Maximum Permissible Exposure(MPE) Estimation Report

Product Name: 3000Mbps Wi-Fi 6 Router

Model: WS7100

Report No.: SYBH(Z-SAR) 20210422005001

FCC ID: 2ATEYWS7100

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Date	Name	Signature

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※ ※ **Notice** ※ ※

1. The laboratory has passed the accreditation by The American Association for Laboratory Accreditation (A2LA). The accreditation number is 2174.01 & 2174.02 & 2174.03

2. The laboratory (Reliability Lab of Huawei Technologies Co., Ltd) is also named as "Global Compliance and Testing Center of Huawei Technologies Co., Ltd", the both names have coexisted since 2009.

3. The test report is invalid if not marked with the signatures of the persons responsible for preparing and approving the test report.

4. The test report is invalid if there is any evidence of erasure and/or falsification.

5. The test report is only valid for the test samples.

6. Content of the test report, in part or in full, cannot be used for publicity and/or promotional purposes without prior written approval from the laboratory.

7. If any question about this report, please contact the laboratory (PublicGCTC@huawei.com).

※ ※ **Modified History** ※ ※

REV.	DESCRIPTION	ISSUED DATE	REMARK
Rev.1.0	Initial Test Report Release	2021-06-01	Liu Yonghong

Table of Contents

1 EUT Description

Device Information：	
Product Name :	3000Mbps Wi-Fi 6 Router
Model :	WS7100
Device Type :	Mobile Device
Device Phase:	Identical Prototype
Exposure Category:	Uncontrolled environment/general population
Hardware Version :	AM1WS7100M
Software Version :	10.0.5.26
Antenna Type :	External Antenna

Device Operating Configurations:			
Test Modulation	WiFi (DSSS/OFDM)		
Operating Frequency Range(s)	Band	Tx (MHz)	Rx (MHz)
	WiFi 2.4G	2400-2483.5	2400-2483.5
	WiFi 5G	5170-5250 5725-5850	5170-5250 5725-5850

1.1 General Description

The WS7100 is a high-speed wireless router designed for homes and small offices.

Complies with 802.11b/g/n/ax(2.4 GHz, wireless rates up to 547 Mbps),802.11a/n/ac/ax(5

GHz, wireless rates up to 2402Mbps) 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 2976 Mbps.

2   Test specification(s)

IEEE C95.1:1991	Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz – 300 GHz.
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 Device Co., Ltd.
Address	No.2 of Xincheng Road, Songshan Lake Zone, Dongguan, Guangdong 523808, People's Republic of China

5   Application details

Start Date of test	2021-06-01
End Date of test	2021-06-01

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

8.1   Calculation of Power Density for Single Chain Transmitters

Band	Antenna	Tune-up Power (dBm)	Gain (dBi)	EIRP (dBm)	EIRP (mW)	R (cm)	S (mW/cm2)	Limit (mW/cm2)	% of limit
WiFi 2.4G	Ant 1	24.00	5.00	29.00	794.33	20.00	0.16	1.00	15.81%
WiFi 2.4G	Ant 2	24.50	5.00	29.00	794.33	20.00	0.16	1.00	15.81%
WiFi 5G	Ant 3	20.50	5.50	26.00	398.11	20.00	0.08	1.00	7.92%
WiFi 5G	Ant 4	20.50	5.50	26.00	398.11	20.00	0.08	1.00	7.92%

According to the power density calculations with a distance from the point to the antenna 20cm above, all values meet the limit specified in section 7, so it is into compliance.

9 Exposure calculations for multiple sources

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 SISO/MIMO + WiFi 5G SISO/MIMO

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 (mW)	R (cm)	S (mW/cm2)	Limit (mW/cm2)	% of limit
WiFi 2.4G MIMO	ANT 1 +ANT 2	24.00	5.00	29.00	794.33	20.00	0.16	1.00	15.81%
WiFi 5G MIMO	ANT 3 +ANT 4	20.50	5.50	26.00	398.11	20.00	0.08	1.00	7.92%

According to the power density calculations with a distance from the point to the antenna 20cm above, all values meet the limit specified in section 7, so it is into compliance.

9.2 Calculation of Co-located Transmitters

NO.	Simultaneous Conditions	Max. PD Mode/Band	% of limit	Total exposure ratio (<1)
1	WiFi 2.4G SISO/MIMO + WiFi 5G SISO/MIMO	WiFi 2.4G SISO/MIMO	15.81%	**23.73%**
		WiFi 5G SISO/MIMO	7.92%	

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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