

Maximum Permissible Exposure

RF Exposure Limit

According to FCC 1.1310 :

The criteria listed in the following table shall be used to evaluate the Environmental of human exposure to radio frequency (RF) radiation as specified in 1.1307(b)

Limits for Maximum Permissible Exposure (MPE)

Frequency	Electric Field	Magnetic Field	Power Density	Averaging Time
Range(MHz)	Strength(V/m)	Strength(A/m)	(mW/cm ²)	(Minutes)
(i) 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
(ii) 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/15	<30
1,500 ~ 100,000			1.0	<30

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

Friis formula

$$\text{Friis transmission formula : } P_d = (P_{out} * G) / (4 * \pi * r^2)$$

$$r = \sqrt{(P_{out} * G) / (4 * \pi * P_d)}$$

Where

P_d = Power density in mW / cm²

P_{out} = Output power to antenna in mW

G = Gain of antenna in linear scale

π = 3.1416

r = Distance between observation point center of radiator in cm

Maximum Permissible Exposure

Pd is the limit of MPE, $1 \text{ mW} / \text{cm}^2$. If we know Maximum Gain of the antenna and the total power input to the antenna, through the calculation, we will know the Maximum distance r where the MPE limit is reached and Power density at prediction frequency.

Test Result :

-Bluetooth LE

Maximum Conducted output power at antenna input terminal:	5.00 (dBm)
Maximum Conducted output power at antenna input terminal:	3.16 (mW)
Antenna gain(typical):	2.30 (dBi)
Maximum antenna gain:	1.70 (numeric)
Prediction distance:	20 (cm)
Prediction frequency:	2402 (MHz)
MPE limit for uncontrolled exposure at prediction frequency:	1 (mW/cm ²)

Power density at prediction frequency : 0.001068 (mW/cm²)

Test result: PASS

-WLAN 5 GHz

Maximum Conducted output power at antenna input terminal:	13.00 (dBm)
Maximum Conducted output power at antenna input terminal:	19.95 (mW)
Antenna gain(typical):	4.51 (dBi)
Maximum antenna gain:	2.82 (numeric)
Prediction distance:	20 (cm)
Prediction frequency:	5775 (MHz)
MPE limit for uncontrolled exposure at prediction frequency:	1 (mW/cm ²)

Power density at prediction frequency : 0.011213 (mW/cm²)

Test result: PASS

-WLAN 6 GHz

Maximum Conducted output power at antenna input terminal:	9.00 (dBm)
Maximum Conducted output power at antenna input terminal:	7.94 (mW)
Antenna gain(typical):	6.86 (dBi)
Maximum antenna gain:	4.85 (numeric)
Prediction distance:	20 (cm)
Prediction frequency:	6385 (MHz)
MPE limit for uncontrolled exposure at prediction frequency:	1 (mW/cm ²)

Power density at prediction frequency : 0.007669 (mW/cm²)

Test result: PASS

Conclusion :

The test result shows that AP6212 is compliance with the exposure limit in 47 CFR §1.1310.

RF Exposure Test Exemptions for Simultaneous Transmission Sources

Simultaneous Transmission Limit

According to KDB 447498 D04, This case is described in detail in § 1.1307(b)(3)(ii)(B) and covers the situations where both SAR-based and MPE-based exemption may be considered for test exemption in fixed, mobile, or portable device exposure conditions. For these cases, a device with multiple RF sources transmitting simultaneously will be considered an RF exempt device if the condition of Formula (1) is satisfied.

$$\sum_{i=1}^a \frac{P_i}{P_{th,i}} + \sum_{j=1}^b \frac{ERP_j}{ERP_{th,j}} + \sum_{k=1}^c \frac{Evaluated_k}{Exposure Limit_k} \leq 1$$

Simultaneous Transmission Configuration

Case	Bluetooth LE	5 GHz WLAN	6 GHz WLAN
1	O	O	X
2	O	X	O

Simultaneous Transmission result

Case	Bluetooth LE	5 GHz WLAN	6 GHz WLAN	Result	Limit
Ratio	0.002 / 1 = 0.002	0.012 / 1 = 0.012	0.008 / 1 = 0.008	-	-
1	0.002	0.012	X	0.014	1
2	0.002	X	0.008	0.01	1

Note. The calculation result was rounded up to three decimal place for comparison.

- When the sum of ratios of simultaneously transmitting antennas in an operating mode and exposure condition combination is within the 1.0 the additional equipment approval is not required.