RF Exposure Report

FCC ID: 2AUBH-VBOT1

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.

BT5.0+EDR

Mode	2402-2480MHz
GFSK	6±1dBm
π/4-DQPSK	2±1dBm
8DPSK	2±1dBm

ANT Gain (G)
Antenna gain : -0.17dBi (gain of antenna in linear scale=0.96)

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	0.96	2480	7	5.0119	0.00096	1
π/4-DQPSK	0.96	2480	3	1.9953	0.00038	1
8DPSK	0.96	2480	3	1.9953	0.00038	1

BT5.0 BLE

Mode	2402-2480MHz
Detector	AV
GFSK（1Mbps）	-1±1dBm
GFSK（2Mbps）	-3±1dBm

ANT Gain (G)

Antenna gain : -0.17dBi (gain of antenna in linear scale=0.96)

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（1Mbps）	0.96	2480	0	1.0000	0.00019	1
GFSK（2Mbps）	0.96	2480	-2	0.6310	0.00012	1

2.4G WIFI

Mode	802.11b/g/n20:2412-2462MHz 802.11n40:2422-2452MHz
Detector	AV
802.11b	13±1dBm
802.11g	10±1dBm
802.11n20	9±1dBm
802.11n40	8±1dBm

ANT Gain (G)

Antenna gain : -0.17dBi (gain of antenna in linear scale=0.96)

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	0.96	2437	14	25.1189	0.00480	1
802.11 g	0.96	2437	11	12.5893	0.00241	1
802.11 n20	0.96	2437	10	10.0000	0.00191	1
802.11 n40	0.96	2437	9	7.9433	0.00152	1

5G WIFI

Mode	IEEE 802.11a/ n(HT20)/ac(VHT20):5.180GHz-5.240GHz IEEE 802.11n(HT40)/ac(VHT40): 5.190GHz-5.310GHz IEEE 802.11ac(VHT80): 5.210GHz
Detector	AV
802.11a/n/ac(HT20)	8±1dBm
802.11 n/ac(HT40)	7±1dBm
802.11 ac(HT80)	6±1dBm

ANT Gain (G)

Antenna gain : 0.49dBi (gain of antenna in linear scale=1.12)

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)	1.12	5180	9	7.9433	0.00177	1
802.11 n/ac(HT40)	1.12	5190	8	6.3096	0.00141	1
802.11 ac(HT80)	1.12	5210	7	5.0119	0.00112	1

5G WIFI

Mode	IEEE 802.11a/ n(HT20)/ac(VHT20):5.260GHz-5.320GHz IEEE 802.11n(HT40)/ac(VHT40):5.270GHz-5.310GHz IEEE 802.11ac(VHT80):5.290GHz
Detector	AV
802.11a/n/ac(HT20)	8±1dBm
802.11 n/ac(HT40)	7±1dBm
802.11 ac(HT80)	6±1dBm

ANT Gain (G)

Antenna gain : 0.49dBi (gain of antenna in linear scale=1.12)

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)	1.12	5260	9	7.9433	0.00177	1
802.11 n/ac(HT40)	1.12	5270	8	6.3096	0.00141	1
802.11 ac(HT80)	1.12	5290	7	5.0119	0.00112	1

5G WIFI

Mode	IEEE 802.11a/ n(HT20)/ac(VHT20):5.500GHz-5.700GHz IEEE 802.11n(HT40)/ac(VHT40):5.510GHz-5.670GHz IEEE 802.11ac(VHT80):5.530GHz-5.610GHz
Detector	AV
802.11a/n/ac(HT20)	7±1dBm
802.11 n/ac(HT40)	6±1dBm
802.11 ac(HT80)	6±1dBm

ANT Gain (G)

Antenna gain : 0.49dBi (gain of antenna in linear scale=1.12)

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)	1.12	5500	8	6.3096	0.00141	1
802.11 n/ac(HT40)	1.12	5510	7	5.0119	0.00112	1
802.11 ac(HT80)	1.12	5610	7	5.0119	0.00112	1

5G WIFI

Mode	IEEE 802.11a/ n(HT20)/ac(VHT20):5.745GHz-5.825GHz IEEE 802.11n(HT40)/ac(VHT40): 5.755GHz-5.795GHz IEEE 802.11ac(VHT80): 5.775GHz
Detector	AV
802.11 a/n/ac(HT20)	6±1dBm
802.11 n/ac(HT40)	5±1dBm
802.11 ac(HT80)	4±1dBm

ANT Gain (G)

Antenna gain : 0.49dBi (gain of antenna in linear scale=1.12)

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)	1.12	5745	7	5.0119	0.00112	1
802.11 n/ac(HT40)	1.12	5755	6	3.9811	0.00089	1
802.11 ac(HT80)	1.12	5775	5	3.1623	0.00070	1

GSM/WCDMA

Mode	GSM/GPRS/EDGE: 850: 824 MHz ~ 849MHz 1900: 1850 MHz ~ 1910MHz WCDMA: Band V: 824 MHz ~ 849 MHz Band II: 1850 MHz ~ 1910 MHz EVDO&CDMA: BC0: 824.70 MHz~ 848.31 MHz BC1: 1851.25 MHz~ 1908.75 MHz
Detector	AV
GSM 850	32±1dBm
GSM 1900	30±1dBm
Band V	21±1dBm
Band II	22±1dBm
BC0	24±1dBm
BC1	24±1dBm

ANT Gain (G)

GSM/WCDMA 850 Antenna gain : -0.49dBi (gain of antenna in linear scale=0.89)

PCS/WCDMA 1900 Antenna gain : 0.66dBi (gain of antenna in linear scale=1.16)

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)
GSM 850	0.89	836.6	33	1995.2623	0.35346	0.557733333
GSM 1900	1.16	1909.8	31	1258.9254	0.22302	1
Band V	0.89	826.4	22	158.4893	0.02808	0.550933333
Band II	1.16	1852.4	23	199.5262	0.03535	1
BC0	0.89	836.52	25	316.2278	0.05602	0.55768
BC1	1.16	1880	25	316.2278	0.07301	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
Detector	AV
LTE Band 2	27±1dBm
LTE Band 4	23±1dBm

LTE Band 5	24±1dBm
LTE Band 12	22±1dBm
LTE Band 13	24±1dBm
LTE Band 17	23±1dBm

ANT Gain (G)

LTE Band 2 Antenna gain : 0.66dBi (gain of antenna in linear scale=1.16)

LTE Band 4 Antenna gain : 0dBi (gain of antenna in linear scale=1)

LTE Band 5 Antenna gain : -0.5dBi (gain of antenna in linear scale=0.89)

LTE Band 12 Antenna gain : -2dBi (gain of antenna in linear scale=0.63)

LTE Band 13 Antenna gain : -0.5dBi (gain of antenna in linear scale=0.89)

LTE Band 17 Antenna gain : -2dBi (gain of antenna in linear scale=0.63)

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	1.16	1850	28	630.9573	0.14568	1
LTE Band 4	1	1750	24	251.1886	0.05800	1
LTE Band 5	0.89	848	25	316.2278	0.05602	0.5653333
LTE Band 12	0.63	699	23	199.5262	0.02502	0.466
LTE Band 13	0.89	782	25	316.2278	0.05602	0.5213333
LTE Band 17	0.63	710	24	251.1886	0.03150	0.4733333

GSM + WLAN

According to the maximum gain of the antenna and the total output power to the antenna, through calculation, we will know MPE value 0.35346+0.00480= 0.35826 at distance 20cm. This is less than the limit 0.55773

WCDMA + WLAN

According to the maximum gain of the antenna and the total output power to the antenna, through calculation, we will know MPE value 0.03535+0.00480= 0.04015 at distance 20cm. This is less than the limit 1.

CDMA + WLAN

According to the maximum gain of the antenna and the total output power to the antenna, through calculation, we will know MPE value 0.07301+0.00480= 0.07781 at distance 20cm. This is less than the limit 1.

LTE + WLAN

According to the maximum gain of the antenna and the total output power to the antenna, through calculation, we will know MPE value 0.14568+0.00480= 0.15048 at distance 20cm. This is less than the limit 1.

GSM+BT

According to the maximum gain of the antenna and the total output power to the

antenna, through calculation, we will know MPE value 0.35346+0.00096= 0.35442 at distance 20cm. This is less than the limit 0.55773

WCDMA +BT

According to the maximum gain of the antenna and the total output power to the antenna, through calculation, we will know MPE value 0.03535+0.00096= 0.03631 at distance 20cm. This is less than the limit 1.

CDMA +BT

According to the maximum gain of the antenna and the total output power to the antenna, through calculation, we will know MPE value 0.07301+0.00096= 0.07397 at distance 20cm. This is less than the limit 1.

LTE +BT

According to the maximum gain of the antenna and the total output power to the antenna, through calculation, we will know MPE value 0.14568+0.00096= 0.14664 at distance 20cm. This is less than the limit 1.