

FCC ID : 2AF9RWH220-IOT

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

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

Pd the limit of MPE, $1\text{mW}/\text{cm}^2$, If we know the maximum gain of the nd total power input to the antenna, through the calculation, we will know the distance where the MPE limit is reached.

CONCLUSION of simultaneous transmitter:

Both of the WIFI2.4G,WIFI5G,BT,BLE and ZigBee Cannot transmit simultaneously,

11.2 Measurement Result

Wifi 2.4G (MAX power)

Antenna gain: 2 dBi

modulation	Channel Freq. (MHz)	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)
11b	2412	13.95	12 to 14	14	1.58	0.0079	1
	2437	14.77	13 to 15	15	1.58	0.0099	1
	2462	15.24	14 to 16	16	1.58	0.0125	1
11g	2412	18.71	17 to 19	19	1.58	0.0250	1
	2437	18.75	17 to 19	19	1.58	0.0250	1
	2462	19.68	18 to 20	20	1.58	0.0314	1
11n HT20	2412	18.48	17 to 19	19	1.58	0.0250	1
	2437	18.93	17 to 19	19	1.58	0.0250	1
	2462	19.09	18 to 20	20	1.58	0.0314	1

MIMO

modulation	Channel Freq. (MHz)	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)
11n HT20	2412	21.35	20 to 22	22	1.58	0.0498	1
	2437	21.83	20 to 22	22	1.58	0.0498	1
	2462	22.09	21 to 23	23	1.58	0.0627	1

Zigbee

Antenna gain: 3 dBi

modulation	Channel Freq. (MHz)	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)
O-QPSK	2405	1.881	0 to 2	2	2.00	0.0006	1
	2440	1.877	0 to 2	2	2.00	0.0006	1
	2480	0.954	-1 to 1	1	2.00	0.0005	1

BT

Antenna gain: 2dBi

modulation	Channel Freq. (MHz)	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)
GFSK	2402	-8.770	-10 to -8	-8	1.58	0.00005	1
	2441	-6.886	-8 to -6	-6	1.58	0.00008	1
	2480	-7.054	-9 to -7	-7	1.58	0.00006	1
pi/4-DQPSK	2402	-10.589	-12 to -10	-10	1.58	0.00003	1
	2441	-8.575	-10 to -8	-8	1.58	0.00005	1
	2480	-8.037	-10 to -8	-8	1.58	0.00005	1
8DPSK	2402	-9.961	-11 to -9	-9	1.58	0.00004	1
	2441	-7.939	-9 to -7	-7	1.58	0.00006	1
	2480	-7.409	-9 to -7	-7	1.58	0.00006	1
GFSK (BLE)	2402	5.004	4 to 6	6	1.58	0.00125	1
	2440	6.247	5 to 7	7	1.58	0.00157	1
	2480	6.374	5 to 7	7	1.58	0.00157	1

Wifi 5G (MAX power)

Antenna gain: 2 dBi

modulation	Channel Freq. (MHz)	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)
11n(HT 20)	5180	15.94	14 to 16	16	1.58	0.0125	1
11ac 20	5280	15.96	14 to 16	16	1.58	0.0125	1
11a	5580	15.95	14 to 16	16	1.58	0.0125	1
11n(HT 40)	5795	15.93	14 to 16	16	1.58	0.0125	1

MIMO

modulation	Channel Freq. (MHz)	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)
11ac (VHT 40)	5190	18.65	17 to 19	19	1.58	0.0250	1
11ac 20	5280	18.97	17 to 19	19	1.58	0.0250	1
11n(HT 20)	5700	18.76	17 to 19	19	1.58	0.0250	1
11n(HT 40)	5795	18.81	17 to 19	19	1.58	0.0250	1