

# RF Exposure Evaluation Declaration

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**FCC ID:** TK4WLE3000HX  
**Applicant:** Compex Systems Pte Ltd  
**Product:** WiFi 6 (802.11ax) 4x4 MU-MIMO Dual Band Module  
**Model No.:** WLE3000HX, WLE3000HX-I  
**Brand Name:** COMPEX  
**FCC Classification:** Digital Transmission System (DTS)  
Unlicensed National Information Infrastructure (NII)  
**FCC Rule Part(s):** FCC Part 2.1091  
**Received Date:** 2023-05-08  
**Evaluation Date:** 2023-09-18  
**Result:** Complies

**Reviewed By:**

\_\_\_\_\_  
Jame Yuan

**Approved By:**

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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.

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### Revision History

Report No.	Version	Description	Issue Date	Note
2305RSU016-U4	V01	Initial Report	2023-09-19	Invalid
2305RSU016-U4	V02	Updated calculated	2023-11-10	Valid

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#### 1.4. Product Information

Product Name	WiFi 6 (802.11ax) 4x4 MU-MIMO Dual Band Module
Model No.	WLE3000HX, WLE3000HX-I
Wi-Fi Specification	802.11a/b/g/n/ac/ax
Antenna Information	Refer to Section 1.5
Operating Voltage	3.3Vdc
Host Information	
1#	FCC ID: 2BA8GPCWL-0510 Applicant: PicoCELA Inc Model No.: PCWL-0510
2#	FCC ID: 2BBYQPCWL-0500 Applicant: PicoCELA Inc Model No.: PCWL-0500
Note: 1. The information of EUT was provided by the manufacturer, and the accuracy of the information shall be the responsibility of the manufacturer. 2. Model Difference: Marketing purpose only.	

#### 1.5. Antenna Details

Antenna No.	Model No.	Polarization	Frequency Band (GHz)	Max. Peak Gain (dBi)	CDD Directional Gain (dBi)	
					For Power	For PSD
1#	SAA04-222060	Directional Panel	2.4 ~2.5	13.50	13.50	19.52
			5.15 ~5.85	15.50	15.50	21.52

Note:

The EUT supports Cyclic Delay Diversity (CDD) mode, and CDD signals are correlated.

For CDD transmissions, directional gain is calculated as follows,  $N_{ANT} = 4$ ,  $N_{SS} = 1$ . If all antennas have the same gain,  $G_{ANT}$ , Directional gain =  $G_{ANT} + \text{Array Gain}$ , where Array Gain is as follows.

- For power spectral density (PSD) measurements on all devices, Array Gain =  $10 \log (N_{ANT}/ N_{SS})$  dB = 6.02;
- For power measurements on IEEE 802.11 devices, Array Gain = 0 dB for  $N_{ANT} \leq 4$ ;

#### 1.6. Device Classification

According to the user manual, this device is classified as a Mobile Device. So, the RF exposure evaluation requirements of § 2.1091 for mobile device exposure conditions subject to MPE limits.

### **1.7. 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 (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm <sup>2</sup> )	Average Time (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 General Population/ Uncontrolled Exposures				
0.3-1.34	614	1.63	*(100)	<30
1.34-30	824/f	2.19/f	*(180/f <sup>2</sup> )	<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:

$$P_{th}(mW) = \{ERP_{20cm}(d / 20cm)^x \quad d \leq 20cm$$

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

Where

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

and

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

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

**(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) - Single RF Sources Subject 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 in 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.

$$\sum_{i=1}^a \frac{P_i}{P_{th,i}} + \sum_{j=1}^b \frac{ERP_j}{ERP_{th,j}} + \sum_{k=1}^c \frac{Evaluated_k}{Exposure\ Limit_k} \leq 1$$

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  $i$ .

$ERP_j$  = 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 §1.1307(b)(3)(i)(C) of this section.

**$Evaluated_k$**  = 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.

**$Exposure Limit_k$**  = 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.

### 2.3. Calculated Result

Product	WiFi 6 (802.11ax) 4x4 MU-MIMO Dual Band Module
Test Item	RF Exposure Evaluation

#### Module

Test Mode	Frequency Band (MHz)	Tune-up Conducted Power (dBm)	Antenna Gain (dBi)	Tune-up ERP (dBm)
802.11b/g/n/ax	2412 ~ 2462	23.0	13.5	34.35
802.11a/n/ac/ax	5180 ~ 5320, 5500 ~ 5720, 5745 ~ 5825	21.0	15.5	34.35

Note: Tune-up power was declared by manufacturer.

#### Host 1# Transmitting Unit

Test Mode	Frequency Band (MHz)	Max. Conducted Power (dBm)	Antenna Gain (dBi)	Max EIRP (dBm)	Max ERP (dBm)	Max Tune-up ERP (dBm)
<b>Antenna 1#</b>						
802.11b/g/n/ax	2412 ~ 2462	29.02	4.50	33.52	31.37	32
802.11a/n/ac/ax	5180 ~ 5825	27.76	7.00	34.76	32.61	33
<b>Antenna 2#</b>						
802.11b/g/n/ax	2412 ~ 2462	22.37	13.50	35.87	33.72	34
802.11a/n/ac/ax	5180 ~ 5825	20.35	15.50	35.85	33.70	34

Note: Tune-up power declared by manufacturer.

#### Host 2# Transmitting Unit

Test Mode	Frequency Band (MHz)	Tune-up Conducted Power (dBm)	Antenna Gain (dBi)	Tune-up ERP (dBm)
802.11b/g/n/ax	2412 ~ 2462	29.00	3	29.85
802.11a/n/ac/ax	5180 ~ 5320, 5500 ~ 5720, 5745 ~ 5825	28.00	6	31.85

Note: Tune-up power was declared by manufacturer.

### Simultaneous Transmitting Condition

Module Wi-Fi 5G + Host 1# / 2# Wi-Fi 2.4G + Host 1# / 2# Wi-Fi 5G

Note: Module Wi-Fi 5G and Host Wi-Fi 5G work on different NII bands.

#### For multiple RF sources (With Host 1#), Option C

Test Mode	$\lambda / 2 \pi$ (m)	R (m)	Tune-up ERP (Watts)	Thresholds ERP (Watts)
<b>Module</b>				
Wi-Fi (NII)	0.0092	0.65	2.723	8.112
<b>Host 1#</b>				
Wi-Fi (DTS)	0.0198	0.65	2.512	8.112
Wi-Fi (NII)	0.0092	0.65	2.512	8.112

Note: R is from user manual.

Max Simultaneous Transmission =  $2.723 / 8.112 + 2.512 / 8.112 + 2.512 / 8.112 = 0.955 < 1$ .

Therefore, the device qualifies for RF exposure test exemption.

#### For multiple RF sources (With Host 2#), Option C

Test Mode	$\lambda / 2 \pi$ (m)	R (m)	Tune-up ERP (Watts)	Thresholds ERP (Watts)
<b>Module</b>				
Wi-Fi (NII)	0.0092	0.55	2.723	5.808
<b>Host 2#</b>				
Wi-Fi (DTS)	0.0198	0.55	0.966	5.808
Wi-Fi (NII)	0.0092	0.55	1.531	5.808

Note: R is from user manual.

Max Simultaneous Transmission =  $2.723 / 5.808 + 0.966 / 5.808 + 1.531 / 5.808 = 0.899 < 1$ .

Therefore, the device qualifies for RF exposure test exemption.

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