RF Exposure Evaluation Declaration

FCC ID:	TK4WLE1216V220
APPLICANT:	Compex Systems Pte Ltd
Application Type:	Class II Permissive Change
Product:	4x4 Wave-2 802.11BGN Mini PCIe WiFi Module
Model No.:	WLE1216V2-20, WLE1216V2-20-I
Brand Name:	COMPEX
FCC Classification:	Digital Transmission System (DTS)

Reviewed By: (Jame Yuan)

Approved By: (Robin Wu)

Revision History

Report No.	Version	Description	Issue Date	Note
1807RSU013-U9	Rev. 01	Initial report	12-18-2018	Valid

1. PRODUCT INFORMATION

1.1. Equipment Description

Product Name	4x4 Wave-2 802.11BGN Mini PCIe WiFi Module
Model No.	WLE1216V2-20, WLE1216V2-20-I
Brand Name	COMPEX
Wi-Fi Specification	802.11b/g/n
Frequency Range	802.11b/g/n-HT20: 2412 ~ 2462 MHz 802.11n-HT40: 2422 ~ 2452 MHz
Type of Modulation	802.11b: DSSS 802.11g/n: OFDM
Data Rate:	802.11b: 1/2/5.5/11Mbps 802.11g: 6/9/12/18/24/36/48/54Mbps 802.11n: up to 600Mbps

1.2. Antenna Description

Antenna Type	Manufacturer	Frequency Band (GHz)	Max Peak Gain (dBi)	Directional Gain (dBi)
Directional Antenna	A*STAR Research	2400 ~ 2483.5	7.0	7.0
		5150 ~ 5850	7.1	7.1

Note: The device didn't support beam-forming technology and Cyclic Delay Diversity (CDD) technology, and the transmit signals are uncorrected, so directional gain = G_{ANT}.

1.3. Description of Support Units

The EUT should be tested with associated equipment as below.

Product Name	Icomera SynAPse Rail Access Point
Model No.	AP01
Two Configurations	
Type 01#	Host board (BBD 0009) Three 5GHz WLAN modules (FCC ID: TK4WLE1216V520)
Type 02#	Host board (BBD 0009) Two 5GHz WLAN modules (FCC ID: TK4WLE1216V520) One 2.4GHz WLAN module (FCC ID: TK4WLE1216V220)

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 of RF Exposure Evaluation

Product	4x4 Wave-2 802.11BGN Mini PCIe WiFi Module
Test Item	RF Exposure Evaluation

Antenna Gain: Refer to clause 1.2.

Test Mode	Frequency Band (MHz)	Maximum EIRP (dBm)	Power Density at R = 20 cm (mW/cm^2)	Limit (mW/cm^2)	Power Density at R = 24 cm (mW/cm^2)
Module (FCC ID: TK4WLE1216V520)					
802.11a/n/ac	5180 ~ 5320, 5500 ~ 5720, 5745 ~ 5825	34.54	0.5659	1	0.3930
Module (FCC ID: TK4WLE1216V220)					
802.11b/g/n	2412 ~ 2462	30.65	0.2311	1	0.1605

CONCULISON:

Both 5GHz modules and one 2.4GHz modules can transmit simultaneously.

The max Power Density at R (20 cm) = $0.5659mW/cm^2 + 0.5659mW/cm^2 + 0.2311mW/cm^2 = 1.3629mW/cm^2 > 1mW/cm^2$.

The max Power Density at R (24 cm) = $0.3930mW/cm^2 + 0.3930mW/cm^2 + 0.1605mW/cm^2 = 0.9465mW/cm^2 < 1mW/cm^2$.

Therefore, the Minimum Safety Distance is 24cm.

The End

Appendix A - Test Setup Photograph

Refer to “1807RSU013-UT” file.

Appendix B - EUT Photograph

Refer to “1807RSU013-UE” file.