RF Exposure Evaluation Declaration

FCC ID:	TK4WLE1216VX
Applicant:	Compex Systems Pte Ltd
Application Type:	Certification
Product:	Dual Band 4x4 802.11ac Wave 2 Mini PCIe WiFi Module
Model No.:	WLE1216VX, WLE1216VX-I
Brand Name:	COMPEX
FCC Classification:	Digital Transmission System (DTS) Unlicensed National Information Infrastructure (NII)
Test Procedure(s):	KDB 447498 D01v06
Test Date:	September 01, 2021

Reviewed By: Kevin Guo

Approved By: Robin Wu

Revision History

Report No.	Version	Description	Issue Date	Note
2103RSU077-U4	Rev. 01	Initial Report	09-01-2021	Valid

CONTENTS

1. General Information

1.1. Applicant

Compex Systems Pte Ltd

No:9 Harrison Road, Harrison Industrial Building, #05-01, Singapore

1.2. Manufacturer

Compex Systems Pte Ltd

No:9 Harrison Road, Harrison Industrial Building, #05-01, Singapore

1.3. Testing Facility

<table>
<tr><td>☒</td><td colspan="5">Test Site – MRT Suzhou Laboratory</td></tr>
<tr><td></td><td colspan="5">Laboratory Location (Suzhou - Wuzhong)
D8 Building, No.2 Tian’edang Rd., Wuzhong Economic Development Zone, Suzhou, China
Laboratory Location (Suzhou - SIP)
4b Building, Liando U Valley, No.200 Xingpu Rd., Shengpu Town, Suzhou Industrial Park, China</td></tr>
<tr><td></td><td colspan="5">Laboratory Accreditations</td></tr>
<tr><td></td><td colspan="2">A2LA: 3628.01</td><td colspan="3">CNAS: L10551</td></tr>
<tr><td></td><td colspan="2">FCC: CN1166</td><td colspan="3">ISED: CN0001</td></tr>
<tr><td></td><td rowspan="2">VCCI:</td><td>☐R-20025</td><td>☐G-20034</td><td>☐C-20020</td><td>☐T-20020</td></tr>
<tr><td></td><td>☐R-20141</td><td>☐G-20134</td><td>☐C-20103</td><td>☐T-20104</td></tr>
<tr><td>☐</td><td colspan="5">Test Site – MRT Shenzhen Laboratory</td></tr>
<tr><td></td><td colspan="5">Laboratory Location (Shenzhen)
1G, Building A, Junxiangda Building, Zhongshanyuan Road West, Nanshan District, Shenzhen, China</td></tr>
<tr><td></td><td colspan="5">Laboratory Accreditations</td></tr>
<tr><td></td><td colspan="2">A2LA: 3628.02</td><td colspan="3">CNAS: L10551</td></tr>
<tr><td></td><td colspan="2">FCC: CN1284</td><td colspan="3">ISED: CN0105</td></tr>
<tr><td>☐</td><td colspan="5">Test Site – MRT Taiwan Laboratory</td></tr>
<tr><td></td><td colspan="5">Laboratory Location (Taiwan)
No. 38, Fuxing 2nd Rd., Guishan Dist., Taoyuan City 333, Taiwan (R.O.C.)</td></tr>
<tr><td></td><td colspan="5">Laboratory Accreditations</td></tr>
<tr><td></td><td colspan="5">TAF: L3261-190725</td></tr>
<tr><td></td><td colspan="2">FCC: 291082, TW3261</td><td colspan="3">ISED: TW3261</td></tr>
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1.4. Product Information

Product Name	Dual Band 4x4 802.11ac Wave 2 Mini PCIe WiFi Module
Model No.	WLE1216VX, WLE1216VX-I
Wi-Fi Specification	802.11a/b/g/n/ac
Antenna Information	Refer to section 1.5

Remark:

1. The information of EUT was provided by the manufacturer, and the accuracy of the information shall be the responsibility of the manufacturer.
2. The difference of models is only for marketing different client, so the model (WLE1216VX) was selected for testing.

1.5. Antenna Details

Antenna Type	Frequency Band (GHz)	T_X Paths	Max Antenna Gain (dBi)	Cable Loss (dB)	Actual Antenna Gain (dBi)	Directional Gain (dBi)	
						For Power	For PSD
Dipole Antenna	2.4	4	3.16	0.52	2.64	2.64	8.66
	5.0	4	4.18	0.83	3.35	3.35	9.37

Remark:

1. The EUT supports Cyclic Delay Diversity (CDD) mode, and CDD signals are correlated.
2. 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} + 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 $N_{ANT} \leq 4$;

2. RF Exposure Evaluation

2.1. 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^2)	Average Time (Minutes)
(A) Limits for Occupational/ Control Exposures				
300-1500	--	--	f/300	6
1500-100,000	--	--	5	6
(B) Limits for General Population/ Uncontrolled Exposures				
300-1500	--	--	f/1500	6
1500-100,000	--	--	1	30

f= Frequency in MHz

Calculation Formula: $Pd = (Pout*G)/(4*pi*r^2)$

Where

Pd = power density in mW/cm^2

Pout = output power to antenna in mW

G = gain of antenna in linear scale

Pi = 3.1416

r = distance between observation point and center of the radiator in cm

Pd is the limit of MPE, $1mW/cm^2$. If we know the maximum gain of the antenna and the total power input to the antenna, through the calculation, we will know the distance r where the MPE limit is reached.

2.2. Test Result

Product	Dual Band 4x4 802.11ac Wave 2 Mini PCIe WiFi Module
Test Item	RF Exposure Evaluation

Test Mode	Frequency Band (MHz)	Maximum conducted power (dBm)	Antenna Gain (dBi)	Cable Loss (dB)	Maximum EIRP (dBm)	Power Density at R = 20 cm (mW/cm^2)	Limit (mW/cm^2)
Wi-Fi	2412 ~ 2462	24.65	3.16	0.52	27.29	0.1066	1
	5180 ~ 5825	24.67	4.18	0.83	28.02	0.1261	1

Note: Maximum EIRP (dBm) = Maximum conducted power (dBm) + Antenna Gain (dBi) – Cable Loss(dB)

CONCLUSION:

The max Power Density at R (20 cm) = 0.1066mW/cm^2 + 0.1261mW/cm^2 = 0.2327mW/cm^2 < 1 mW/cm^2.

Therefore, the Min Safety Distance is 20cm.

The End

Appendix A - EUT Photograph

Refer to “2103RSU077-UE” file.