

RF Exposure Report

FCC ID: 2AFENXK13S

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)

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

Limits for Maximum Permissible Exposure (MPE)

F= Frequency in MHz

Friss Formula

Friss 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 = gain of antenna in linear scale

π = 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.

BR+EDR

Mode	2402-2480MHz
Detector	AVG
GFSK	5±1dBm
$\pi/4$ -DQPSK	0±1dBm
8DPSK	0±1dBm

ANT Gain (G)

Antenna gain : 3.49dBi (gain of antenna in linear scale=2.234)

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)
GFSK	2.234	2402	6	3.9811	0.00177	1
$\pi/4$ -DQPSK	2.234	2402	1	1.2589	0.00056	1
8DPSK	2.234	2402	1	1.2589	0.00056	1

BLE

Mode	2402-2480MHz
Detector	AVG
GFSK 1MPHY	4.5±1dBm
GFSK 2MPHY	5±1dBm

ANT Gain (G)

Antenna gain : 3.49dBi (gain of antenna in linear scale=2.234)

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)
GFSK 1MPHY	2.234	2402	5.5	3.5481	0.00158	1
GFSK 2MPHY	2.234	2402	6	3.9811	0.00177	1

2.4G WIFI

Mode	802.11b/g/n20:2412-2462MHz 802.11n40:2422-2452MHz
Detector	AVG
802.11b	12±1dBm
802.11g	10±1dBm
802.11n20	12±1dBm
802.11n40	11±1dBm

ANT Gain (G)

Antenna number: 2

Antenna A gain : 3.57dBi (gain of antenna in linear scale=2.275)

Antenna B gain : 3.57dBi (gain of antenna in linear scale=2.275)

MIMO technology Directional gain=6.58dBi

Antenna gain : 6.58dBi (gain of antenna in linear scale=4.55)

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 b	2.275	2437	13	19.9526	0.00904	1
802.11 g	2.274	2412	11	12.5893	0.00570	1
802.11 n20	4.55	2412	13	19.9526	0.01807	1
802.11 n40	4.55	2422	12	15.8489	0.01435	1

5G WIFI

Mode	IEEE 802.11a/ n/ac(HT20) 5.180GHz-5.240GHz IEEE 802.11n/ac(HT40) 5.190GHz-5.230GHz IEEE 802.11ac(HT80) 5.210GHz
Detector	AVG
802.11 a/n/ac(HT20)	11±1dBm
802.11 n/ac(HT40)	11±1dBm
802.11 ac(HT80)	10±1dBm

ANT Gain (G)

Antenna number: 2

Antenna A gain : 6.99dBi (gain of antenna in linear scale=5)

Antenna B gain : 6.99dBi (gain of antenna in linear scale=5)

MIMO technology Directional gain=10dBi

Antenna gain : 10dBi (gain of antenna in linear scale=10)

Protocol	ANT Gain(gain of antenna in linear	Channel Frequen cy (MHz)	Output Power to Antenna (dBm)	Output Power to Antenna (mW)	Power Density (mW/cm ²)	Limit (mW/cm ²)
802.11 a/n/ac(HT20)	10	5180	12	15.8489	0.03155	1
802.11 n/ac(HT40)	10	5190	12	15.8489	0.03155	1
802.11 ac(HT80)	10	5210	11	12.5893	0.02506	1

5G WIFI

Mode	IEEE 802.11a/ n/ac(HT20) 5.260GHz-5.300GHz IEEE 802.11n/ac(HT40) 5.270GHz-5.310GHz IEEE 802.11ac(HT80) 5.290GHz
Detector	AVG
802.11 a/n/ac(HT20)	11±1dBm
802.11 n/ac(HT40)	10±1dBm
802.11 ac(HT80)	10±1dBm

ANT Gain (G)**Antenna number: 2****Antenna A gain : 6.99dBi (gain of antenna in linear scale=5)****Antenna B gain : 6.99dBi (gain of antenna in linear scale=5)****MIMO technology Directional gain=10dBi****Antenna gain : 10dBi (gain of antenna in linear scale=10)**

Protocol	ANT Gain(gain of antenna in linear)	Channel Frequency (MHz)	Output Power to Antenna (dBm)	Output Power to Antenna (mW)	Power Density (mW/cm ²)	Limit (mW/cm ²)			
802.11 a/n/ac(HT20)	10	5260	12	15.8489	0.03155	1			
802.11 n/ac(HT40)	10	5270	11	12.5893	0.02506	1			
802.11 ac(HT80)	10	5290	11	12.5893	0.02506	1			

5G WIFI**ANT Gain (G)**

Mode	IEEE 802.11a/ n/ac(HT20) 5.500GHz-5.700GHz IEEE 802.11n/ac(HT40) 5.510GHz-5.6700GHz IEEE 802.11ac(HT80) 5.530GHz-5.610GHzs
Detector	AVG
802.11 a/n/ac(HT20)	11±1dBm
802.11 n/ac(HT40)	10±1dBm
802.11 ac(HT80)	11±1dBm

ANT Gain (G)**Antenna number: 2****Antenna A gain : 6.99dBi (gain of antenna in linear scale=5)****Antenna B gain : 6.99dBi (gain of antenna in linear scale=5)****MIMO technology Directional gain=10dBi****Antenna gain : 10dBi (gain of antenna in linear scale=10)**

Protocol	ANT Gain(gain of antenna in linear	Channel Frequency (MHz)	Output Power to Antenna (dBm)	Output Power to Antenna (mW)	Power Density (mW/cm ²)	Limit (mW/cm ²)
802.11 a/n/ac(HT20)	10	5580	12	15.8489	0.03155	1
802.11 n/ac(HT40)	10	5670	11	12.5893	0.02506	1
802.11 ac(HT80)	10	5610	12	15.8489	0.03155	1

5G WIFI

ANT Gain (G)

Mode	IEEE 802.11a/ n/ac(HT20) 5.745GHz-5.825GHz IEEE 802.11n/ac(HT40) 5.755GHz-5.795GHz IEEE 802.11ac(HT80) 5775GHz
Detector	AVG
802.11 a/n/ac(HT20)	11±1dBm
802.11 n/ac(HT40)	10±1dBm
802.11 ac(HT80)	11±1dBm

ANT Gain (G)

Antenna number: 2

Antenna A gain : 6.99dBi (gain of antenna in linear scale=5)

Antenna B gain : 6.99dBi (gain of antenna in linear scale=5)

MIMO technology Directional gain=10dBi

Antenna gain : 10dBi (gain of antenna in linear scale=10)

Protocol	ANT Gain(gain of antenna in linear	Channel Frequency (MHz)	Output Power to Antenna (dBm)	Output Power to Antenna (mW)	Power Density (mW/cm ²)	Limit (mW/cm ²)
802.11 a/n/ac(HT20)	10	5825	12	15.8489	0.03155	1
802.11 n/ac(HT40)	10	5755	11	12.5893	0.02506	1
802.11 ac(HT80)	10	5775	12	15.8489	0.03155	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 0.03155 at distance 20cm. This is less than the limit 1. So SAR testing is not required.