

MRT Technology (Suzhou) Co., Ltd Phone: +86-512-66308358

Web: www.mrt-cert.com

Report No.: 2207RSU003-U4 Report Version: V01 Issue Date: 2022-09-02

# **RF Exposure Evaluation Declaration**

**FCC ID:** 188WX5512-T0

**Applicant:** Zyxel Communications Corporation

**Product:** AX6000 Gigabit Wireless Extender

Model No.: WX5512-T0

**Brand Name:** ZYXEL

FCC Classification: Digital Transmission System (DTS)

Unlicensed National Information Infrastructure (NII)

FCC Rule Part(s): FCC Part 2.1091

Result: Complies

Approved By:

Reviewed By:

Kevin Guo

Robin Wu

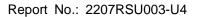
Robin Wu

Robin Wu

The test results relate only to the samples tested.

The test results shown in the test report are traceable to the national/international standards through the calibration of the equipment and evaluated measurement uncertainty herein.

The test report shall not be reproduced except in full without the written approval of MRT Technology (Suzhou) Co., Ltd.





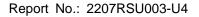
## **Revision History**

Report No.	Version	Description	Issue Date	Note
2207RSU003-U4	Rev. 01	Initial Report	2022-09-02	Valid



## **CONTENTS**

Des	cription		Page
1.	Gene	ral Information	4
	1.1.	Applicant	4
	1.2.	Manufacturer	4
	1.3.	Testing Facility	4
	1.4.	Product Information	5
	1.5.	Antenna Details	5
	1.6.	Applied Standards	6
2.		xposure Evaluation	
	2.1.	Test Limits	7
	2.2.	MPE Exemptions	8
	2.3.	Calculated Result	11





#### 1. General Information

#### 1.1. Applicant

**Zyxel Communications Corporation** 

No.2 Industry East RD.IX, Hsinchu Science Park, Hsinchu 30075, Taiwan, R.O.C

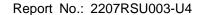
#### 1.2. Manufacturer

**Zyxel Communications Corporation** 

No.2 Industry East RD.IX, Hsinchu Science Park, Hsinchu 30075, Taiwan, R.O.C

## 1.3. Testing Facility

Test Site - MRT S	Test Site – MRT Suzhou Laboratory						
Laboratory Loca	Laboratory Location (Suzhou - Wuzhong)						
D8 Building, No.2 Tian'edang Rd., Wuzhong Economic Development Zone, Suzhou, China							
Laboratory Location (Suzhou - SIP)							
4b Building, Liand	lo U Valley, No.200	Xingpu Rd., Shengpu	ս Town, Suzhou Indu	strial Park, China			
Laboratory Accre	editations						
A2LA: 3628.01		CNAS	S: L10551				
FCC: CN1166		ISED:	CN0001				
VCCI:	□R-20025	□G-20034	□C-20020	□T-20020			
 VCCI.	□R-20141	□G-20134	□C-20103	□T-20104			
Test Site - MRT S	Shenzhen Laborat	ory					
Laboratory Loca	tion (Shenzhen)						
1G, Building A, Ju	ınxiangda Building,	Zhongshanyuan Roa	ıd West, Nanshan Di	strict, Shenzhen, China			
Laboratory Accre	editations						
A2LA: 3628.02		CNAS	: L10551				
FCC: CN1284		ISED:	CN0105				
Test Site – MRT Taiwan Laboratory							
Laboratory Loca	tion (Taiwan)						
No. 38, Fuxing 2nd Rd., Guishan Dist., Taoyuan City 333, Taiwan (R.O.C.)							
Laboratory Accre	editations						
TAF: L3261-19072	25						
FCC: 291082, TW	/3261	ISED:	TW3261				





#### 1.4. Product Information

Product Name	AX6000 Gigabit Wireless Extender	
Model No.	WX5512-T0	
Wi-Fi Specification	802.11a/b/g/n/ac/ax	
Antenna Information	Refer to section 1.5	
Working Temperature	0 ~ 40°C	
Accessory		
AC Adapter	MODEL NO.: MAUS-1201501801	
INPUT: 100-240V~50/60Hz, 0.5A		
	OUTPUT: 12V, 1.5A	

#### Remark:

The information of EUT was provided by the manufacturer, and the accuracy of the information shall be the responsibility of the manufacturer.

#### 1.5. Antenna Details

Antenna Type	Frequency	T <sub>X</sub> Paths	CDD Directional	Beamforming Gain
	(MHz)		Gain (dBi)	(dBi)
	2400 ~ 2483.5	4	5.82	5.82
	5150 ~ 5250	4	5.86	5.86
PIFA	5250 ~ 5350	4	5.86	5.86
	5470 ~ 5725	4	5.82	5.82
	5725 ~ 5850	4	5.89	5.89

#### Remark:

- 1. The antenna gain and directional gain refer to manufacturer's antenna specification.
- 2. The device supports CDD Mode and Beamforming mode, details refer to the table as below.
- 3. CDD and Beamforming signals are correlated, the directional gain as follows, the max directional gain (each angle) =  $10 \log[(10^{G1/20} + 10^{G2/20} + ... + 10^{GN/20})^2/N_{ANT}]$

Test Mode	T <sub>X</sub> Paths	CDD Mode	Beamforming Mode					
Wi-Fi 2.4G								
802.11b/g	4	V	X					
802.11n/ax	4	$\sqrt{}$	$\sqrt{}$					
Wi-Fi 5G	Wi-Fi 5G							
802.11a	4	$\sqrt{}$	X					
802.11n/ac/ax	4	$\sqrt{}$	V					

Note: "√" means "Support", "X" means "Not support".



## 1.6. Applied Standards

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

• FCC Part 2.1091 & KDB 447498 D04 Interim General RF Exposure Guidance v01



## 2. RF Exposure Evaluation

#### 2.1. Test Limits

According to FCC §1.1310: The criteria listed in the following table shall be used to evaluate the environment impact of human exposure to radio frequency (RF) radiation as specified in §1.1307(b)

Limits For Maximum Permissible Exposure (MPE)

Frequency Range	Electric Field	Magnetic Field	Power Density	Average Time				
(MHz)	Strength (V/m)	Strength (A/m)	(mW/cm <sup>2</sup> )	(Minutes)				
	(A) Limits for Occupational/ Control Exposures							
0.3-3.0	614	1.63	*(100)	≤6				
3.0-30	1842/f	4.89/f	*(900/f <sup>2</sup> )	<6				
30-300	61.4	0.163	1.0	<6				
300-1,500			f/300	<6				
1,500-100,000			5	<6				
	(B) Limits for Gen	eral Population/ Uncor	trolled Exposures					
0.3-1.34	614	1.63	*(100)	<30				
1.34-30	824/f	2.19/f	*(180/f²)	<30				
30-300	27.5	0.073	0.2	<30				
300-1,500			f/1500	<30				
1,500-100,000			1.0	<30				

f= frequency in MHz. \* = Plane-wave equivalent power density.



#### 2.2. MPE Exemptions

**For single RF sources** (i.e., any single fixed RF source, mobile device, or portable device, as defined in paragraph §1.1307(b)(2) of this section): A single RF source is exempt if:

**(Option A)** The available maximum time-averaged power is no more than 1 mW, regardless of separation distance. This exemption may not be used in conjunction with other exemption criteria other than those in paragraph §1.1307(b)(3)(ii)(A) of this section.

Medical implant devices may only use this exemption and that in paragraph §1.1307(b)(3)(ii)(A);

**(Option B)** Or the available maximum time-averaged power or effective radiated power (ERP), whichever is greater, is less than or equal to the threshold P (mW) described in the following formula. This method shall only be used at separation distances (cm) from 0.5 centimeters to 40 centimeters and at frequencies from 0.3 GHz to 6 GHz (inclusive). P is given by:

$$P th(mW) = \{ERP_{20cm}(d / 20cm)^x d \le 20cm\}$$

$$P th(mW) = \{ERP_{20cm} \text{ 20cm} < d \leq 40cm\}$$

Where

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

and

$$ERP_{20cm}(mW) = \{2040f \ 0.3GHz \le f < 1.5GHz\}$$

$$ERP_{20cm}(mW) = \{3060 \ 1.5GHz \le f \le 6GHz \}$$

(Option C) Or using Table 1 and the minimum separation distance (R in meters) from the body of a nearby person for the frequency (f in MHz) at which the source operates, the ERP (watts) is no more than the calculated value prescribed for that frequency. For the exemption in Table 1 to apply, R must be at least  $\lambda/2\pi$ , where  $\lambda$  is the free-space operating wavelength in meters. If the ERP of a single RF source is not easily obtained, then the available maximum time-averaged power may be used in lieu of ERP if the physical dimensions of the radiating structure(s) do not exceed the electrical length of  $\lambda/4$  or if the antenna gain is less than that of a half-wave dipole (1.64 linear value).



Table 1 to §1.1307(b)(3)(i)(C)	<ul> <li>Single RF Sources Sub</li> </ul>	eject to Routine Environmental Evaluation

RF Source Frequency (MHz)	Threshold ERP (watts)
0.3-1.34	1920R <sup>2</sup>
1.34-30	3450R <sup>2</sup> /f <sup>2</sup>
30-300	3.83R <sup>2</sup>
300-1,500	0.0128R <sup>2</sup> /f
1,500-100,000	19.2R <sup>2</sup>

For multiple RF sources: Multiple RF sources are exempt if:

- (A) The available maximum time-averaged power of each source is no more than 1 mW and there is a separation distance of two centimeters between any portion of a radiating structure operating and the nearest portion of any other radiating structure in the same device, except if the sum of multiple sources is less than 1 mW during the time-averaging period, in which case they may be treated as a single source (separation is not required). This exemption may not be used in conjunction with other exemption criteria other than those is paragraph §1.1307(b)(3)(i)(A) of this section. Medical implant devices may only use this exemption and that in paragraph §1.1307(b)(3)(i)(A).
- (B) in the case of fixed RF sources operating in the same time-averaging period, or of multiple mobile or portable RF sources within a device operating in the same time averaging period, if the sum of the fractional contributions to the applicable thresholds is less than or equal to 1 as indicated in the following equation.

$$\sum\nolimits_{i=1}^{a} \frac{P_{i}}{P_{th,i}} + \sum\nolimits_{j=1}^{b} \frac{ERP_{j}}{ERP_{th,j}} + \sum\nolimits_{k=1}^{c} \frac{Evaluated_{k}}{Exposure\ Limit_{k}} \leq 1$$

#### Where:

a = number of fixed, mobile, or portable RF sources claiming exemption using paragraph §1.1307(b)(3)(i)(B) of this section for  $P_{th}$ , including existing exempt transmitters and those being added.

b = number of fixed, mobile, or portable RF sources claiming exemption using paragraph 1.1307(b)(3)(i)(C) of this section for Threshold ERP, including existing exempt transmitters and those being added.

c = number of existing fixed, mobile, or portable RF sources with known evaluation for the specified minimum distance including existing evaluated transmitters.

 $P_i$ = the available maximum time-averaged power or the ERP, whichever is greater, for fixed, mobile, or portable RF source i at a distance between 0.5 cm and 40 cm (inclusive).

 $P_{th,i}$  = the exemption threshold power ( $P_{th}$ ) according to paragraph §1.1307(b)(3)(i)(B) of this section for fixed, mobile, or portable RF source i.



 $ERP_i$  = the ERP of fixed, mobile, or portable RF source j.

 $ERP_{th,j}$  = exemption threshold ERP for fixed, mobile, or portable RF source j, at a distance of at least  $\lambda/2\pi$  according to the applicable formula of paragraph  $\S1.1307(b)(3)(i)(C)$  of this section.

**Evaluated**<sub>k</sub> = the maximum reported SAR or MPE of fixed, mobile, or portable RF source k either in the device or at the transmitter site from an existing evaluation at the location of exposure.

**Exposure Limit**<sub>k</sub> = either the general population/uncontrolled maximum permissible exposure (MPE) or specific absorption rate (SAR) limit for each fixed, mobile, or portable RF source k, as applicable from §1.1310 of this chapter.



Report No.: 2207RSU003-U4

#### 2.3. Calculated Result

Product	AX6000 Gigabit Wireless Extender	
Test Item	RF Exposure Evaluation	

Test Mode	Frequency Band	Maximum	Turn-up	Antenna Gain	Turn-up EIRP
	(MHz)	Conducted Power	Conducted Power	(dBi)	(dBm)
		(dBm)	(dBm)		
802.11b/g/n/ax	2412 ~ 2462	28.46	28.50	5.82	34.32
	5180 ~ 5320				
802.11a/n/ac/ax	5500 ~ 5720	29.58	29.60	5.89	35.49
	5745 ~ 5825				

Note: Tune-up power was declared by manufacturer.

#### For single RF source, Option C

Test Mode	λ/2π	R	Turn-up ERP	Threshold ERP	Power Density	Limit
	(m)	(m)	(mW)	(mW)	(mW/cm <sup>2</sup> )	(mW/cm <sup>2</sup> )
Wi-Fi (DTS)	0.0198	0.45	1648.2	3888.0	0.1063	< 1
Wi-Fi (NII)	0.0092	0.45	2157.7	3888.0	0.1391	< 1

Note: R is from user manual.

#### For multiple RF sources

The EUT supports Wi-Fi 2.4GHz + Wi-Fi 5GHz simultaneous transmissions.

So the Max Simultaneous Transmission = 1648.2/3888.0 + 2157.7/3888.0 = 0.9789 < 1

Therefore, the device qualifies for RF exposure test exemption.

The End	
THE LITE	