RF EXPOSURE REPORT

REPORT NO.: SA981110H01

MODEL NO.: RG231, RG231-2.5-4D2V1W, RG231-2.5-1D2V1W

ACCORDING: FCC Guidelines for Human Exposure
IEEE C95.1

APPLICANT: Accton Wireless Broadband Corp.

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ISSUED BY: Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch

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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 our lab, 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

Pd is the limit of MPE, 1 mW/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 MPE value at distance 20cm.

Ref. : David K. Cheng, *Field and Wave Electromagnetics*, Second Edition,
Page 640, Eq. (11-133).

4. EUT Operating condition

The software provided by client enabled the EUT to transmit and receive data at specific channel frequencies 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 **Temporary fix user station**

6. Test Results

6.1 Antenna Gain

For WLAN

The maximum Gain is Printed PCB antenna: 2.65dBi or 1.84077 (numeric)

For WiMAX

No.	Antenna Type	Antenna Connector	Antenna Gain (dBi)	Cable loss(dB)	Net Gain (dBi)	Cable Length (cm)	Frequency range (MHz)
1	Printed Dipole	IPEX	6.15	0.5	5.65	6.2	2500~2700
2	PCB Dipole	Mini connector	6.76	0.5	6.26	6.2	2500~2700

6.2 Output Power Into Antenna & RF Exposure value at distance 20cm:

For WLAN

Part 802.11b:

Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density (mW/cm2)	Limit of Power Density (mW/cm^2)
1	2412	120.2	0.044	1.0
6	2437	134.9	0.049	1.0
11	2462	125.9	0.046	1.0

Part 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	195.0	0.071	1.0
6	2437	257.0	0.094	1.0
11	2462	234.4	0.086	1.0

802.11n (20MHz) :

Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density (mW/cm^2)	Limit of Power Density (mW/cm^2)
1	2412	182.0	0.067	1.0
6	2437	186.2	0.068	1.0
11	2462	169.8	0.062	1.0

802.11n (40MHz) :

Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density (mW/cm^2)	Limit of Power Density (mW/cm^2)
1	2422	63.1	0.023	1.0
4	2437	245.5	0.090	1.0
7	2452	128.8	0.047	1.0

For WiMAX
CHANNEL BANDWIDTH: 5MHz

Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density (mW/cm^2)	Limit of Power Density (mW/cm^2)
Low	2502.5	524.8	0.441	1.0
Middle	2600	537.0	0.452	1.0
High	2687.5	467.7	0.393	1.0

CHANNEL BANDWIDTH: 10MHz

Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density (mW/cm^2)	Limit of Power Density (mW/cm^2)
Low	2505	524.8	0.441	1.0
Middle	2590	512.9	0.431	1.0
High	2685	501.2	0.421	1.0

CONCULSION:

Both of the WLAN and WiMAX can transmit simultaneously, the formula of calculated the MPE is:

$CPD_1 / LPD_1 + CPD_2 / LPD_2 + ……etc. < 1$
CPD = Calculation power density
LPD = Limit of power density

Therefore, the worst-case situation is 0.094 / 1 + 0.452 / 1 = 0.5455, which is less than “1”. This confirmed that the device comply with FCC 1.1310 MPE limit.