RF Exposure Report

FCC ID: 2AA5OCH4G

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)

Limits for Maximum Permissible Exposure (MPE)

F= Frequency in MHz

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm²)
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

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.

1. BT5.0

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

ANT Gain (G)

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)
GFSK	0.63	2402	0	1	0.000125	1

2. GSM

Mode	850: 824 MHz ~ 849MHz 1900: 1850 MHz ~ 1910MHz
824 MHz ~ 849MHz	32.5±1dBm
1850 MHz ~ 1910MHz	30±1dBm

ANT Gain (G)

GSM 850: -2dBi (gain of antenna in linear scale=0.63)

PCS 1900: -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)
GSM 850	0.63	848.80	33.50	2238.72	0.28	0.57
GSM 1900	0.63	1909.80	31.00	1258.93	0.16	1.00

3. LTE(CAT-M)

Mode	CAT-M Band 2:1850~1910MHz
	CAT-M Band 4:1710~1755MHz
	CAT-M Band 5:824~849MHz
	CAT-M Band 12:699~716MHz
	CAT-M Band 13:777~787MHz
	CAT-M Band 25:1850~1915MHz
	CAT-M Band 26:814~849MHz
	CAT-M Band 66:1710~1780MHz
	CAT-M Band 85:698~716MHz
Band 2	23±1dBm
Band 4	23±1dBm
Band 5	23±1dBm
Band 12	23±1dBm
Band 13	23±1dBm
Band 25	23±1dBm
Band 26	23±1dBm
Band 26(Part 90)	23±1dBm
Band66	23±1dBm
Band85	23±1dBm

ANT Gain (G) :-2 dBi (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)
Band2	0.63	1909.3	24	251.1886	0.031483	1.00
Band4	0.63	1754.3	24	251.1886	0.031483	1.00
Band5	0.63	848.3	24	251.1886	0.031483	0.57
Band12	0.63	715.3	24	251.1886	0.031483	0.48
Band13	0.63	784.5	24	251.1886	0.031483	0.52
Band25	0.63	1914.3	24	251.1886	0.031483	1.00
Band26	0.63	823.3	24	251.1886	0.031483	0.57
Band26(Part90)	0.63	848.3	24	251.1886	0.031483	0.57
Band66	0.63	1779.3	24	251.1886	0.031483	1.00
Band85	0.63	713.5	24	251.1886	0.031483	0.48

4. LTE(NB-IOT)

Mode	NB-IOT Band 2:1930 ~1990MHz NB-IOT Band 4:2110~2155MHz NB-IOT Band 5:869~894MHz NB-IOT Band 12:729~746MHz NB-IOT Band 13:746~756MHz NB-IOT Band 25:1930~1995MHz NB-IOT Band 26:859~894MHz NB-IOT Band 66:2110~2200MHz NB-IOT Band 71:617~652MHz NB-IOT Band 85:728~746MHz
Band 2	23±1dBm
Band 4	23±1dBm
Band 5	23±1dBm
Band 12	23±1dBm
Band 13	23±1dBm
Band 25	23±1dBm
Band 26	23±1dBm
Band 26(Part 90)	23±1dBm
Band66	23±1dBm
Band71	22±1dBm
Band85	23±1dBm

ANT Gain (G) :-2 dBi (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)
Band2	0.63	1909.3	24	251.1886	0.031483	1.00
Band4	0.63	1754.3	24	251.1886	0.031483	1.00
Band5	0.63	848.3	24	251.1886	0.031483	0.57
Band12	0.63	715.3	24	251.1886	0.031483	0.48
Band13	0.63	784.5	24	251.1886	0.031483	0.52
Band25	0.63	1914.3	24	251.1886	0.031483	1.00
Band26	0.63	823.3	24	251.1886	0.031483	0.57
Band26(Part90)	0.63	848.3	24	251.1886	0.031483	0.57
Band66	0.63	1779.3	24	251.1886	0.031483	1.00
Band71	0.63	697.9	23	199.5262	0.025007	0.48
Band85	0.63	713.5	24	251.1886	0.031483	0.48

5. Evaluate Simultaneous

Protocol	PD1+PD2 (mW/cm²)	Total Power Density (mW/cm²)	Limit (mW/cm²)
BT+GSM	=0.000125+0.28	0.280125	1
BT+LTE	=0.000125+0.031483	0.031608	1

According to the maximum gain of the antenna and the total output power to the antenna, through calculation, we will know MPE value 0.280125 at distance 20cm. This is less than the limit 1, so the SAR test is not required.