

FCC ID : 2AP3S-GPSPRO

RF EXPOSURE EVALUATION

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/cm²)	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: $P_d = \frac{P_{out} * G}{4 * \pi * R^2}$

Where

P_d = Power density in mW/cm^2

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

P_d the limit of MPE, $1mW/cm^2$, 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.

RF Exposure Information: The radiated output power of this device meets the limits of FCC/IC radio frequency exposure limits. This device should be operated with a minimum separation distance of 40cm between the equipment and a person's body.

11.2 Measurement Result

LTE and radio stations can transmit at the same time, BLE and radio stations can transmit at the same time; LTE and Bluetooth cannot transmit at the same time,

BLE

Antenna gain: 3.8 dBi

Measured power (dBm)	Tune-up power (dBm)	Max tune-up power (dBm)	Antenna Gain Numeric	Evaluation result (mW/cm ²)	Power density Limits (mW/cm ²)
-9.36	-10 to -8	-8	2.39	0.00007	1

LTE

Antenna Gain:	LTE Band 2: 1.52dBi LTE Band 4: 1.27dBi LTE Band 12: 1.33dBi LTE Band 13: 0.6 dBi
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modulation	Measured power (dBm)	Tune-up power (dBm)	Max tune-up power (dBm)	Antenna Gain Numeric	Evaluation result (mW/cm ²)	Power density Limits (mW/cm ²)
LTE Band 2	23.24	22 to 24	24	1.42	0.07	1
LTE Band 4	23.01	22 to 24	24	1.33	0.07	1
LTE Band 12	23.70	22 to 24	24	1.36	0.07	0.5
LTE Band 13	23.61	22 to 24	24	1.15	0.06	0.5

CONCLUSION of simultaneous transmitter

Both of the module 1 and module 2 can transmit simultaneously, the formula of calculated the MPE is:

$$CPD1/LPD1+CPD2/LPD2+\dots\text{etc.} < 1$$

CPD = Calculation power density

LPD = Limit of power density

Therefore the worst-case situation is $0.00007 / 1.00 + 0.07 / 0.5 = 0.15$ which is less than "0.31",

This confirmed that the device comply with FCC 1.1310 MPE limit.