FCC Maximum Permissible Exposure(MPE) Estimation Report

Product Name: 1200Mbps Wireless Router

Model: WS5200 V2

Report No.: SYBH(Z-SAR)20190823019001-2

FCC ID: QISWS5200V2

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1. The laboratory has passed the accreditation by China National Accreditation Service for Conformity Assessment (CNAS). The accreditation number is L0310.
2. The laboratory has passed the accreditation by The American Association for Laboratory Accreditation (A2LA). The accreditation number is 2174.01 & 2174.02 & 2174.03
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※ ※ **Modified History** ※ ※

REV.	DESCRIPTION	ISSUED DATE	REMARK
Rev.1.0	Initial Test Report Release	2019-09-24	Zhang Zufu

Table of Contents

1 EUT Description 5

1.1 General Description 6

2 Test specification(s) 7

3 Testing laboratory 7

4 Applicant and Manufacturer 7

5 Application details 7

6 Ambient Condition 7

7 RF Exposure Requirements 8

7.1 FCC MPE Limits 9

8 RF Exposure Evaluation (FCC) 10

8.1 Calculation of Power Density for Single Chain Transmitters 10

9 Exposure calculations for multiple sources (FCC) 11

9.1 Calculation of WiFi MIMO Transmitters 12

9.2 Calculation of Co-located Transmitters 12

1 EUT Description

Device Information：			
Product Name :	1200Mbps Wireless Router		
Model :	WS5200 V2		
FCC ID:	QISWS5200V2		
Device Type :	Mobile Device		
Device Phase:	Identical Prototype		
Exposure Category:	Uncontrolled environment/general population		
Hardware Version :	AM1WS5200V2M1		
Software Version :	10.0.2.7		
Antenna Type :	External Antenna		
Device Operating Configurations:			
Supporting Mode(s)	WiFi 2.4G/5G		
Test Modulation	WiFi(DSSS/OFDM)		
Operating Frequency Range(s)	Band	Tx (MHz)	Rx (MHz)
	WiFi 2.4G	2402-2472	2402-2472
	WiFi 5G	5150-5250 5725-5850	5150-5250 5725-5850

1.1 General Description

The WS5200 V2 is a high-speed wireless router designed for homes and small offices. Complies with 802.11b/g/n/a/ac multiple-input multiple-output (MIMO) technology and provides 4 external high-gain antennas. This enhances wireless performance, improves wireless signal stability, increases wireless network range, provide a transmission rate of up to 1200 Mbps.

2 Test specification(s)

ANSI Std C95.1-1992	Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz – 300 GHz.(IEEE Std C95.1-1991)
KDB 447498 D01	General RF Exposure Guidance v06

3 Testing laboratory

Test Site	Reliability Laboratory of Huawei Technologies Co., Ltd.
Test Location	NO.2 New City Avenue Songshan Lake Sci. & Tech. Industry Park, Dongguan, Guangdong, P.R.C
Telephone	+86 769 23830808
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State of accreditation	The Test laboratory (area of testing) is accredited according to ISO/IEC 17025. CNAS Registration number: L0310 A2LA TESTING CERT #2174.01 & 2174.02 & 2174.03

4 Applicant and Manufacturer

Company Name	HUAWEI TECHNOLOGIES CO., LTD
Address	Administration Building, Headquarters of Huawei Technologies Co., Ltd., Bantian, Longgang District, Shenzhen, 518129, P.R.C

5 Application details

Start Date of test	2019-09-24
End Date of test	2019-09-24

6 Ambient Condition

Ambient temperature	18°C – 25°C
Relative Humidity	30% – 70%

7 RF Exposure Requirements

An estimation of MPE in this application for product is used to ensure if it complies with the rules of the standard in the regulation list above.

Maximum permissible exposure (MPE) refers to the RF energy that is acceptable for human exposure. It is broken down into two categories, Occupational/controlled and General population/uncontrolled.

Occupational/controlled limits apply in situations in which persons are exposed as a consequence of their employment provided those persons are fully aware of the potential for exposure and can exercise control over their exposure. Limits for occupational/controlled exposure also apply in situations when an individual is transient through a location where occupational/controlled limits apply provided he or she is made aware of the potential for exposure.

General population/uncontrolled exposures apply in situations in which the general public may be exposed, or in which persons that are exposed as a consequence of their employment may not be fully aware of the potential for exposure or cannot exercise control over their exposure.

A rough estimation of the expected exposure in power flux density on a given point can be made with the following equation:

$$S = \frac{P \times G}{4 \times \pi \times R^2}$$

Where:

S = power density

P = power input to the antenna

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

R= distance to the centre of radiation of the antenna

EIRP = P*G

The antenna of the product, under normal use condition is at least 20 cm away from the

body of the user. Warning statement to the user for keeping at least 20cm separation distance and the prohibition of operating to a person has been printed on the user's manual. Therefore, the S of the device is calculated with R=20cm, and if it is below the limit S, then we can conclude the device complies with the rules.

7.1 FCC MPE Limits

We analysis if it comply with the limits for General population/uncontrolled exposure. The FCC MPE limits for field strength and power density are given in 47CFR 1.1310(Table below).These limits are generally based on recommended exposure guidelines published by the National Council on Radiation Protection and Measurements (NCRP), and also partly based on guidelines recommended by the American National Standards Institute (ANSI) in Section 4.1 of ANSI/IEEE C95.1.

Table: Limits for Maximum Permissible Exposure (MPE)

(A) Limits for Occupational/controlled Exposure				
Frequency Range(MHz)	Electric Field Strength(E)(V/m)	Magnetic Field Strength(H)(A/m)	Power Density (S)(mW/cm^2)	Averaging Time (minute)|E|^2,|H|^2 or S
0.3-3.0	614	1.63	(100)*	6
3.0-30	1842/f	4.89/f	(900/f^2)*	6
30-300	61.4	0.163	1.0	6
300-1500	--	--	f/300	6
1500-100,000	--	--	5	6
(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 (minute)|E|^2,|H|^2 or S
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
f=frequency in MHz			*Plane-wave equivalent power density	

8 RF Exposure Evaluation (FCC)

8.1 Calculation of Power Density for Single Chain Transmitters

Band	Antenna	Tune-up Power (dBm)	Gain (dBi)	EIRP (dBm)	EIRP (W)	R (m)	S (W/m^2)	Limit (W/m^2)	% of limit
WiFi 2.4G	External Ant 1	20.0	4.0	24.0	251.2	20	0.050	1.000	5.00%
	External Ant 2	20.0	4.0	24.0	251.2	20	0.050	1.000	5.00%
WiFi 5G	External Ant 3	22.0	4.0	26.0	398.1	20	0.079	1.000	7.92%
	External Ant 4	22.0	4.0	26.0	398.1	20	0.079	1.000	**7.92%**

Note:*- based on the maximum tune-up tolerance limit declared by manufacturer

According to the table above, we can conclude that the limit percentage of above supporting frequency bands calculation results are less than 1, therefore, the product meets the requirements.

9 Exposure calculations for multiple sources (FCC)

When a number of sources at different frequencies, and/or broadband sources, contribute to the total exposure, it becomes necessary to weigh each contribution relative to the MPE in accordance with the provisions of Table (A) and Table (B). To comply with the MPE, the fraction of the MPE in terms of E^2, H^2 (or power density) incurred within each frequency interval should be determined and the sum of all such fractions should not exceed unity.

In order to ensure compliance with the MPE for a controlled environment, the sum of the ratios of the power density to the corresponding MPE should not exceed unity. That is

$$\sum_{i=1}^{n} \frac{S_i}{MPE_i} \leq 1$$

The product also has multiple transmitters The Simultaneous Transmission Possibilities are as below:

No.	Simultaneous Tx Combination
1	WiFi 2.4G MIMO
2	WiFi 5G MIMO
3	WiFi 2.4G + WiFi 5G

Note: There are four WiFi antennas. Ant1 and Ant2 support WiFi 2.4G. Ant3 and Ant4 support WiFi 5G.WiFi 2.4G and WiFi 5G can work at the same time.

9.1 Calculation of WiFi MIMO Transmitters

Band	Antenna	Tune-up Power (dBm)	Gain (dBi)	EIRP (dBm)	EIRP (W)	R (m)	S (W/m^2)	Limit (W/m^2)	%of limit	Total Exposure ratio (<1)
WiFi 2.4G 2*2 MIMO	External Ant 1	20.0	4.0	24.0	251.2	20	0.050	1.000	5.00%	10.00%
	External Ant 2	20.0	4.0	24.0	251.2	20	0.050	1.000	5.00%	
WiFi 5G 2*2 MIMO	External Ant 3	22.0	4.0	26.0	398.1	20	0.079	1.000	7.92%	**15.84%**
	External Ant 4	22.0	4.0	26.0	398.1	20	0.079	1.000	7.92%	

9.2 Calculation of Co-located Transmitters

NO.	Simultaneous Conditions	Max. PD Mode/Band	% of limit	Total exposure ratio (<1)
1	WiFi 2.4G + WiFi 5G	WiFi 2.4G MIMO	10.00%	**25.84%**
		WiFi 5G MIMO	15.84%	

According to the Table above, we can conclude that the calculation results of all simultaneous transmission possibilities are less than 1, so it is into compliance.

Therefore the product also meets the requirements under multiple sources condition.

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