RF Exposure Report

Report No.:	SA191111E03
FCC ID:	RRKC4000XG
Test Model:	C4000XG
Received Date:	Nov. 11, 2019
Test Date:	Nov. 23, 2019
Issued Date:	Dec. 13, 2019
Applicant:	Alpha Networks Inc.
Address:	No.8 Li-shing 7th Rd., Science-based Industrial Park, Hsinchu, Taiwan, R.O.C.
Issued By:	Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch Hsin Chu Laboratory
Lab Address:	E-2, No.1, Li Hsin 1st Road, Hsinchu Science Park, Hsinchu City 300, Taiwan
Test Location:	E-2, No.1, Li Hsin 1st Road, Hsinchu Science Park, Hsinchu City 300, Taiwan
FCC Registration / Designation Number:	723255 / TW2022

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Release Control Record

Issue No.	Description	Date Issued
SA191111E03	Original release.	Dec. 13, 2019

1 Certificate of Conformity

Product:	Wireless Gateway
Brand:	CenturyLink
Test Model:	C4000XG
Sample Status:	ENGINEERING SAMPLE
Applicant:	Alpha Networks Inc.
Test Date:	Nov. 23, 2019
Standards:	FCC Part 2 (Section 2.1091) KDB 447498 D01 General RF Exposure Guidance v06 IEEE C95.3-2002

The above equipment has been tested by **Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch**, and found compliance with the requirement of the above standards. The test record, data evaluation & Equipment Under Test (EUT) configurations represented herein are true and accurate accounts of the measurements of the sample's EMC characteristics under the conditions specified in this report.

Prepared by : _____ , **Date:** Dec. 13, 2019

Joyce Kuo / Specialist

Approved by : _____ , **Date:** Dec. 13, 2019

Clark Lin / Technical Manager

2 RF Exposure

2.1 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)
Limits For General Population / Uncontrolled Exposure				
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

2.2 MPE Calculation 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

2.3 Classification

The antenna of this product, under normal use condition, is at least 34cm away from the body of the user. So, this device is classified as **Mobile Device**.

2.4 Antenna Gain

The antennas provided to the EUT, please refer to the following table:

1st source

Antenna NO.	Brand	Model	Antenna Type	Connector Type	Cable Length(mm)
2.4G-1	Hongbo	290-20433	PCB	i-pex(MHF)	295
2.4G-2	Hongbo	290-20434	PCB	i-pex(MHF)	340
2.4G-3	Hongbo	290-20435	PCB	i-pex(MHF)	220
2.4G-4	Hongbo	290-20436	PCB	i-pex(MHF)	240
5G-1	Hongbo	290-20437	PCB	i-pex(MHF)	125
5G-2	Hongbo	290-20438	PCB	i-pex(MHF)	220
5G-3	Hongbo	290-20439	PCB	i-pex(MHF)	240
5G-4	Hongbo	290-20440	PCB	i-pex(MHF)	175
*5G-5	Hongbo	290-20441	PCB	i-pex(MHF)	350

*Reserved for future permissive change. (Not evaluation for 5G-5 antenna)

2nd source

Antenna NO.	Brand	Model	Antenna Type	Connector Type	Cable Length(mm)
2.4G-1	Walsin	RFPCA351129IMAB401	PCB	i-pex(MHF)	295
2.4G-2	Walsin	RFPCA351134IMAB401	PCB	i-pex(MHF)	340
2.4G-3	Walsin	RFPCA351122IMAB401	PCB	i-pex(MHF)	220
2.4G-4	Walsin	RFPCA351124IMAB401	PCB	i-pex(MHF)	240
5G-1	Walsin	RFPCA201112IM5B401	PCB	i-pex(MHF)	125
5G-2	Walsin	RFPCA201122IM5B401	PCB	i-pex(MHF)	220
5G-3	Walsin	RFPCA201124IM5B401	PCB	i-pex(MHF)	240
5G-4	Walsin	RFPCA201117IM5B401	PCB	i-pex(MHF)	175
*5G-5	Walsin	RFPCA201135IM5B401	PCB	i-pex(MHF)	350

*Reserved for future permissive change. (Not evaluation for 5G-5 antenna)

From the above brand, brand: H**ongbo** was selected as representative model for the test and its data was recorded in this report.

The directional antenna gain, please refer to the following table:

Frequency Range (GHz)	Directional Antenna Gain (dBi)	Antenna Type	Antenna Connector
2.4 ~ 2.5	7.4	PCB	i-pex(MHF)
5.15 ~ 5.25	9.1		
5.25 ~ 5.35	8.4		
5.47 ~ 5.725	8.3		
5.725 ~ 5.85	8.1		
Note: More detailed information, please refer to antenna specification.			

2.5 Calculation Result of Maximum Conducted Power

Operation Mode	Evaluation Frequency (MHz)	Max Power (mW)	Antenna Gain (dBi)	Distance (cm)	Power Density (mW/cm^2)	Limit (mW/cm^2)
WLAN 2.4GHz	2437	965.166	7.4	34	0.36512	1
WLAN 5GHz U-NII-1	5230	928.785	9.1	34	0.51969	1
WLAN 5GHz U-NII-3	5785	959.035	8.1	34	0.42625	1

NOTE:
2.4GHz: The directional gain = 10 log $[(10^{Chain0/20} + 10^{Chain1/20} + 10^{Chain2/20} + 10^{Chain3/20})^2 / 4] = 7.4dBi$
5GHz:
U-NII-1: The directional gain = 10 log $[(10^{Chain0/20} + 10^{Chain1/20} + 10^{Chain2/20} + 10^{Chain3/20})^2 / 4] = 9.1dBi$
U-NII-3: The directional gain = 10 log $[(10^{Chain0/20} + 10^{Chain1/20} + 10^{Chain2/20} + 10^{Chain3/20})^2 / 4] = 8.1dBi$

Conclusion:

The formula of calculated the MPE is:

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

CPD = Calculation power density

LPD = Limit of power density

WLAN 2.4GHz + WLAN 5GHz = 0.36512 / 1 + 0.51969 / 1 = 0.88481
Therefore the maximum calculations of above situations are less than the "1" limit.

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