

FCC RF EXPOSURE REPORT

FCC ID: T58N4R

Project No. : 1809T061
Equipment : AC1200 Wireless Daul Band Router
Model : N4, N4D
Applicant : Netis systems Co., Ltd.
Address : Building 6, IC Park, Baolong 4th Road, Baolong
Street, Longgang District, Shenzhen, China, 518116
Exposure category : General population/uncontrolled environment
EUT Type: : Production Unit (Engineer Sample)
Device Type : Mobile Device

B T L I N C .

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REPORT ISSUED HISTORY

Report Version	Description	Issued Date
R00	Original Issue.	Oct. 31, 2018
R01	Revised report to address TCB's comments.	Dec. 21, 2018
R02	Revised report to address TCB's comments.	Dec. 27, 2018

1. Evaluation Method

Systems operating under the provisions of FCC 47 CFR section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy level in excess of the Commission’s guidelines.

In accordance with 47 CFR FCC Part 2 Subpart J, section 2.1091 this device has been defined as mobile device whereby a distance of 0.2m normally can be maintained between the user and the device, and below RF Permissible Exposure limit shall comply with.

In accordance with KDB447498D01 for Simultaneous transmission MPE test exclusion applies when the sum of the MPE ratios for all simultaneous transmitting antennas incorporated in a host device, based on the calculated/estimated, numerically modeled or measured field strengths or power density, is ≤ 1.0 . The MPE ratio of each antenna is determined at the minimum test separation distance required by the operating configurations and exposure conditions of the host device, according to the ratio of field strengths or power density to MPE limit, at the test frequency. Either the maximum peak or spatially averaged results from measurements or numerical simulations may be used to determine the MPE ratios. Spatial averaging does not apply when MPE is estimated using simple calculations based on far-field plane-wave equivalent conditions. The antenna installation and operating requirements for the host device must meet the minimum test separation distances required by all antennas, in both standalone and simultaneous transmission operations, to satisfy compliance.

2. Limits for General Population/Uncontrolled Exposure

(B) Limits for General Population / Uncontrolled Exposure

Frequency Range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (H) (A/m)	Power Density (S) (mW/cm ²)	Averaging Time E ² , H ² or S (minutes)
0.3-1.34	614	1.63	(100)*	30
1.34-30	824/f	2.19/f	(180/f)*	30
30-300	27.5	0.073	0.2	30
300-1500			F/1500	30
1500-100,000			1.0	30

Note: f = frequency in MHz ; *Plane-wave equivalent power density

3. Refer Evaluation Method

ANSI C95.1–1999: IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz.

FCC KDB publication 447498 D01 General RF Exposure Guidance v06: Mobile and Portable Devices RF Exposure Procedures and Equipment Authorization Policies.

FCC CFR 47 part1 1.1310: Radiofrequency radiation exposure limits.

FCC CFR 47 part2 2.1091: Radiofrequency radiation exposure evaluation: Mobile devices

4. Calculation Method

Predication of MPE limit at a given distance

Equation from page 18 of OET Bulletin 65, Edition 97-01

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

Where:

S=power density

P=power input to 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

5. Conducted Power Results

5.1 Test setup



5.2 Test Equipment

Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	Power Meter	Anritsu	ML2495A	1128008	Aug. 15, 2019
2	Power Sensor	Anritsu	MA2411B	1126001	Aug. 15, 2019

Remark: all calibration period of equipment list is one year.

5.3 Test Equipment

- The EUT was directly connected to the power meter and antenna output port as show in the block diagram Test Setup.
- Setup EUT work at duty cycle more than 98%;
- Read power sensor values in RMS detector;

5.4 Test Results and Manufacturing Tolerance

Communication Type	Frequency Band (MHz)	Maximum power declared by Manufacturer	
		Antenna 1	Antenna 2
IEEE 802.11b	2412-2462	≤ 18.00	≤ 19.00
IEEE 802.11g	2412-2462	≤ 25.50	≤ 26.00
IEEE 802.11n HT20	2412-2462	≤ 25.50	≤ 25.50
IEEE 802.11n HT40	2422-2452	≤ 25.50	≤ 25.00
IEEE 802.11a	5180-5240	≤ 17.50	≤ 17.00
	5745-5825	≤ 15.50	≤ 15.50
IEEE 802.11n HT20	5180-5240	≤ 17.50	≤ 16.50
	5745-5825	≤ 15.50	≤ 15.50
IEEE 802.11n HT40	5190-5230	≤ 18.00	≤ 17.50
	5755-5795	≤ 16.00	≤ 16.50
IEEE 802.11ac VHT20	5180-5240	≤ 17.50	≤ 16.50
	5745-5825	≤ 15.50	≤ 15.50
IEEE 802.11ac VHT40	5190-5230	≤ 18.50	≤ 17.50
	5755-5795	≤ 16.00	≤ 16.50
IEEE 802.11ac VHT80	5210	≤ 12.00	≤ 11.00
	5775	≤ 15.50	≤ 15.50

6. Antenna Information

Antenna	Manufacturer	Model Name	Antenna Type	Connector	Maximum Gain (dBi)
Antenna 1	RF Link	RF21C03631A	Dipole	IPEX	3.00
Antenna 2	RF Link	RF21C03631A	Dipole	IPEX	3.00

7. Evaluation Results

7.1 Standalone

[2.4GHz]

Antenna 1

Mode	Output power		Antenna Gain (dBi)	Antenna Gain (linear)	Duty Cycle	MPE (mW/cm ²)	MPE Limits (mW/cm ²)
	(dBm)	(mW)					
IEEE 802.11b	18.00	63.0957	3.00	1.9953	100%	0.0251	1.0000
IEEE 802.11g	25.50	354.8134	3.00	1.9953	100%	0.1409	1.0000
IEEE 802.11n HT20	25.50	354.8134	3.00	1.9953	100%	0.1409	1.0000
IEEE 802.11n HT40	25.50	354.8134	3.00	1.9953	100%	0.1409	1.0000

Antenna 2

Mode	Output power		Antenna Gain (dBi)	Antenna Gain (linear)	Duty Cycle	MPE (mW/cm ²)	MPE Limits (mW/cm ²)
	(dBm)	(mW)					
IEEE 802.11b	19.00	79.4328	3.00	1.9953	100%	0.0315	1.0000
IEEE 802.11g	26.00	398.1072	3.00	1.9953	100%	0.1581	1.0000
IEEE 802.11n HT20	25.50	354.8134	3.00	1.9953	100%	0.1409	1.0000
IEEE 802.11n HT40	25.50	354.8134	3.00	1.9953	100%	0.1409	1.0000

[5GHz Band 1]

Antenna 1

Mode	Output power		Antenna Gain (dBi)	Antenna Gain (linear)	Duty Cycle	MPE (mW/cm ²)	MPE Limits (mW/cm ²)
	(dBm)	(mW)					
IEEE 802.11a	17.50	56.2341	3.00	1.9953	100%	0.0223	1.0000
IEEE 802.11n HT20	17.50	56.2341	3.00	1.9953	100%	0.0223	1.0000
IEEE 802.11n HT40	18.00	63.0957	3.00	1.9953	100%	0.0251	1.0000
IEEE 802.11ac VHT20	17.50	56.2341	3.00	1.9953	100%	0.0223	1.0000
IEEE 802.11ac VHT40	18.50	70.7946	3.00	1.9953	100%	0.0281	1.0000
IEEE 802.11ac VHT80	12.00	15.8489	3.00	1.9953	100%	0.0063	1.0000

Antenna 2

Mode	Output power		Antenna Gain (dBi)	Antenna Gain (linear)	Duty Cycle	MPE (mW/cm ²)	MPE Limits (mW/cm ²)
	(dBm)	(mW)					
IEEE 802.11a	17.00	50.1187	3.00	1.9953	100%	0.0199	1.0000
IEEE 802.11n HT20	16.50	44.6684	3.00	1.9953	100%	0.0177	1.0000
IEEE 802.11n HT40	17.50	56.2341	3.00	1.9953	100%	0.0223	1.0000
IEEE 802.11ac VHT20	16.50	44.6684	3.00	1.9953	100%	0.0177	1.0000
IEEE 802.11ac VHT40	17.50	56.2341	3.00	1.9953	100%	0.0223	1.0000
IEEE 802.11ac VHT80	11.00	12.5893	3.00	1.9953	100%	0.0050	1.0000

[5GHz Band 4]

Antenna 1

Mode	Output power		Antenna Gain (dBi)	Antenna Gain (linear)	Duty Cycle	MPE (mW/cm ²)	MPE Limits (mW/cm ²)
	(dBm)	(mW)					
IEEE 802.11a	15.50	35.4813	3.00	1.9953	100%	0.0141	1.0000
IEEE 802.11n HT20	15.50	35.4813	3.00	1.9953	100%	0.0141	1.0000
IEEE 802.11n HT40	16.00	39.8107	3.00	1.9953	100%	0.0158	1.0000
IEEE 802.11ac VHT20	15.50	35.4813	3.00	1.9953	100%	0.0141	1.0000
IEEE 802.11ac VHT40	16.00	39.8107	3.00	1.9953	100%	0.0158	1.0000
IEEE 802.11ac VHT80	15.50	35.4813	3.00	1.9953	100%	0.0141	1.0000

Antenna 2

Mode	Output power		Antenna Gain (dBi)	Antenna Gain (linear)	Duty Cycle	MPE (mW/cm ²)	MPE Limits (mW/cm ²)
	(dBm)	(mW)					
IEEE 802.11a	15.50	35.4813	3.00	1.9953	100%	0.0141	1.0000
IEEE 802.11n HT20	15.50	35.4813	3.00	1.9953	100%	0.0141	1.0000
IEEE 802.11n HT40	16.50	44.6684	3.00	1.9953	100%	0.0177	1.0000
IEEE 802.11ac VHT20	15.50	35.4813	3.00	1.9953	100%	0.0141	1.0000
IEEE 802.11ac VHT40	16.50	44.6684	3.00	1.9953	100%	0.0177	1.0000
IEEE 802.11ac VHT80	15.50	35.4813	3.00	1.9953	100%	0.0141	1.0000

Remark:

1. Maximum power including tune-up tolerance;
2. EIRP including tune-up tolerance;
3. MPE use distance is 20 cm from manufacturer declaration of user manual.

7.2 Simultaneous Transmission for MPE Exclusion

The sample support two WLAN modular, 2T2R MIMO antennas for 2.4GHz and 2T2R MIMO for 5GHz, 2.4GHz and 5GHz share same antennas, no need consider simultaneous transmission for 2.4GHz and 5GHz;

Antenna 1 and Antenna 2 for 2.4GWLAN

Band	Mode	MPE Ratio	MPE Ratio	\sum MPE ratios	Limit	Results
		Antenna 1	Antenna 2			
2.4G	IEEE 802.11b	0.0251	0.0315	< 0.1	1.0	PASS
	IEEE 802.11g	0.1409	0.1581	< 0.3	1.0	PASS
	IEEE 802.11n HT20	0.1409	0.1409	< 0.3	1.0	PASS
	IEEE 802.11n HT40	0.1409	0.1409	< 0.3	1.0	PASS

Antenna 1 and Antenna 2 for 5GWLAN Band 1

Band	Mode	MPE Ratio	MPE Ratio	\sum MPE ratios	Limit	Results
		Antenna 1	Antenna 2			
5G	IEEE 802.11a	0.0223	0.0199	< 0.1	1.0	PASS
	IEEE 802.11n HT20	0.0223	0.0177	< 0.1	1.0	PASS
	IEEE 802.11n HT40	0.0251	0.0223	< 0.1	1.0	PASS
	IEEE 802.11ac VHT20	0.0223	0.0177	< 0.1	1.0	PASS
	IEEE 802.11ac VHT40	0.0281	0.0223	< 0.1	1.0	PASS
	IEEE 802.11ac VHT80	0.0063	0.0050	< 0.1	1.0	PASS

Antenna 1 and Antenna 2 for 5GWLAN Band 3

Band	Mode	MPE Ratio	MPE Ratio	\sum MPE ratios	Limit	Results
		Antenna 1	Antenna 2			
5G	IEEE 802.11a	0.0141	0.0141	< 0.1	1.0	PASS
	IEEE 802.11n HT20	0.0141	0.0141	< 0.1	1.0	PASS
	IEEE 802.11n HT40	0.0158	0.0177	< 0.1	1.0	PASS
	IEEE 802.11ac VHT20	0.0141	0.0141	< 0.1	1.0	PASS
	IEEE 802.11ac VHT40	0.0158	0.0177	< 0.1	1.0	PASS
	IEEE 802.11ac VHT80	0.0141	0.0141	< 0.1	1.0	PASS

Remark:

1. Maximum power including tune-up tolerance;
2. EIRP including tune-up tolerance;
3. MPE use distance is 20 cm from manufacturer declaration of user manual.

8. Conclusion

The measurement results comply with the FCC Limit per 47 CFR 2.1093 for the uncontrolled RF Exposure and SAR Exclusion Threshold per KDB 447498 v06