RF Exposure Report

FCC ID: 2AFQA-IMX-THOR96

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: Pd = (Pout * G) / (4*pi*r²)

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.

ZigBee

Mode	2405-2480MHz
Detector	PEAK
O-QPSK	12±1dBm

ANT Gain (G)
Antenna gain: 1dBi (gain of antenna in linear scale=1.26)

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/cm²)	Limit (mW/cm²)
O-QPSK	1.26	2405	13	19.9526	0.00500	1

BT4.2+EDR

Mode	2402-2480MHz
Detector	PEAK
GFSK	7±1dBm
π/4-DQPSK	8±1dBm
8DPSK	8±1dBm

ANT Gain (G)

Antenna gain : 0.1dBi (gain of antenna in linear scale=1.023)

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/cm²)	Limit (mW/cm²)
GFSK	1.023	2402	8	6.3096	0.00128	1
π/4-DQPSK	1.023	2402	9	7.9433	0.00162	1
8DPSK	1.023	2402	9	7.9433	0.00162	1

BLE4.2

Mode	2402-2480MHz
Detector	PEAK
GFSK	5±1dBm

ANT Gain (G)

Antenna gain : 0.1dBi (gain of antenna in linear scale=1.023)

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/cm²)	Limit (mW/cm²)
GFSK	1.023	2402	6	3.9811	0.00081	1

2.4G WIFI

Mode	802.11b/g/n20:2412-2462MHz
Detector	PEAK
802.11b	20±1dBm
802.11g	23±1dBm
802.11n20	23±1dBm

ANT Gain (G)

Antenna gain : 0.1dBi (gain of antenna in linear scale=1.023)

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/cm²)	Limit (mW/cm²)
802.11 b	1.023	2462	21	125.8925	0.02563	1
802.11 g	1.023	2437	24	251.1886	0.05115	1
802.11 n20	1.023	2437	24	251.1886	0.05115	1

5.2G WIFI

ANT Gain (G)

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	PEAK
802.11a/n/ac(HT20)	14±1dBm
802.11 n/ac(HT40)	13±1dBm
802.11 ac(HT80)	9±1dBm

ANT Gain (G)

Antenna gain : -0.4dBi (gain of antenna in linear scale=0.912)

Protocol	ANT Gain(gain of antenna in linear	Channel Frequency (MHz)	Output Power to Antenna (dBm)	Output Power to Antenna (mW)	Power Density (mW/cm²)	Limit (mW/cm²)
802.11 a/n/ac(HT20)	0.912	5220	15	31.6228	0.00574	1
802.11 n/ac(HT40)	0.912	5230	14	25.1189	0.00456	1
802.11 ac(HT80)	0.912	5210	10	10.0000	0.00182	1

5.8G 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) 5.775GHz
Detector	PEAK
802.11 a/n/ac(HT20)	13±1dBm
802.11 n/ac(HT40)	9±1dBm
802.11 ac(HT80)	9±1dBm

ANT Gain (G)

Antenna gain : -0.4dBi (gain of antenna in linear scale=0.912)

Protocol	ANT Gain(gain of antenna in linear	**Channel Frequency (MHz)**	**Output Power to Antenna (dBm)**	**Output Power to Antenna (mW)**	**Power Density (mW/cm²)**	**Limit (mW/cm²)**
802.11 a/n/ac(HT20)	0.912	5785	14	25.1189	0.00456	1
802.11 n/ac(HT40)	0.912	5755	10	10.0000	0.00182	1
802.11 ac(HT80)	0.912	5775	10	10.0000	0.00182	1

ZigBee+ BT + WLAN

According to the maximum gain of the antenna and the total output power to the antenna, through calculation, we will know MPE value 0.005+0.00162+0.05115= 0.05777 at distance 20cm. This is less than the limit 1.