna gain (1.78 numeric antenna gain))

2) The maximum output power for ANT 2(Module RTL8822CU) is 14.17 dBm (26.12mW) at 2412MHz, (with 2.5 dBi antenna gain (1.78 numeric antenna gain))

3) For mobile or fixed location transmitters, no SAR consideration applied. The minimum separation generally be used is at least 20cm, even if the calculation indicate that the MPE distance would be lesser.

Maximum Permissible Exposure

ANT 1(Module RTL8821CU) output power=45.39mW

ANT 2(Module RTL8822CU) output power=26.12mW

Numeric Antenna gain=1.78 Substituting the MPE safe distance using d=20cm into above equation.

Yields: S=0.000199*P*G

Where P=Power in mW

G=Numeric antenna 1.78 gain

S=Power density in mW/cm2

ANT 1(Module RTL8821CU) Power density=0.016mW/cm2 <1mW/cm2

ANT 2(Module RTL8822CU) Power density=0.009mW/cm2 <1mW/cm2

Two antennas operate simultaneously

Total Power density=0.016/1+0.009/1=0.025 <1

For 5G WIFI

U-NII-1 Band

1) The maximum output power for ANT 1(Module RTL8821CU) is 11.73 dBm (14.89mW) at 5200MHz, (with 3.5 dBi antenna gain (2.24 numeric antenna gain))

2) The maximum output power for ANT 2(Module RTL8822CU) is 8.68 dBm (7.38mW) at 5240MHz, (with 3.5 dBi antenna gain (2.24 numeric antenna gain))

Maximum Permissible Exposure

ANT 1(Module RTL8821CU) output power=14.89mW

ANT 2(Module RTL8822CU) output power=7.38mW

Numeric Antenna gain=2.24 Substituting the MPE safe distance using d=20cm into above equation.

Yields: S=0.000199*P*G

Where   P=Power in mW

G=Numeric antenna gain

S=Power density in mW/cm2

ANT 1(Module RTL8821CU) Power density=0.007 mW/cm2<1mW/cm2

ANT 2(Module RTL8822CU) Power density=0.003 mW/cm2<1mW/cm2

Two antennas operate simultaneously

Total Power density=0.007/1+0.003/1=0.01 <1

U-NII-3 Band

3) The maximum output power for ANT 1(Module RTL8821CU) is 10.79 dBm (11.99mW) at 5825MHz, (with 3.5 dBi antenna gain (2.24 numeric antenna gain))

4) The maximum output power for ANT 2(Module RTL8822CU) is 8.66 dBm (7.35mW) at 5745MHz, (with 3.5 dBi antenna gain (2.24 numeric antenna gain))

Maximum Permissible Exposure

ANT 1(Module RTL8821CU) output power=11.99mW

ANT 2(Module RTL8822CU) output power=7.35mW

Numeric Antenna gain=2.24 Substituting the MPE safe distance using d=20cm into above equation.

Yields: S=0.000199*P*G

Where   P=Power in mW

G=Numeric antenna gain

S=Power density in mW/cm2

ANT 1(Module RTL8821CU) Power density=0.005mW/cm2<1mW/cm2

ANT 2(Module RTL8822CU) Power density=0.003mW/cm2<1mW/cm2

Two antennas operate simultaneously

Total Power density=0.005/1+0.003/1=0.008 <1

If 2.4G wifi and 5G wifi operate simultaneously,

Total power density=0.016/1+0.009/1+0.007/1+0.003/1=0.035 <1