RF Exposure Measurement

1. Introduction
The maximum Gain measured in Fully Anechoic Chamber
Because this deivce is transmitting the high power signal, it is regarded specially as a dangerous band for its heating harmfulness to the human body. The manufacturer whose product is working in this frequency band is obligatory to prove the harmfulness of his product.

In this document, we try to prove the safety of radiation harmfulness to the human body for our product. The limit for Maximum Permissible Exposure (MPE) specified in FCC 1.1310 is followed. The Gain of the antenna used in this product is measured in a Fully Anechoic Chamber (FAC), and 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.

2. Classification
MODE: WLAN . BT

The antenna of the product, under normal use condition, is at least 20cm away from the body of the user. Warning statement for keeping 20cm separation distance and the prohibition of operating next to a person has been printed on the user's manual. So, this product is classified as the Mobile Device.

3. RF Exposure Limit

According to FCC 1.1310: The criteria listed in the following table shall be used to evaluate the environmental impact of human exposure to radio-frequency(RF) radiation as specified in 1.1307(b).

LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE) - **Class A**

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength(A/m)	Power Density (mW/cm^2)	Average Time (minutes)
0.3 - 3.0	614	1.63	*(100)	6
3.0 - 30	1842/f	4.89/f	*(900/f^2)	6
30 - 300	61.4	0.163	1.0	6
300 - 1500			F/300	6
1500 - 100,000			5	6

LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE) - **Class B**

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength(A/m)	Power Density (mW/cm^2)	Average Time (minutes)
0.3 - 1.34	614	1.63	*(100)	30
1.34 - 30	824/f	2.19/f	*(180/f^2)	30
30 - 300	27.5	0.073	0.2	30
300 - 1500	-	-	F/1500	30
1500 - 100,000	-	-	1.0	30

F = Frequency in MHz   * = Plane-wave equivalent power density

4. Friis Formula

$$R = \sqrt{\frac{PG}{4\pi S}}$$

The maximum Gain measured in Fully Anechoic Chamber

BT(BASIC/EDR) : 3.5 dBi or 2.239 (nemeric)

BT(LE) : 2 dBi or 1.585 (nemeric)

WCDMA : 6.15 dBi or 4.121 (nemeric)

P_{out} = output power to antenna in mW

G = gain of antenna in linear scale

Pi = 3.1416

MODE: WLAN , BT , WCDMA

Pd is the limit of MPE, $1mW/cm^2$. If we know the maximum Gain of the antenna and the total power input to the antenna, through the calculation, we will know the distance r where the MPE limit is reached.

The software provided by Manufacturer enabled the EUT to transmit with max power at lowest, middle and highest channel individually.

5. Test Results

The maximum Gain measured in Fully Anechoic Chamber

Band	dBi	nemeric
BT(BASIC/EDR)	3.5 dBi	2.239 (nemeric)
BT(LE)	2 dBi	1.585 (numeric)
WCDMA	6.15 dBi	4.121 (numeric)

5.2 Output Power into Antenna & Power Density (1mW/cm2) :

MODE: BT(BASIC/EDR)

Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density (mW/cm2)
First ch	2402.00	0.710	0.000316
Middle ch	2442.00	1.038	0.000462
Last ch	2480.00	1.146	0.000510

MODE: BT(LE)

Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density (mW/cm2)
First ch	2412.00	0.290	0.0001
Middle ch	2442.00	0.352	0.0001
Last ch	2462.00	0.354	0.0001

MODE : WCDMA

Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density (mW/cm2)
824.7 ~ 848.31	300.000	0.2460
1851.25 ~ 1908.75	274.000	0.2246

Max Calculations for simultaneous	Power Density (mW/cm2)
	0.24656