



RF EXPOSURE REPORT

REPORT NO.: SA980320L04

MODEL NO.: AT-TQ2403

ACCORDING: FCC Guidelines for Human Exposure
IEEE C95.1

APPLICANT: Delta Networks, Inc.

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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 : $P_d = (P_{out} * G) / (4 * \pi * r^2)$

where

P_d = power density in mW/cm^2

P_{out} = 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 ANTENNA GAIN

The maximum Gain measured in Fully Anechoic Chamber is 2.43dBi or 1.749847(numeric), 2.26dBi or 1.682674(numeric).

6.2 OUTPUT POWER INTO ANTENNA & RF EXPOSURE VALUE AT DISTANCE 20cm:

For 2.412 ~ 2.4362GHz band:

FOR ANTENNA 2.43dBi GAIN

802.11b DSSS MODULATION

CHANNEL	CHANNEL FREQUENCY (MHz)	PEAK POWER OUTPUT (dBm)	PEAK POWER (mW)	POWER DENSITY (mW/cm ²)	LIMIT OF POWER DENSITY (mW/cm ²)
1	2412	19.06	80.538	0.028	1.0
6	2437	19.08	80.910	0.028	1.0
11	2462	19.05	80.353	0.028	1.0

802.11g OFDM MODULATION

CHANNEL	CHANNEL FREQUENCY (MHz)	PEAK POWER OUTPUT (dBm)	PEAK POWER (mW)	POWER DENSITY (mW/cm ²)	LIMIT OF POWER DENSITY (mW/cm ²)
1	2412	21.06	127.644	0.044	1.0
6	2437	23.52	224.905	0.078	1.0
11	2462	21.05	127.350	0.044	1.0

802.11g OFDM MODULATION (TURBO MODE)

CHANNEL	CHANNEL FREQUENCY (MHz)	PEAK POWER OUTPUT (dBm)	PEAK POWER (mW)	POWER DENSITY (mW/cm ²)	LIMIT OF POWER DENSITY (mW/cm ²)
6	2437	23.02	200.447	0.070	1.0



For 5.180 ~ 5.320GHz & 5.500 ~ 5.700GHz band:
 FOR ANTENNA 2.26dBi GAIN
 802.11a OFDM MODULATION

CHANNEL	CHANNEL FREQUENCY (MHz)	PEAK POWER OUTPUT (dBm)	PEAK POWER (mW)	POWER DENSITY (mW/cm ²)	LIMIT OF POWER DENSITY (mW/cm ²)
36	5180	15.52	35.645	0.012	1.0
40	5200	16.08	40.551	0.014	1.0
48	5240	16.04	40.179	0.013	1.0
52	5260	16.05	40.272	0.013	1.0
60	5300	16.09	40.644	0.014	1.0
64	5320	16.53	44.978	0.015	1.0
100	5500	16.06	40.365	0.014	1.0
120	5600	16.03	40.087	0.013	1.0
140	5700	16.04	40.179	0.013	1.0

802.11a OFDM MODULATION (TURBO MODE)

CHANNEL	CHANNEL FREQUENCY (MHz)	PEAK POWER OUTPUT (dBm)	PEAK POWER (mW)	POWER DENSITY (mW/cm ²)	LIMIT OF POWER DENSITY (mW/cm ²)
42	5210	16.04	40.179	0.013	1.0

For 5.745 ~ 5.825GHz band
 FOR ANTENNA 2.26dBi GAIN
 802.11a OFDM MODULATION

CHANNEL	CHANNEL FREQUENCY (MHz)	PEAK POWER OUTPUT (dBm)	PEAK POWER (mW)	POWER DENSITY (mW/cm ²)	LIMIT OF POWER DENSITY (mW/cm ²)
149	5745	20.02	100.462	0.034	1.0
157	5785	20.09	102.094	0.034	1.0
165	5825	20.04	100.925	0.034	1.0

802.11a OFDM MODULATION (TURBO MODE)

CHANNEL	CHANNEL FREQUENCY (MHz)	PEAK POWER OUTPUT (dBm)	PEAK POWER (mW)	POWER DENSITY (mW/cm ²)	LIMIT OF POWER DENSITY (mW/cm ²)
152	5760	20.10	102.329	0.034	1.0
160	5800	20.06	101.391	0.034	1.0

CONCLUSION:

EUT can transmit 2.4 and 5GHz simultaneously through the same antenna, the formula of calculated the MPE is:

$$CPD1 / LPD1 + CPD2 / LPD2 + \dots \text{etc.} < 1$$

CPD = Calculation power density

LPD = Limit of power density

$$WLAN\ 2.4G + WLAN\ 5G = 0.078 + 0.034 = 0.112$$

Therefore, the maximum calculation of this situation is 0.112, which is less than the "1" limit.