

RF Exposure Report

Report No.: SA191111E03A

FCC ID: RRC4000XG

Test Model: C4000XG

Received Date: Nov. 12, 2019

Test Date: Nov. 23 to Dec. 04, 2019

Issued Date: Aug. 08, 2020

Applicant: Alpha Networks Inc.

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R.O.C.

Issued By: Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch
Hsin Chu Laboratory

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Test Location: E-2, No.1, Li Hsin 1st Road, Hsinchu Science Park, Hsinchu City 300,
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**FCC Registration /
Designation Number:** 723255 / TW2022

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Release Control Record

Issue No.	Description	Date Issued
SA191111E03A	Original release.	Aug. 08, 2020

1 Certificate of Conformity

Product: Wireless Gateway

Brand: CenturyLink

Test Model: C4000XG

Sample Status: ENGINEERING SAMPLE

Applicant: Alpha Networks Inc.

Test Date: Nov. 23 to Dec. 04, 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:

Aug. 08, 2020

Joyce Kuo / Specialist

Approved by :



Date:

Aug. 08, 2020

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

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

where

Pd = power density in mW/cm²

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

1st source

Antenna NO.	Brand	Model	Antenna Net Gain(dBi)	Frequency range	Antenna Type	Connector Type	Cable Length(mm)
2.4G-1	Hongbo	290-20433	3.97	2.4~2.4835GHz	PCB	i-pex(MHF)	295
2.4G-2	Hongbo	290-20434	5.72	2.4~2.4835GHz	PCB	i-pex(MHF)	340
2.4G-3	Hongbo	290-20435	4.97	2.4~2.4835GHz	PCB	i-pex(MHF)	220
2.4G-4	Hongbo	290-20436	3.59	2.4~2.4835GHz	PCB	i-pex(MHF)	240
5G-1	Hongbo	290-20437	5.18	5.15~5.25GHz	PCB	i-pex(MHF)	125
	Hongbo		4.61	5.25~5.35GHz	PCB	i-pex(MHF)	
	Hongbo		5.36	5.47~5.725GHz	PCB	i-pex(MHF)	
	Hongbo		5.36	5.725~5.85GHz	PCB	i-pex(MHF)	
5G-2	Hongbo	290-20438	4.29	5.15~5.25GHz	PCB	i-pex(MHF)	220
	Hongbo		3.71	5.25~5.35GHz	PCB	i-pex(MHF)	
	Hongbo		5.23	5.47~5.725GHz	PCB	i-pex(MHF)	
	Hongbo		5.23	5.725~5.85GHz	PCB	i-pex(MHF)	
5G-3	Hongbo	290-20439	4.55	5.15~5.25GHz	PCB	i-pex(MHF)	240
	Hongbo		4.16	5.25~5.35GHz	PCB	i-pex(MHF)	
	Hongbo		5.16	5.47~5.725GHz	PCB	i-pex(MHF)	
	Hongbo		5.16	5.725~5.85GHz	PCB	i-pex(MHF)	
5G-4	Hongbo	290-20440	4.6	5.15~5.25GHz	PCB	i-pex(MHF)	175
	Hongbo		4.47	5.25~5.35GHz	PCB	i-pex(MHF)	
	Hongbo		5.21	5.47~5.725GHz	PCB	i-pex(MHF)	
	Hongbo		3.91	5.725~5.85GHz	PCB	i-pex(MHF)	
*5G-5	Hongbo	290-20441	5.51	5.15~5.25GHz	PCB	i-pex(MHF)	350
	Hongbo		5.03	5.25~5.35GHz	PCB	i-pex(MHF)	
	Hongbo		5.75	5.47~5.725GHz	PCB	i-pex(MHF)	
	Hongbo		5.75	5.725~5.85GHz	PCB	i-pex(MHF)	

*Reserved for future permissive change.

2nd source

Antenna NO.	Brand	Model	Antenna Net Gain(dBi)	Frequency range	Antenna Type	Connector Type	Cable Length(mm)
2.4G-1	Walsin	RFPCA351129IMAB401	4.35	2.4~2.4835GHz	PCB	i-pex(MHF)	295
2.4G-2	Walsin	RFPCA351134IMAB401	4.56	2.4~2.4835GHz	PCB	i-pex(MHF)	340
2.4G-3	Walsin	RFPCA351122IMAB401	4.71	2.4~2.4835GHz	PCB	i-pex(MHF)	220
2.4G-4	Walsin	RFPCA351124IMAB401	4.67	2.4~2.4835GHz	PCB	i-pex(MHF)	240
5G-1	Walsin	RFPCA201112IM5B401	4.11	5.15~5.25GHz	PCB	i-pex(MHF)	125
	Walsin		4.11	5.25~5.35GHz	PCB	i-pex(MHF)	
	Walsin		4.49	5.47~5.725GHz	PCB	i-pex(MHF)	
	Walsin		4.89	5.725~5.85GHz	PCB	i-pex(MHF)	
5G-2	Walsin	RFPCA201122IM5B401	4.30	5.15~5.25GHz	PCB	i-pex(MHF)	220
	Walsin		4.30	5.25~5.35GHz	PCB	i-pex(MHF)	
	Walsin		4.50	5.47~5.725GHz	PCB	i-pex(MHF)	
	Walsin		4.30	5.725~5.85GHz	PCB	i-pex(MHF)	
5G-3	Walsin	RFPCA201124IM5B401	3.79	5.15~5.25GHz	PCB	i-pex(MHF)	240
	Walsin		3.79	5.25~5.35GHz	PCB	i-pex(MHF)	
	Walsin		3.89	5.47~5.725GHz	PCB	i-pex(MHF)	
	Walsin		4.80	5.725~5.85GHz	PCB	i-pex(MHF)	
5G-4	Walsin	RFPCA201117IM5B401	3.88	5.15~5.25GHz	PCB	i-pex(MHF)	175
	Walsin		3.88	5.25~5.35GHz	PCB	i-pex(MHF)	
	Walsin		4.51	5.47~5.725GHz	PCB	i-pex(MHF)	
	Walsin		5.10	5.725~5.85GHz	PCB	i-pex(MHF)	
*5G-5	Walsin	RFPCA201135IM5B401	4.09	5.15~5.25GHz	PCB	i-pex(MHF)	350
	Walsin		4.09	5.25~5.35GHz	PCB	i-pex(MHF)	
	Walsin		4.29	5.47~5.725GHz	PCB	i-pex(MHF)	
	Walsin		4.68	5.725~5.85GHz	PCB	i-pex(MHF)	

*Reserved for future permissive change.

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

2.5 Calculation Result of Maximum Conducted Power

For 2.4GHz, 5GHz (U-NII-1 & U-NII-3 band) data was copied from the original test report (Report No.: SA191111E03)

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-2A	5290	239.913	8.4	34	0.33020	1
WLAN 5GHz U-NII-2C	5510	250.727	8.3	34	0.33723	1
WLAN 5GHz U-NII-3	5785	959.035	8.1	34	0.42625	1

NOTE:

2.4GHz: The directional gain = $10 \log [(10^{\text{Chain0/20}} + 10^{\text{Chain1/20}} + 10^{\text{Chain2/20}} + 10^{\text{Chain3/20}})^2 / 4] = 7.4\text{dBi}$

5GHz:

U-NII-1: The directional gain = $10 \log [(10^{\text{Chain0/20}} + 10^{\text{Chain1/20}} + 10^{\text{Chain2/20}} + 10^{\text{Chain3/20}})^2 / 4] = 9.1\text{dBi}$

U-NII-2A: The directional gain = $10 \log [(10^{\text{Chain0/20}} + 10^{\text{Chain1/20}} + 10^{\text{Chain2/20}} + 10^{\text{Chain3/20}})^2 / 4] = 8.4\text{dBi}$

U-NII-2C: The directional gain = $10 \log [(10^{\text{Chain0/20}} + 10^{\text{Chain1/20}} + 10^{\text{Chain2/20}} + 10^{\text{Chain3/20}})^2 / 4] = 8.3\text{dBi}$

U-NII-3: The directional gain = $10 \log [(10^{\text{Chain0/20}} + 10^{\text{Chain1/20}} + 10^{\text{Chain2/20}} + 10^{\text{Chain3/20}})^2 / 4] = 8.1\text{dBi}$

Conclusion:

The formula of calculated the MPE is:

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

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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