



RADIO EXPOSURE TEST REPORT

FCC ID : MSQ-RTAX5P00

Equipment : AX1800 Dual Band WiFi Router

Brand Name : ASUS

Model Name : XD4S, ZenWiFi XD4S

Applicant : ASUSTeK COMPUTER INC.
1F., No. 15, Lide Rd., Beitou, Taipei City 112, Taiwan

Manufacturer (1) : Shenzhen Gongjin Electronics Co., Ltd. (ID No.: 102875)
No.2 Danzi North Road, Kengzi Street, Pingshan District, 518118 Shenzhen, Guangdong, PEOPLE'S REPUBLIC OF CHINA

Manufacturer (2) : GONGJIN ELECTRONICS (VIETNAM) COMPANY LIMITED (ID No.: 108155)
Factory No.31 & 32, An Duong Industrial Zone, Hong Phong Commune, 04415 An Duong District, Hai Phong, VIETNAM

Standard : 47 CFR Part 2.1091

The product was received on May 16, 2022, and testing was started from Jun. 07, 2022 and completed on Jul. 14, 2022. We, Sporton International Inc. Hsinchu Laboratory, would like to declare that the tested sample has been evaluated in accordance with the procedures given in 47 CFR Part 2.1091 and shown compliance with the applicable technical standards.

The test results in this report apply exclusively to the tested model / sample. Without written approval of Sporton International Inc. Hsinchu Laboratory, the test report shall not be reproduced except in full.


Approved by: Sam Chen

Sporton International Inc. Hsinchu Laboratory

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Photographs of EUT v01



History of this test report

TEL : 886-3-656-9065
FAX : 886-3-656-9085
Report Template No.: CB-A1_1 Ver1.1

Page Number : 3 of 11
Issued Date : Jul. 25, 2022
Report Version : 01



Summary of Test Result

Report Clause	Ref Std. Clause	Test Items	Result (PASS/FAIL)	Remark
2	-	Exposure evaluation	PASS	-

Declaration of Conformity:

1. The test results with all measurement uncertainty excluded are presented in accordance with the regulation limits or requirements declared by manufacturers. It's means measurement values may risk exceeding the limit of regulation standards, if measurement uncertainty is include in test results.
2. The measurement uncertainty please refer to report "Measurement Uncertainty".

Comments and Explanations:

The declared of product specification for EUT presented in the report are provided by the manufacturer, and the manufacturer takes all the responsibilities for the accuracy of product specification.

Reviewed by: Sam Chen

Report Producer: Viola Huang



1 General Description

1.1 EUT General Information

RF General Information			
Evaluation Mode	Frequency Range (MHz)	Operating Frequency (MHz)	Modulation Type
2.4GHz WLAN	2400-2483.5	2412-2462	802.11b: DSSS (DBPSK, DQPSK, CCK) 802.11g/n: OFDM (BPSK, QPSK, 16QAM, 64QAM) VHT: OFDM (BPSK, QPSK, 16QAM, 64QAM, 256QAM, 1024QAM) 802.11ax: OFDMA (BPSK, QPSK, 16QAM, 64QAM, 256QAM, 1024QAM)
5GHz WLAN	5150-5250 5725-5850	5180-5240 5745-5825	802.11a/n: OFDM (BPSK, QPSK, 16QAM, 64QAM) 802.11ac: OFDM (BPSK, QPSK, 16QAM, 64QAM, 256QAM, 1024QAM) 802.11ax: OFDMA (BPSK, QPSK, 16QAM, 64QAM, 256QAM, 1024QAM)

1.2 Antenna Information

Ant.	Port	Brand	Model Name	Antenna Type	Connector	Gain (dBi)
1	1	T&W	EmP323h-B+D6	PCB Antenna	I-PEX	Note 1
2	2	T&W	EmP323-B	PCB Antenna	I-PEX	

Note 1:

Ant.	Antenna Gain (dBi)				
	2.4GHz	UNII 1	UNII 2A	UNII 2C	UNII 3
1	3.30	3.05	3.41	3.49	3.51
2	3.30	3.05	3.41	3.49	3.51

Note 2: The above information was declared by manufacturer.

Note 3: The EUT has two antennas.

Note 4: The EUT doesn't enable the DFS band at this time.

Note 5: Directional gain information

Type	Maximum Output Power	Power Spectral Density
Non-BF	Directional gain = Max.gain + array gain. For power measurements on IEEE 802.11 devices Array Gain = 0 dB (i.e., no array gain) for N ANT ≤ 4	$DirectionalGain = 10 \cdot \log \left[\frac{\sum_{j=1}^{N_{ANT}} \left(\sum_{k=1}^{N_{ANT}} g_{j,k} \right)^2}{N_{ANT}} \right]$
BF	$DirectionalGain = 10 \cdot \log \left[\frac{\sum_{j=1}^{N_{ANT}} \left(\sum_{k=1}^{N_{ANT}} g_{j,k} \right)^2}{N_{ANT}} \right]$	$DirectionalGain = 10 \cdot \log \left[\frac{\sum_{j=1}^{N_{ANT}} \left(\sum_{k=1}^{N_{ANT}} g_{j,k} \right)^2}{N_{ANT}} \right]$

Ex.

Directional Gain (NSS1) formula :

$$DirectionalGain = 10 \cdot \log \left[\frac{\sum_{j=1}^{N_{ANT}} \left(\sum_{k=1}^{N_{ANT}} g_{j,k} \right)^2}{N_{ANT}} \right]$$

$$NSS1(g1,1) = 10^{G1/20} ; NSS1(g1,2) = 10^{G2/20} ; g_{j,k} = (NSS1(g1,1) + NSS1(g1,2) +)^2$$

$$DG = 10 \log[(NSS1(g1,1) + NSS1(g1,2))^2 / N_{ANT}] \Rightarrow 10 \log[(10^{G1/20} + 10^{G2/20})^2 / N_{ANT}]$$

Where ;

$$G1 = 10 ; G2 = 10 ; G3 = 10 ; G4 = 10 ;$$

$$2.4 \text{ GHz } G1 = 3.30 \text{ dBi} ; G2 = 3.30 \text{ dBi} ; DG = 6.31 \text{ dBi}$$

$$5 \text{ GHz Band1 } G1 = 3.05 \text{ dBi} ; G2 = 3.05 \text{ dBi} ; DG = 6.06 \text{ dBi}$$

$$5 \text{ GHz Band2 } G1 = 3.41 \text{ dBi} ; G2 = 3.41 \text{ dBi} ; DG = 6.42 \text{ dBi}$$

$$5 \text{ GHz Band3 } G1 = 3.49 \text{ dBi} ; G2 = 3.49 \text{ dBi} ; DG = 6.50 \text{ dBi}$$

$$5 \text{ GHz Band4 } G1 = 3.51 \text{ dBi} ; G2 = 3.51 \text{ dBi} ; DG = 6.52 \text{ dBi}$$

For 2.4GHz function:

For IEEE 802.11 b/g/n/VHT/ax mode (2TX/2RX)

Port 1 and Port 2 can be used as transmitting/receiving antenna.

Port 1 and Port 2 could transmit/receive simultaneously.

For 5GHz function:

For IEEE 802.11a/n/ac/ax mode (2TX/2RX)

Port 1 and Port 2 can be used as transmitting/receiving antenna.

Port 1 and Port 2 could transmit/receive simultaneously.



1.3 Table for Multiple Listing

Model Name	Description
XD4S	All the models are identical, the different model names served as marketing strategy.
ZenWiFi XD4S	

Note 1: From the above models, model: XD4S was selected as representative model for the test and its data was recorded in this report.

Note 2: The EUT has two colors for housing (White and Black). The white EUT was selected to execute the testing.

Note 3: The above information was declared by manufacturer.

1.4 Table for EUT supports function

Function	Remark
AP Router	Support 2.4GHz/5GHz
Mesh	Support 5GHz

1.5 Accessories

Accessories				
Equipment Name	Brand Name	Model Name	Color	Rating
Adapter 1	T&W	S18Y1X-120A150-C4	Black	INPUT: 100-240V ~ 50/60Hz, 0.6A OUTPUT: 12.0V, 1.5A 18.0W
Adapter 2	T&W	S18Y1X-120A150-C4	White	INPUT: 100-240V ~ 50/60Hz, 0.6A OUTPUT: 12.0V, 1.5A 18.0W
Adapter 3	Ruide	RD1201500-C55-198MG	White	INPUT: 100-240V ~ 50/60Hz, 0.6A OUTPUT: 12V, 1.5A
Others				
RJ-45 cable 1*1, Brand: EJE, Model: 902-0A11686, color: Black, non shielded, 1m				
RJ-45 cable 2*1, Brand: EJE, Model: 902-0A11698, color: White, non shielded, 1m				

Note:

1. The difference between Adapter 1 & Adapter 2 is only color. The Adapter 1 was selected to execute all items test.
2. The difference between RJ-45 cable 1 & RJ-45 cable 2 is only color. The RJ-45 cable 2 was selected to execute all items test excepting AC Power-line Conducted Emissions. The RJ-45 cable 1 was selected to execute AC Power-line Conducted Emissions test.



1.6 Applicable Standards

According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

- ♦ 47 CFR Part 2.1091
- ♦ KDB 447498 D04 Interim General RF Exposure Guidance v01

The following reference test guidance is not within the scope of accreditation of TAF.

- ♦ 47 CFR Part 1.1307
- ♦ 47 CFR Part 1.1310

1.7 Testing Location

Testing Location Information	
Test Lab. : Sporton International Inc. Hsinchu Laboratory	
Hsinchu	ADD: No.8, Ln. 724, Bo'ai St., Zhubei City, Hsinchu County 302010, Taiwan (R.O.C.)
(TAF: 3787)	TEL: 886-3-656-9065 FAX: 886-3-656-9085
	Test site Designation No. TW3787 with FCC.
	Conformity Assessment Body Identifier (CABID) TW3787 with ISCED.



2 Maximum Permissible Exposure

2.1 Limit of Maximum Permissible Exposure

(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 E ² , H ² or S (minutes)
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 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 ²)	<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

2.2 MPE Calculation Method

The MPE was calculated at 51 cm to show compliance with the power density limit.

The following formula was used to calculate the Power Density:

$$E \text{ (V/m)} = \frac{\sqrt{30 \times P \times G}}{d} \quad \text{Power Density: } Pd \text{ (W/m}^2\text{)} = \frac{E^2}{377}$$

E = Electric field (V/m)

P = RF output power (W)

G = EUT Antenna numeric gain (numeric)

d = Separation distance between radiator and human body (m)

The formula can be changed to

$$Pd = \frac{30 \times P \times G}{377 \times d^2}$$



2.3 MPE Exemption

Option (A): 1.1307(b)(3)(i)(A): Available maximum time-averaged power is < 1 mW

Option (B): 1.1307(b)(3)(i)(B): Device operates between 300 MHz and 6 GHz and the maximum time-averaged power or effective radiated power (ERP), whichever is greater, <= P_{th}.

$$P_{th} \text{ (mW)} = \begin{cases} ERP_{20 \text{ cm}} (d/20 \text{ cm})^x & d \leq 20 \text{ cm} \\ ERP_{20 \text{ cm}} & 20 \text{ cm} < d \leq 40 \text{ cm} \end{cases}$$

Where

$$x = -\log_{10} \left(\frac{60}{ERP_{20 \text{ cm}} \sqrt{f}} \right) \text{ and } f \text{ is in GHz;}$$

and

$$ERP_{20 \text{ cm}} \text{ (mW)} = \begin{cases} 2040f & 0.3 \text{ GHz} \leq f < 1.5 \text{ GHz} \\ 3060 & 1.5 \text{ GHz} \leq f \leq 6 \text{ GHz} \end{cases}$$

d = the separation distance (cm);

Option (C): 1.1307(b)(3)(i)(C): ERP is below a threshold calculated based on the distance

R between the person and the antenna / radiating structure, where $R > \lambda / 2 \pi$.

Single RF Sources Subject to Routine Environmental Evaluation	
RF Source frequency (MHz)	Threshold ERP (watts)
0.3-1.34	$1,920 R^2$.
1.34-30	$3,450 R^2/f^2$.
30-300	$3.83 R^2$.
300-1,500	$0.0128 R^2 f$.
1,500-100,000	$19.2 R^2$.
Note: R is in meters, f is in MHz.	



2.4 Calculated Result and Limit

Exposure Environment: General Population / Uncontrolled Exposure

Mode	DG (dBi)	Power (dBm)	EIRP (dBm)	Tolerance (dB)	Tune-up EIRP (dBm)	Tune-up EIRP (W)	Distance (cm)	S (mW/cm ²)	S Limit (mW/cm ²)
2.4G;D1D	6.31	29.40	35.71	0.28	35.99	3.97192	51	0.12152	1.00000
5.2G;D1D	6.06	28.97	35.03	0.50	35.53	3.57273	51	0.10931	1.00000
5.8G;D1D	6.52	29.43	35.95	0.04	35.99	3.97192	51	0.12152	1.00000

Note: The above antenna gain was declared by manufacturer.

MPE Exemption Option C							
Frequency (MHz)	$\lambda/2\pi$ (m)	R (m)	Tune-up EIRP (dBm)	Tune-up ERP (dBm)	Tune-up ERP (W)	ERP Threshold (W)	MPE Exemption
2437	0.0196	0.51	35.99	33.84	2.421	4.994	Complies
5745	0.0083		35.99	33.84	2.421	4.994	Complies

Simultaneous Transmission Analysis Mode: WLAN 2.4GHz + WLAN 5GHz

Simultaneous Transmissions Option C							
Frequency (MHz)	R (m)	Tune-up EIRP (dBm)	Tune-up ERP (dBm)	Tune-up ERP (W)	ERP Threshold (W)	Simultaneous Transmissions	Simultaneous Transmissions Limit
2437	0.51	35.99	33.84	2.421	4.994	0.97	<= 1
5745		35.99	33.84	2.421	4.994		

————THE END————