RF EXPOSURE REPORT

REPORT NO.: SA970523H02

MODEL NO.: NBG410W3G

ACCORDING: FCC Guidelines for Human Exposure

IEEE C95.1

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RF EXPOSURE MEASUREMENT (MOBILE DEVICE)

1. INTRODUCTION

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) calibrated for antenna measurement in ADT, 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 a far field assumption, the calculated result of that is an over-prediction for near field power density. We will take that as the worst case to specify the safety range.

2. 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)

FREQUENCY RANGE (MHz)	ELECTRIC FIELD STRENGTH (V/m)	MAGNETIC FIELD STRENGTH (A/m)	POWER DENSITY (mW/cm^2)	AVERAGE TIME (minutes)
(A)LIMITS FOR OCCUPATIONAL / CONTROL EXPOSURES				
300-1500	…	…	F/300	6
1500-100,000	…	…	5	6
(B)LIMITS FOR GENERAL POPULATION / UNCONTROLLED EXPOSURE				
300-1500	…	…	F/1500	30
1500-100,000	…	…	1.0	30

F = Frequency in MHz

3. FRIIS FORMULA

Friis 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 center of the radiator in cm

If we know the maximum Gain of the antenna and the total power input to the antenna, through the calculation, we will know the MPE value at distance r.

Ref.: David K. Cheng, *Field and Wave Electromagnetics*, Second Edition,

   Page 640, Eq. (11-133).

4. EUT OPERATING CONDITION

The software provided by Manufacturer enabled the EUT to transmit and receive data at lowest, middle and highest channel individually.

5. 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 with the antenna should be included in users manual. So, this device is classified as **Mobile Device**.

6. TEST RESULTS

6.1 OUTPUT POWER & RF EXPOSURE VALUE AT DISTANCE 20cm:

GPRS 850

CHANNEL	CHANNEL FREQUENCY (MHz)	OUTPUT POWER (PEAK erp)	OUTPUT POWER (PEAK eirp)	OUTPUT POWER (AV eirp)	POWER DENSITY (mW/cm^2)	LIMIT OF POWER DENSITY (mW/cm^2)
128	824.2	32.03	34.18	31.180	0.261	0.549
190	**836.6**	**32.04**	**34.19**	**31.190**	**0.262**	**0.558**
251	848.8	30.96	33.11	30.110	0.204	0.566

EGPRS 850

CHANNEL	CHANNEL FREQUENCY (MHz)	OUTPUT POWER (PEAK erp)	OUTPUT POWER (PEAK eirp)	OUTPUT POWER (AV eirp)	POWER DENSITY (mW/cm^2)	LIMIT OF POWER DENSITY (mW/cm^2)
128	**824.2**	**26.87**	**29.02**	**26.020**	**0.080**	**0.549**
190	836.6	26.79	28.94	25.940	0.078	0.558
251	848.8	25.74	27.89	24.890	0.061	0.566

NOTE:

Power class of GPRS and EGPRS is class 12 which supports 4 time slots in uplink mode.

Average power = peak power * 4 / 8

WCDMA 850

CHANNEL	CHANNEL FREQUENCY (MHz)	OUTPUT POWER (erp)	OUTPUT POWER (eirp)	POWER DENSITY (mW/cm^2)	LIMIT OF POWER DENSITY (mW/cm^2)
4132	826.4	22.69	24.84	0.061	0.551
4182	**836.4**	**23.14**	**25.29**	**0.067**	**0.558**
4233	846.6	22.59	24.74	0.059	0.564

GPRS 1900

CHANNEL	CHANNEL FREQUENCY (MHz)	OUTPUT POWER (PEAK eirp)	OUTPUT POWER (AV eirp)	POWER DENSITY (mW/cm^2)	LIMIT OF POWER DENSITY (mW/cm^2)
512	**1850.2**	**28.42**	**25.420**	**0.069**	**1.000**
661	1880.0	28.21	25.210	0.066	1.000
810	1909.8	27.45	24.450	0.055	1.000

EGPRS 1900

CHANNEL	CHANNEL FREQUENCY (MHz)	OUTPUT POWER (PEAK eirp)	OUTPUT POWER (AV eirp)	POWER DENSITY (mW/cm^2)	LIMIT OF POWER DENSITY (mW/cm^2)
512	**1850.2**	**25.38**	**22.380**	**0.034**	**1.000**
661	1880.0	25.03	22.030	0.032	1.000
810	1909.8	24.39	21.390	0.027	1.000

NOTE:

Power class of GPRS and EGPRS is class 12 which supports 4 time slots in uplink mode.

Average power = peak power * 4 / 8

WCDMA 1900

CHANNEL	CHANNEL FREQUENCY (MHz)	OUTPUT POWER (eirp)	POWER DENSITY (mW/cm^2)	LIMIT OF POWER DENSITY (mW/cm^2)
9262	**1852.40**	**25.09**	**0.064**	**1.000**
9400	1880.00	24.61	0.058	1.000
9538	1907.60	23.86	0.048	1.000

FOR WLAN MODULE (FCC ID: I88NWD670)

ANT GAIN	3.6 dBi			
BAND	CONDUCTED POWER (dBm)	OUTPUT POWER (eirp)	MPE	LIMIT
2.4GHz	19.26	22.86	0.038	1.000

CONCULSION:

Both of the modules can transmit simultaneously, the formula of calculated the MPE is:

CPD1 / LPD1 + CPD2 / LPD2 + ……etc. < 1

CPD = Calculation power density

LPD = Limit of power density

1. WLAN 2.4G + GPRS 850 = 0.508
2. WLAN 2.4G + EGPRS 850 = 0.184
3. WLAN 2.4G + WCDMA 850 = 0.158
4. WLAN 2.4G + GPRS 1900 = 0.107
5. WLAN 2.4G + EGPRS 1900 = 0.072
6. WLAN 2.4G + WCDMA 1900 = 0.102

Therefore, the maximum calculation of this situation is 0.508, which is less than the 1.