

FCC RF EXPOSURE REPORT

FCC ID: 2ACFN-QMIROP201W

Project No. : 2004H039
Equipment : Tri-Band Mesh WiFi Satellite
Brand Name : QNAP
Test Model : QMiro-201W
Series Model : N/A
Applicant : QNAP Systems, Inc.
Address : 2F, No. 22, Zhongxing Road, Xizhi District., New Taipei City, Taiwan, 221
Manufacturer : QNAP Systems, Inc.
Address : 2F, No. 22, Zhongxing Rd, Xizhi Dist., 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 : May. 25, 2020
Date of Test : May. 25, 2020~Jun. 17, 2020
Issued Date : Sep. 04, 2020
Report Version : R00
Test Sample : Engineering Sample No.: SH20200528127 for radiated; SH2020051457 for conducted; SH2020051457-1 for adapter.
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	Sep. 04, 2020

1. MPE CALCULATION METHOD

Calculation Method of RF Safety Distance:

$$S = \frac{PG}{4\pi^3} = \frac{EIRP}{4\pi^3}$$

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

1. Antenna Specification:

Ant.	Brand	Model Name	Antenna Type	Connector	Gain (dBi)	Note
1		N/A	PCB	N/A	4.6	N/A
2		N/A	PCB	N/A	2.7	N/A

Note:

This EUT supports CDD, all antenna gains are not equal, so Directional gain = $10\log [(10^{G1/20} + 10^{G2/20} + \dots + 10^{GN/20})^2 / N] \text{dBi}$,

(1) CDD:

For power spectral density measurements, Directional gain = $10\log [(10^{G1/20} + 10^{G2/20} + \dots + 10^{GN/20})^2 / N] \text{dBi}$. that is Directional gain = $10\log [(10^{2.54/20} + 10^{2.62/20})^2 / 2] = 6.71$

For power measurements, Directional gain = $G_{\text{ANT MAX}} + \text{Array Gain}$, Array Gain = 0 dB ($N_{\text{ANT}} \leq 4$), so the Directional gain = 4.6

(2) Beamforming:

Directional gain = $10\log [(10^{G1/20} + 10^{G2/20} + \dots + 10^{GN/20})^2 / N] \text{dBi} = 10\log [(10^{2.54/20} + 10^{2.62/20})^2 / 2] = 6.71$

2. Table for Antenna Configuration:

For CDD

Operating Mode TX Mode	1TX	2TX
802.11b	V (Ant. 1 or Ant. 2)	V (Ant. 1 + Ant. 2)
802.11g	V (Ant. 1 or Ant. 2)	V (Ant. 1 + Ant. 2)
802.11n(20 MHz)	V (Ant. 1 or Ant. 2)	V (Ant. 1 + Ant. 2)
802.11n(40 MHz)	V (Ant. 1 or Ant. 2)	V (Ant. 1 + Ant. 2)
802.11ac(20 MHz)	V (Ant. 1 or Ant. 2)	V (Ant. 1 + Ant. 2)
802.11ac(40 MHz)	V (Ant. 1 or Ant. 2)	V (Ant. 1 + Ant. 2)

For Beamforming

Operating Mode TX Mode	2TX
802.11b	V (Ant. 1 + Ant. 2)
802.11g	V (Ant. 1 + Ant. 2)
802.11n(20 MHz)	V (Ant. 1 + Ant. 2)
802.11n(40 MHz)	V (Ant. 1 + Ant. 2)
802.11ac(20 MHz)	V (Ant. 1 + Ant. 2)
802.11ac(40 MHz)	V (Ant. 1 + Ant. 2)

For 5G

1. Antenna Specification:

Ant.	Brand	Model Name	Antenna Type	Connector	Gain (dBi)	Note
1		N/A	PCB	N/A	4.9	N/A
2		N/A	PCB	N/A	6	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:

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

that is Directional gain = $10\log[(10^{4.56/20} + 10^{4.39/20})^2 / 2] \text{dBi} = 8.48$;

Then, the UNII-1, UNII-3 output power limit is $30 - (8.48 - 6) = 27.52$,

the UNII-2A, UNII-2C output power limit is $24 - (8.48 - 6) = 21.52$.

The UNII-1 power spectral density limit is $17 - (8.48 - 6) = 14.52$,

the UNII-2A, UNII-2C power spectral density limit is $11 - (8.48 - 6) = 8.52$,

the UNII-3 power spectral density limit is $30 - (8.48 - 6) = 27.52$.

2.) CDD:

For power spectral density measurements, the Directional gain = $10\log[(10^{G1/20} + 10^{G2/20} + \dots + 10^{GN/20})^2 / N_{ANT}] \text{dBi}$, that is Directional gain = $10\log[(10^{4.56/20} + 10^{4.39/20})^2 / 2] \text{dBi} = 8.48$;

Then, the UNII-1 power spectral density limited is $17 - (8.48 - 6) = 14.52$,

the UNII-2A, UNII-2C power spectral density limit is $11 - (8.48 - 6) = 8.52$,

the UNII-3 power spectral density limit is $30 - (8.48 - 6) = 27.52$.

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 = 6.

2. Table for Antenna Configuration:

For CDD

Operating Mode	TX Mode	1TX	2TX
IEEE 802.11a		V (Ant. 1 / Ant. 2)	V (Ant. 1 + Ant. 2)
IEEE 802.11n (HT20)		V (Ant. 1 / Ant. 2)	V (Ant. 1 + Ant. 2)
IEEE 802.11n (HT40)		V (Ant. 1 / Ant. 2)	V (Ant. 1 + Ant. 2)
IEEE 802.11ac (VHT20)		V (Ant. 1 / Ant. 2)	V (Ant. 1 + Ant. 2)
IEEE 802.11ac (VHT40)		V (Ant. 1 / Ant. 2)	V (Ant. 1 + Ant. 2)
IEEE 802.11ac (VHT80)		V (Ant. 1 / Ant. 2)	V (Ant. 1 + Ant. 2)

For Beamforming

Operating Mode	TX Mode	2TX
IEEE 802.11a		V (Ant. 1 + Ant. 2)
IEEE 802.11n (HT20)		V (Ant. 1 + Ant. 2)
IEEE 802.11n (HT40)		V (Ant. 1 + Ant. 2)
IEEE 802.11ac (VHT20)		V (Ant. 1 + Ant. 2)
IEEE 802.11ac (VHT40)		V (Ant. 1 + Ant. 2)
IEEE 802.11ac (VHT80)		V (Ant. 1 + Ant. 2)

2. TEST RESULTS

For BLE:

Directional gain (dBi)	Directional Gain (numeric)	Max. Output Power (dBm)	Max. Output Power (mW)	Power Density (S) (mW/cm ²)	Limit of Power Density (S) (mW/cm ²)	Test Result
2.3	1.69820	5.5	3.5481	0.00110	1	Complies

For 2.4GHz CDD:

Directional gain (dBi)	Directional Gain (numeric)	Max. Output Power (dBm)	Max. Output Power (mW)	Power Density (S) (mW/cm ²)	Limit of Power Density (S) (mW/cm ²)	Test Result
4.6	2.8840	28	630.9573	0.32840	1	Complies

For 2.4GHz With Beamforming:

Directional gain (dBi)	Directional Gain (numeric)	Max. Output Power (dBm)	Max. Output Power (mW)	Power Density (S) (mW/cm ²)	Limit of Power Density (S) (mW/cm ²)	Test Result
6.71	4.6881	27.5	562.3413	0.47570	1	Complies

For 5GHz UNII-1 CDD:

Directional gain (dBi)	Directional Gain (numeric)	Max. Output Power (dBm)	Max. Output Power (mW)	Power Density (S) (mW/cm ²)	Limit of Power Density (S) (mW/cm ²)	Test Result
6	3.9811	26	398.1072	0.28600	1	Complies

For 5GHz With Beamforming:

Directional gain (dBi)	Directional Gain (numeric)	Max. Output Power (dBm)	Max. Output Power (mW)	Power Density (S) (mW/cm ²)	Limit of Power Density (S) (mW/cm ²)	Test Result
8.48	7.0469	25.5	354.8134	0.45120	1	Complies

For the max simultaneous transmission MPE:

Power Density (S) (mW/cm ²)	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	BLE			
0.4757	0.4512	0.0011	0.928	1	Complies

Note:

(1) The evaluated distance is 21cm.

End of Test Report