



RF EXPOSURE REPORT

REPORT NO.: SA940804H03B

MODEL NO.: RBT-4102-LIC

ACCORDING: FCC Guidelines for Human Exposure
IEEE C95.1

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RF Exposure Measurement

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	6
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/cm²

P_{out} = output power to antenna in mW

G = gain of antenna in linear scale

π = 3.1416

R = distance between observation point and center of the radiator in cm

P_d is the limit of MPE, 1 mW/cm². 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 25cm.

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 antennas (except the below antennas) 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.

The antenna (RBTES-BG-P18M) of this product, under normal use condition, is at least 40cm away from the body of the user. Warning statement to the user for keeping at least 40cm or more separation distance with the antenna should be included in users manual.

The antenna (RBTES-BG-PAR24M) of this product, under normal use condition, is at least 68cm away from the body of the user. Warning statement to the user for keeping at least 68cm or more separation distance with the antenna should be included in users manual.

The antenna (RBTES-AW-S1590M) of this product, under normal use condition, is at least 28cm away from the body of the user. Warning statement to the user for keeping at least 28cm or more separation distance with the antenna should be included in users manual.

The antenna (RBTES-AH-P23M) of this product, under normal use condition, is at least 61cm away from the body of the user. Warning statement to the user for keeping at least 61cm or more separation distance with the antenna should be included in users manual.

The antenna (RBTES-AW-S1590M) of this product, under normal use condition, is at least 25cm away from the body of the user. Warning statement to the user for keeping at least 25cm 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

For 2.4GHz

Antenna 1: The maximum Gain of the antenna is 2.0dBi.

For 5GHz

Operated in 5150 ~ 5250MHz, 5250MHz ~ 5350MHz, 5725MHz ~ 5825MHz band: (15.407)

Antenna 1: The maximum Gain of the antenna is 4.0dBi.

Operated in 5725 ~ 5850MHz band: (15.247)

Antenna 1: The maximum Gain of the antenna is 4.0dBi.

Antenna 2: The maximum Gain of the antenna is 23.0dBi.

Antenna 3: The maximum Gain of the antenna is 10.0dBi.

For 4.9GHz

Operated in 4955 ~ 4975MHz

Antenna 1: The maximum Gain of the antenna is 16dBi.

For 802.11b/g(2400 ~ 2483.5MHz)

Item	SPEC No.	Model No.	Product Description	Antenna Gain	Remark	Connector
1	NA	RBT4K-AG-IA	2.4-4.9/5.8 GHz, 8ft of cable RPSMA Indoor Antenna.	2dBi	Omni	RPSMA

For 802.11a (5725 ~ 5850MHz band)

Item	SPEC No.	Model No.	Product Description	Antenna Gain	Remark	Connector
1	NA	RBT4K-AG-IA	2.4-4.9/5.8 GHz, 8ft of cable RPSMA Indoor Antenna.	4dBi	Omni	RPSMA
2	8910605	RBTES-AH-P23M	5.8GHz GHz Directional Antenna Assy Outdoor Antenna..	23 dBi	Point to point Directional	Reverse N
3	8910606	RBTES-AH-M10M	5.8GHz GHz Omni Antenna Assy Outdoor Antenna.	10 dBi	Omni	Reverse N



For 802.11a (5150 ~ 5350MHz band)

Item	SPEC No.	Model No.	Product Description	Antenna Gain	Remark	Connector
1	NA	RBT4K-AG-IA	2.4-4.9/5.8 GHz, 8ft of cable RPSMA Indoor Antenna.	4dBi	Omni	RPSMA

For 802.11j (4955 ~ 4975MHz band)

Item	SPEC No.	Model No.	Product Description	Antenna Gain	Remark	Connector
1	8910620	RBTES-AW-S1590M	4.9 GHz -6 GHz Adjustable Sector Antenna Assy Outdoor Antenna	16 dBi at 60° 15 dBi at 90°	1. Point to point 2. Directional 3. Reverse N Connector	RPSMA



6.2 Output Power Into Antenna & RF Exposure value at distance 25cm:

For 2.4GHz

802.11b:

Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density (mW/cm ²)	Limit of Power Density (mW/cm ²)
1	2412	229.0867653	0.072231915	1.0
6	2437	316.227766	0.099707799	1.0
11	2462	132.4341535	0.041756985	1.0

802.11g:

Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density (mW/cm ²)	Limit of Power Density (mW/cm ²)
1	2412	162.1810097	0.05113628	1.0
6	2437	309.0295433	0.097438172	1.0
11	2462	74.98942093	0.023644445	1.0

**For 5GHz**

Operated in 5150 ~ 5250MHz, 5250MHz ~ 5350MHz, 5725MHz ~ 5825MHz band: (15.407)

Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density (mW/cm ²)	Limit of Power Density (mW/cm ²)
1	5180	44.15704474	0.02206628	1.0
4	5240	45.91980128	0.02294717	1.0
5	5260	202.768272	0.10132792	1.0
8	5320	110.9174815	0.05542799	1.0

Operated in 5725 ~ 5850MHz band: (15.247)

Antenna 1

Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density (mW/cm ²)	Limit of Power Density (mW/cm ²)
1	5745	211.348904	0.105615857	1.0
3	5785	223.3572223	0.111616687	1.0
5	5825	230.6747189	0.115273407	1.0

Antenna 2

Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density (mW/cm ²)	Limit of Power Density (mW/cm ²)
1	5745	211.348904	0.901839909	1.0
3	5785	223.3572223	0.953080207	1.0
5	5825	230.6747189	0.984304454	1.0

Antenna 3

Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density (mW/cm ²)	Limit of Power Density (mW/cm ²)
1	5745	211.348904	0.420464302	1.0
3	5785	223.3572223	0.444354036	1.0
5	5825	230.6747189	0.458911699	1.0



For 4.9GHz

Operated in 4955 ~ 4975MHz

Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density (mW/cm ²)	Limit of Power Density (mW/cm ²)
4955	195.884	0.993	1.0
4965	195.434	0.991	1.0
4975	194.536	0.986	1.0