

RF Exposure Report

FCC ID: 2AZCK-MINER300

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.

1. BT5.1+EDR

Mode	2402-2480MHz
Detector	PEAK
GFSK	12±1dBm
$\pi/4$ -DQPSK	9±1dBm
8DPSK	9±1dBm

ANT Gain (G)

Antenna gain : 0.8dBi (gain of antenna in linear scale=1.20)

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	1.2	2480	13	19.9526	0.00477	1
$\pi/4$ -DQPSK	1.2	2480	10	10.0000	0.00239	1
8DPSK	1.2	2480	10	10.0000	0.00239	1

2. BT5.0 BLE

Mode	2402-2480MHz
Detector	PEAK
GFSK(1M PHY)	8±1dBm

ANT Gain (G)

Antenna gain : 0.8dBi (gain of antenna in linear scale=1.20)

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	1.2	2440	9	7.9433	0.00190	1

3. 2.4G WIFI

Mode	802.11b/g/n20:2412-2462MHz
Detector	PEAK
802.11b	15±1dBm
802.11g	18±1dBm
802.11n20	17±1dBm

ANT Gain (G)

Antenna gain : 0.8dBi (gain of antenna in linear scale=1.20)

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	1.2	2437	16	39.8107	0.00951	1
802.11 g	1.2	2437	19	79.4328	0.01897	1
802.11 n20	1.2	2412	18	63.0957	0.01507	1

4. LongFi A

Mode	US915:902-928MHz
Detector	PEAK
CH01(904MHz)	8±1dBm
CH06(915MHz)	9±1dBm
CH09(926MHz)	9±1dBm

ANT Gain (G)

Antenna gain : 4dBi (gain of antenna in linear scale=2.51)

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)
US915	2.51	926	10	10.0000	0.00500	0.617333333

5. LongFi B

Mode	AS923:919-925MHz
Detector	PEAK
CH01(919MHz)	9±1dBm
CH03(922MHz)	8±1dBm
CH10(925MHz)	8±1dBm

ANT Gain (G)

Antenna gain : 4dBi (gain of antenna in linear scale=2.51)

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)
AS923	2.51	919	10	10.0000	0.00500	0.612666667

6. Multiple transmit evaluation

BT/BLE+WIFI+LongFi=0.00477/1+0.01897/1+0.0050/0.6127=0.031901

According to the maximum gain of the antenna and the total output power to the antenna, through calculation, we will know max MPE value 0.031901 at distance 20cm. This is less than the limit 1, So Compliance the RF exposure requirement.