

FCC ID: 2ALW2-GROUND

MPE calculation

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)	Average Time
(A) Limits for Occupational/Control Exposures				
300-1500	--	--	F/300	6
1500-100000	--	--	5	6
(B) Limits for General Population/Uncontrol Exposures				
300-1500	--	--	F/1500	6
1500-100000	--	--	1	30

11.1 Friis transmission formula: $P_d = (P_{out} \cdot G) / (4 \cdot \pi \cdot R^2)$

Where

P_d = Power density in mW/cm²

P_{out} =output power to antenna in mW

G = Numeric gain of the antenna relative to isotropic antenna

π =3.1416

R = distance between observation point and center of the radiator in cm(20cm)

P_d the limit of MPE, 1mW/cm². If we know the maximum gain of the antenna and total power input to the antenna, through the calculation, we will know the distance where the MPE limit is reached.

mW=10^{^(dBm/10)}

11.2 Measurement Result

Operation Frequency: 5200MHz, 5220MHz

Antenna 1 Gain =5dBi, Antenna 2 Gain =5dBi ,MIMO mode: Directional gain
= $10\log(\text{antenna 1} + \text{antenna 2}) \text{ dBi} = 8\text{dBi}$

	Frequency	Antenna port	Maximum Conducted Output Power(PK)	Maximum Conducted Output Power(PK)	Total Conducted Output Power(PK)	Total Conducted Output Power(PK)	LIMIT
	(MHz)		(dBm)	(mW)	(mW)	(dBm)	dBm
Module 1	5200	Ant.1	14.75	29.85	52.55	17.21	28
		Ant.2	13.56	22.70			
	5220	Ant.1	13.85	24.27	50.88	17.07	28
		Ant.2	14.25	26.61			
Module 2	5220	Ant.1	14.57	28.64	55.13	17.41	28
		Ant.2	14.23	26.49			

5G :

5G max possible output power (PK,conducted): $17 \pm 1\text{dbm}$

$P_{\text{out}}=18\text{dBm}=63.10\text{mW}$

5G Antenna 1 Gain =5dBi, Antenna 2 Gain =5dBi ,MIMO mode: Directional gain = $10\log(\text{antenna 1} + \text{antenna 2}) \text{ dBi} = 8\text{dBi}$, numeric gain result =6.31=G R=20cm

$P_d=(P_{\text{out}}*G)/(4*\pi*R^2)=0.079126(\text{mW}/\text{cm}^2)$

Conclusion:

For the max result : $0.079126(\leq 3.0 \text{ for } 1\text{g SAR})$, No SAR is required.