RF Exposure Report

FCC ID: T58Q7R

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/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

Friss Formula

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	AVG
802.11b	9.5±1dBm
802.11g	10±1dBm
802.11n20	14±1dBm
802.11n40	14±1dBm

ANT Gain (G)

Antenna A gain : 5dBi, Antenna B gain : 5dBi

GANT + 10 log(NANT) dBi=MIMO technology Directional gain=8.01dBi

Antenna gain : 5dBi/8.01dBi (gain of antenna in linear scale=3.16/6.32),

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	3.16	2412	10.5	11.2202	0.00706	1
802.11 g	3.16	2437	11	12.5893	0.00792	1
802.11 n20	6.32	2437	15	31.6228	0.03978	1
802.11 n40	6.32	2422	15	31.6228	0.03978	1

GSM

Mode	GSM 850: 824 MHz ~ 849MHz 1900: 1850 MHz ~ 1910MHz
Detector	AVG
GSM 850	25±1dBm
GSM 1900	22±1dBm

ANT Gain (G)

GSM 850: 2.53dBi (gain of antenna in linear scale=1.79)

PCS 1900:1.59dBi

(gain of antenna in linear scale=1.44)

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	1.79	824	25	316.2278	0.11267	0.549333333
GSM 1900	1.44	1850	25	316.2278	0.09064	1

WCDMA

Mode	WCDMA Band V: 824 MHz ~ 849 MHz Band II: 1850 MHz ~ 1910 MHz Band IV: 1710 MHz ~ 1755 MHz
Detector	AVG
Band II	24±1dBm
Band IV	24±1dBm
Band V	24±1dBm

ANT Gain (G)

WCDMA 850: 2.53dBi (gain of antenna in linear scale=1.79)

WCDMA1900: 1.59dBi (gain of antenna in linear scale=1.44)

WCDMA1700:2dBi (gain of antenna in linear scale=1.58)

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	1.79	824	25	316.2278	0.11267	0.549333333
Band II	1.44	1850	25	316.2278	0.09064	1
Band IV	1.58	1710	25	316.2278	0.09945	1

LTE

Mode	LTE LTE Band 2:1850~1910MHz LTE Band 4:1710~1755MHz LTE Band 5:824~849MHz LTE Band 7:2500~2570MHz LTE Band 66:1710~1780MHz
Detector	AVG
LTE Band 2	24±1dBm
LTE Band 4	24±1dBm
LTE Band 5	24±1dBm
LTE Band 7	24±1dBm
LTE Band 66	24±1dBm

ANT Gain (G)

LTE Band2:1.59dBi (gain of antenna in linear scale=1.44)

LTE Band4:2dBi (gain of antenna in linear scale=1.58)

LTE Band5:2.53dBi (gain of antenna in linear scale=1.79)

LTE Band7:3dBi (gain of antenna in linear scale=2.0)

LTE Band66:2dBi (gain of antenna in linear scale=1.58)

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	1.44	1850	25	316.2278	0.09064	1
LTE Band 4	1.58	1710	25	316.2278	0.09945	1
LTE Band 5	1.79	824	25	316.2278	0.11267	0.549333333
LTE Band 7	2	2500	25	316.2278	0.12589	1
LTE Band 66	1.58	1710	25	316.2278	0.09945	1

Multiple Evaluation

WIFI/1+GSM/0.55+WCDMA/1+LTE/1=(0.03978/1) + (0.11267/0.55) + (0.11267/0.55) +(0.11267/0.55)=0.6543

According to the maximum gain of the antenna and the total output power to the antenna, through calculation, we will know max MPE value 0.6543 at distance 20cm. This is less than the limit 1, So Compliance the RF exposure requirement.