RF Exposure Report

FCC ID: 2ADX3I232

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: $Pd = (Pout * G) / (4*pi*r^2)$

Where
Pd = power density in mW/cm^2
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.

2.4G WIFI

Mode	802.11b/g/n20: 2412-2462MHz 802.11n40: 2422-2452MHz
Detector	PEAK
802.11b	16±1dBm
802.11g	14±1dBm
802.11n20	17±1dBm
802.11n40	17±1dBm

ANT Gain (G)
Antenna number: 2*Dipole
Antenna A gain : 4.2dBi
Antenna B gain : 4.2dBi
MIMO technology Directional gain= 7.21dBi
(gain of antenna in linear scale=5.26)

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)
802.11 b	5.26	2462	17	50.1187	0.05247	1
802.11 g	5.26	2462	15	31.6228	0.03311	1
802.11 n20	5.26	2412	18	63.0957	0.06606	1
802.11 n40	5.26	2437	18	63.0957	0.06606	1

5G WIFI

Mode	IEEE 802.11a/ n/ac(HT20) 5.180GHz-5.240GHz IEEE 802.11n/ac(HT40) 5.190GHz-5.310GHz IEEE 802.11ac(HT80) 5.210GHz
Detector	PEAK
802.11 a/n/ac(HT20)	15±1dBm
802.11 n/ac(HT40)	16±1dBm
802.11 ac(HT80)	14±1dBm

ANT Gain (G)

Antenna number: 2*Dipole

Antenna A gain : 4.5dBi

Antenna B gain : 4.5dBi

MIMO technology Directional gain= 7.51dBi

(gain of antenna in linear scale=5.636)

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)	5.636	5180	16	39.8107	0.04466	1
802.11 n/ac(HT40)	5.636	5190	17	50.1187	0.05622	1
802.11 ac(HT80)	5.636	5210	15	31.6228	0.03547	1

5G WIFI

Mode	IEEE 802.11a/ n/ac(HT20)5.745GHz-5.825GHz IEEE 802.11a/ n/ac(HT40)5.755GHz-5.795GHz IEEE 802.11ac(HT80) 5.775GHz
Detector	PEAK
802.11 a/n/ac(HT20)	16±1dBm
802.11 n/ac(HT40)	16±1dBm
802.11 ac(HT80)	14±1dBm

ANT Gain (G)

Antenna number: 2*Dipole

Antenna A gain : 4.5dBi

Antenna B gain : 4.5dBi

MIMO technology Directional gain= 7.51dBi

(gain of antenna in linear scale=5.636)

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)	6.636	5785	17	50.1187	0.06620	1
802.11 n/ac(HT40)	6.636	5795	17	50.1187	0.06620	1
802.11 ac(HT80)	6.636	5775	15	31.6228	0.04177	1

GSM

Mode	GPRS/EGPRS: 850: 824 MHz ~ 849 MHz 1900: 1850 MHz ~ 1910 MHz
Detector	PEAK
GPRS/EGPRS:850	26±1dBm
GPRS/EGPRS:1900	23±1dBm

ANT Gain (G)

Antenna gain :

850: 1.5dBi (gain of antenna in linear scale=1.41)

1900: 2.5dBi (gain of antenna in linear scale=1.78)

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)
GSM850	1.41	848.8	27	501.1872	0.14066	0.565866667
GSM1900	1.78	1850.2	24	251.1886	0.08900	1

WCDMA

Mode	WCDMA: Band V: 824 MHz ~ 849 MHz Band II: 1850 MHz ~ 1910 MHz Band IV: 1710 MHz ~ 1755 MHz
Detector	PEAK
Band V	22±1dBm
Band II	22±1dBm
Band IV	22±1dBm

ANT Gain (G)

Antenna gain :

Band V: 1.5dBi (gain of antenna in linear scale=1.41)

Band II: 2.5dBi (gain of antenna in linear scale=1.78)

Band IV: 2.5dBi (gain of antenna in linear scale=1.78)

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)
Band V	1.41	826.4	23	199.5262	0.05600	0.550933333
Band II	1.78	1907.4	23	199.5262	0.07069	1
Band IV	1.78	1712.6	23	199.5262	0.07069	1

CDMA

Mode	WCDMA: BC0: 824.70 MHz ~ 848.31 MHz BC1:1851.25 MHz ~ 1908.75 MHz
Detector	PEAK
BC0	23±1dBm
BC1	23±1dBm

ANT Gain (G)

Antenna gain :

BC0: 1.5dBi (gain of antenna in linear scale=1.41)

BC1: 2.5dBi (gain of antenna in linear scale=1.78)

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)
BC0	1.41	824.7	24	251.1886	0.07050	0.5498
BC1	1.78	1908.75	24	251.1886	0.08900	1

LTE

Mode	LTE Band 2:1850~1910MHz LTE Band 4:1710~1755MHz LTE Band 5:824~849MHz LTE Band 12:699~716MHz LTE Band 13:777~787MHz LTE Band 17:704~716MHz LTE Band 25:1850~1915MHz LTE Band 26:814~849MHz LTE Band 41:2555~2655MHz
Detector	PEAK
LTE Band 2	22±1dBm
LTE Band 4	22±1dBm
LTE Band 5	23±1dBm
LTE Band 12	22±1dBm
LTE Band 13	22±1dBm
LTE Band 17	23±1dBm
LTE Band 25	22±1dBm
LTE Band 26	23±1dBm
LTE Band 26	21±1dBm (Part 90)
LTE Band 41	22±1dBm

ANT Gain (G)

Antenna gain :

Band 2: 2.8dBi (gain of antenna in linear scale=1.905)

Band 4: 2.5dBi (gain of antenna in linear scale=1.778)

Band 5: 0.8dBi (gain of antenna in linear scale=1.202)

Band 12: 0.8dBi (gain of antenna in linear scale=1.202)
Band 13: 0.8dBi (gain of antenna in linear scale=1.202)
Band 17: 0.8dBi (gain of antenna in linear scale=1.202)
Band 25: 2.5dBi (gain of antenna in linear scale=1.778)
Band 26: 0.8dBi (gain of antenna in linear scale=1.202)
Band 41: 2.8dBi (gain of antenna in linear scale=1.905)

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)
LTE Band 2	1.905	1880	23	199.5262	0.07566	1
LTE Band 4	1.778	1732.5	23	199.5262	0.07061	1
LTE Band 5	1.202	836.4	24	251.1886	0.06010	0.5576
LTE Band 12	1.202	707.5	23	199.5262	0.04774	0.471666667
LTE Band 13	1.202	782	23	199.5262	0.04774	0.521333333
LTE Band 17	1.202	710	24	251.1886	0.06010	0.473333333
LTE Band 25	1.778	1882.5	23	199.5262	0.07061	1
LTE Band 26	1.202	831.5	24	251.1886	0.06010	1
LTE Band 41	1.905	777	23	199.5262	0.07566	0.518

GSM + 2.4GHz WLAN
According to the maximum gain of the antenna and the total output power to the antenna, through calculation, we will know MPE value 0.14066+0.06606= 0.20672 at distance 20cm. This is less than the limit 0.56586667.

WCDMA + 2.4GHz WLAN
According to the maximum gain of the antenna and the total output power to the antenna, through calculation, we will know MPE value 0.07069+0.06606= 0.13675 at distance 20cm. This is less than the limit 1.

CDMA + 2.4GHz WLAN
According to the maximum gain of the antenna and the total output power to the antenna, through calculation, we will know MPE value 0.08900+0.06606= 0.15506 at distance 20cm. This is less than the limit 1.

LTE + 2.4GHz WLAN
According to the maximum gain of the antenna and the total output power to the antenna, through calculation, we will know MPE value 0.07566+0.06606= 0.14172 at distance 20cm. This is less than the limit 0.518.

GSM + 5GHz WLAN
According to the maximum gain of the antenna and the total output power to the

antenna, through calculation, we will know MPE value 0.14066+0.06620= 0.20686 at distance 20cm. This is less than the limit 0.56586667.

WCDMA + 5GHz WLAN

According to the maximum gain of the antenna and the total output power to the antenna, through calculation, we will know MPE value 0.07069+0.06620= 0.13689 at distance 20cm. This is less than the limit 1.

CDMA + 5GHz WLAN

According to the maximum gain of the antenna and the total output power to the antenna, through calculation, we will know MPE value 0.08900+0.06620= 0.1552 at distance 20cm. This is less than the limit 1.

LTE + 5GHz WLAN

According to the maximum gain of the antenna and the total output power to the antenna, through calculation, we will know MPE value 0.07566+0.06620= 0.14186 at distance 20cm. This is less than the limit 0.518.