

RF Exposure Report

FCC-ID: 2AQ7Q-DCR200

RF Exposure Measurement

The limit for Maximum Permissible Exposure (MPE) specified in FCC 1.1310 is followed. The gain of the antennas used in the product is extracted from the Antenna data sheets provided and also the maximum total power input to the antenna is measured. Through the Friis transmission formula and the maximum gain of the antenna, we can calculate the distance, away from the product, where the limit of MPE is reached.

Although the Friis Transmission formula is far field assumption, the calculated result of that is an over-prediction for near field power density. It is taken as worst case to specify the safety range.

RF Exposure Limit

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

Limits for Maximum Permissible Exposure (MPE)

F= Frequency in MHz

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm ²)
Limits for Occupational / controlled Exposures			
300 - 1500	--	--	F/300
1500 – 100000	--	--	5.0
Limits for General population / Uncontrolled Exposure			
300 - 1500	--	--	F/1500
1500 – 100000	--	--	1.0

Friss Formula

Friss Transmission Formula: $Pd = (Pout * G) / (4 * \pi * r^2)$

Where

Pd = power density in mW/cm²

Pout = output power to antenna in mW

G = gain of antenna in linear scale

Pi = 3.1416

R = Distance between observation point and the center of radiator in cm

If we know the maximum gain of the antenna and the total output power to the antenna, through calculation, we will know MPE value at distance 20cm.

EUT Operation condition

EUT was enabled to transmit and receive at lowest, middle and highest channels.

Classification

The antenna of this product, under normal use condition, is at least 20cm away from the body of the user. Warning statement to the user for keeping at least 20cm or more separation distance from the antenna should be included in the User manual. So, this device is classified as Mobile device.

Bluetooth

Mode	2402-2480MHz
Detector	PEAK
BR	2±1dBm
2EDR	3±1dBm
3EDR	3±1dBm
BLE 1M PHY	7±1dBm
BLE 2M PHY	7±1dBm

ANT Gain (G)

Antenna number: 1

Antenna gain : 1.19dBi

(gain of antenna in linear scale=1.315)

Protocol	ANT Gain(gain of antenna in linear scale)	Channel Frequency (MHz)	Output Power to Antenna (dBm)	Output Power to Antenna (mW)	Power Density (mW/cm ²)	Limit (mW/cm ²)
BR	1.315	2402	3	1.9953	0.00052	1
2EDR	1.315	2480	4	2.5119	0.00066	1
3EDR	1.315	2480	4	2.5119	0.00066	1
BLE 1MPHY	1.315	2440	8	6.3096	0.00165	1
BLE 2MPHY	1.315	2440	8	6.3096	0.00165	1

2.4G WIFI (Worst case)

Mode	802.11b/g/n20/ax20:2412-2462MHz
Detector	PEAK
802.11ax20	17±1dBm

ANT Gain (G)

Antenna number: 2

ANT 1(R): 3.38

ANT 2(L): 7.28

MIMO technology Directional gain= 8.56dBi

(gain of antenna in linear scale=7.178)

Protocol	ANT Gain(gain of antenna in linear scale)	Channel Frequency (MHz)	Output Power to Antenna (dBm)	Output Power to Antenna (mW)	Power Density (mW/cm ²)	Limit (mW/cm ²)
802.11 ax20	7.718	2462	18	63.0957	0.09693	1

5G WIFI (Worst case)

Mode	IEEE 802.11a/n(HT20)/n(HT40)/ac(VHT20)/ac(VHT40)/ac(VHT80)/ax(HE20)/ax(HE40)/ax(HE80) 5180-5240MHz 5260-5320MHz 5500-5700MHz 5745-5825MHz
Detector	PEAK
802.11 a/n/ac(HT20)	14±1dBm

ANT Gain (G)

Antenna number: 2

ANT 1(R): 4.10

ANT 2(L): 7.96

MIMO technology Directional gain= 9.25dBi

(gain of antenna in linear scale=8.414)

Protocol	ANT Gain(gain of antenna in linear scale)	Channel Frequency (MHz)	Output Power to Antenna (dBm)	Output Power to Antenna (mW)	Power Density (mW/cm ²)	Limit (mW/cm ²)
802.11 n(HT40)	8.414	5270	15	31.6228	0.05296	1

24GHz Radar

Mode	24.059-24.239GHz
Detector	PEAK
Max power	96.56dBuV/m
Tune-up power	1±1dBm

ANT Gain (G): 2dBi

(gain of antenna in linear scale=1.585)

Protocol	ANT Gain(gain of antenna in linear scale)	Channel Frequency (MHz)	Output Power to Antenna (dBm)	Output Power to Antenna (mW)	Power Density (mW/cm ²)	Limit (mW/cm ²)
24GHz	1.585	24239	2	1.5849	0.00050	1

The max MPE of BT & WIFI simultaneous transmission:

$$0.00066(\text{BT}) + 0.00165(\text{BLE}) + 0.09693(2.4\text{GHz Wi-Fi}) + 0.05296(5\text{G Wi-Fi}) + 0.0005(24\text{GHz}) = 0.1527 < 1$$

According to the maximum gain of the antenna and the total output power to the antenna, through calculation, we will know max MPE value 0.1527 at distance 20cm. This is less than the limit 1. So SAR testing is not required.