

FCC RF EXPOSURE REPORT

FCC ID: 2ACFN-HORA301W

Project No. : 2002H016
Equipment : New Generation WiFi 6 and Dual 10GbE SD-WAN Router
Brand Name : QNAP
Test Model : QHora-301W
Series Model : N/A
Applicant : QNAP System, Inc.
Address : 2F, No.22, Zhongxing Road, Xizhi District, New Taipei City, 221,Taiwan
Manufacturer : QNAP System, Inc.
Address : 2F, No.22, Zhongxing Road, Xizhi District, New Taipei City, 221,Taiwan
Factory : CIG Shanghai Co., Ltd., Shanghai Branch.
Address : F/2, 3 Building 1, No. 505 Jiangyue Road, Minhang District, Shanghai, P.R. China
Date of Receipt : Feb. 27, 2020
Date of Test : Feb. 27, 2020~Jun. 15, 2020
Issued Date : Sep. 15, 2020
Report Version : R02
Test Sample : Engineering Sample No.: SH2020021330, SH2020021330-1
Standard(s) : FCC Guidelines for Human Exposure IEEE C95.1 & FCC Part 2.1091
FCC Title 47 Part 2.1091, OET Bulletin 65 Supplement C

The above equipment has been tested and found compliance with the requirement of the relative standards by BTL Inc.

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REPORT ISSUED HISTORY

Report Version	Description	Issued Date
R00	Original Issue	Jun. 24, 2020
R01	Revised report to address TCB's comments.	Jul. 29, 2020
R02	Added a description in page 5.	Sep. 15, 2020

1. MPE CALCULATION METHOD

Calculation Method of RF Safety Distance:

$$S = \frac{PG}{4\pi r^2} = \frac{EIRP}{4\pi r^2}$$

where:

S = power density

P = power input to the antenna

G = power gain of the antenna in the direction of interest relative to an isotropic radiator

R = distance to the center of radiation of the antenna

Table for Filed Antenna

For 2.4G

Ant.	Brand	Model Name	Antenna Type	Connector	Gain(dBi)	Note
1		N/A	PCB	N/A	2.89	N/A
2		N/A	PCB	N/A	4.17	N/A
3		N/A	PCB	N/A	3.95	N/A
4		N/A	PCB	N/A	3.38	N/A

Note:

This EUT supports Beamforming and CDD, all antennas have the same gain, any transmit signals are correlated with each other, so

1) Beamforming:

Directional gain = $10\log[(10^{G1/20} + 10^{G2/20} + \dots + 10^{GN/20})^2 / N_{ANT}] \text{dBi}$,

that is Directional gain = $10\log[(10^{G1/20} + 10^{G2/20} + \dots + 10^{GN/20})^2 / N_{ANT}] \text{dBi} = 9.63$;

So output power limit is $30 - 9.63 + 6 = 26.37$, the power spectral density limit is $8 - 9.63 + 6 = 4.37$.

2) CDD:

For power spectral density measurements,

Directional gain = $10\log[(10^{G1/20} + 10^{G2/20} + \dots + 10^{GN/20})^2 / N_{ANT}] \text{dBi}$,

that is Directional gain = $10\log[(10^{G1/20} + 10^{G2/20} + \dots + 10^{GN/20})^2 / N_{ANT}] \text{dBi} = 9.63$;

So power spectral density limit is $8 - 9.63 + 6 = 4.37$.

For power measurements, Directional gain = $G_{ANT \text{ MAX.}} + \text{Array Gain}$, Array Gain = $0\text{dB} (N_{ANT} \leq 4)$,

so the Directional gain = 4.17 .

Operating Mode / TX Mode	Ant. 1	Ant. 2	Ant. 3	Ant. 4	Ant. 1+2+3+4
IEEE 802.11b	✓	✓	✓	✓	✓
IEEE 802.11g	✓	✓	✓	✓	✓
IEEE 802.11n (HT20)	✓	✓	✓	✓	✓
IEEE 802.11n (HT40)	✓	✓	✓	✓	✓
IEEE 802.11ax (HE20)	✓	✓	✓	✓	✓
IEEE 802.11ax (HE40)	✓	✓	✓	✓	✓

For 5G

Ant.	Brand	Model Name	Antenna Type	Connector	Gain(dBi)	Note
1		N/A	PCB	N/A	2.40	N/A
2		N/A	PCB	N/A	4.96	N/A
3		N/A	PCB	N/A	4.48	N/A
4		N/A	PCB	N/A	4.21	N/A

Note:

This EUT supports Beamforming and CDD, all antennas have unequal gains, any transmit signals are correlated with each other, so

1) Beamforming:

$$\text{Directional gain} = 10\log[(10^{G1/20} + 10^{G2/20} + \dots + 10^{GN/20})^2 / N_{\text{ANT}}] \text{dBi},$$

that is Directional gain = $10\log[(10^{G1/20} + 10^{G2/20} + \dots + 10^{GN/20})^2 / N_{\text{ANT}}] \text{dBi} = 10.09$;

Then, the UNII-1, UNII-3 output power limit is $30 - 10.09 + 6 = 25.91$, the UNII-2A, UNII-2C output power limit is $24 - 10.09 + 6 = 19.91$. The UNII-1 power spectral density limit is

$17 - 10.09 + 6 = 12.91$, UNII-2A, UNII-2C power spectral density limit is $11 - 10.09 + 6 = 6.91$,

the UNII-3 power spectral density limit is $30 - 10.09 + 6 = 25.91$.

2) CDD:

For power spectral density measurements, the Directional

$$\text{gain} = 10\log[(10^{G1/20} + 10^{G2/20} + \dots + 10^{GN/20})^2 / N_{\text{ANT}}] \text{dBi},$$

that is Directional gain = $10\log[(10^{G1/20} + 10^{G2/20} + \dots + 10^{GN/20})^2 / N_{\text{ANT}}] \text{dBi} = 10.09$;

Then, the UNII-1 power spectral density limited is $17 - 10.09 + 6 = 12.91$, UNII-2A, UNII-2C power spectral density limit is $11 - 10.09 + 6 = 6.91$, the UNII-3 power spectral density limit is

$30 - 10.09 + 6 = 25.91$.

For power measurements, Directional gain = $G_{\text{ANT MAX.}} + \text{Array Gain}$. Array Gain = $0 \text{dB} (N_{\text{ANT}} \leq 4)$, so the Directional gain = 4.96.

Operating Mode	Ant. 1	Ant. 2	Ant. 3	Ant. 4	Ant. 1+2+3+4
TX Mode					
IEEE 802.11a	✓	✓	✓	✓	✓
IEEE 802.11n (HT20)	✓	✓	✓	✓	✓
IEEE 802.11n (HT40)	✓	✓	✓	✓	✓
IEEE 802.11ac (VHT20)	✓	✓	✓	✓	✓
IEEE 802.11ac (VHT40)	✓	✓	✓	✓	✓
IEEE 802.11ac (VHT80)	✓	✓	✓	✓	✓
IEEE 802.11ax (HE20)	✓	✓	✓	✓	✓
IEEE 802.11ax (HE40)	✓	✓	✓	✓	✓
IEEE 802.11ax (HE80)	✓	✓	✓	✓	✓

2. TEST RESULTS

For 2.4GHz:

Beamforming

Antenna Gain (dBi)	Antenna Gain (numeric)	Max. tune up Power (dBm)	Max. tune up Power (mW)	Power Density (S) (mW/cm ²)	Limit of Power Density (S) (mW/cm ²)	Test Result
9.63	9.18330	27	501.1872	0.50240	1	Complies

CDD:

Antenna Gain (dBi)	Antenna Gain (numeric)	Max. tune up Power (dBm)	Max. tune up Power (mW)	Power Density (S) (mW/cm ²)	Limit of Power Density (S) (mW/cm ²)	Test Result
4.17	2.6122	29	794.3282	0.22650	1	Complies

For 5GHz :

Beamforming

Antenna Gain (dBi)	Antenna Gain (numeric)	Max. tune up Power (dBm)	Max. tune up Power (mW)	Power Density (S) (mW/cm ²)	Limit of Power Density (S) (mW/cm ²)	Test Result
10.09	10.2094	26	398.1072	0.44370	1	Complies

CDD:

Antenna Gain (dBi)	Antenna Gain (numeric)	Max. tune up Power (dBm)	Max. tune up Power (mW)	Power Density (S) (mW/cm ²)	Limit of Power Density (S) (mW/cm ²)	Test Result
4.96	3.1333	29	794.3282	0.27170	1	Complies

For the max simultaneous transmission MPE:

2.4G+5G

Power Density (S) (mW/cm ²)	Power Density (S) (mW/cm ²)	Total	Limit of Power Density (S) (mW/cm ²)	Test Result
2.4GHz	5GHz			
0.50240	0.44370	0.9461	1	Complies

Note: The calculated distance is 27 cm.

Output power including tune up tolerance.

While multi-user establish the connection with the AP, the antenna gain will not increase.

End of Test Report