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Report No.: 1807RSU013-U9 Report Version: V01 Issue Date: 12-18-2018

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 PCle 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)





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.

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Revision History

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

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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	Max Peak	Directional
		(GHz)	Gain (dBi)	Gain (dBi)
Directional Antonno	A*STAR Research	2400 ~ 2483.5	7.0	7.0
Directional Antenna		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)	

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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	Electric Field	Magnetic Field	Power Density	Average Time	
(MHz)	Strength (V/m)	Strength (A/m)	(mW/cm ²)	(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/cm²

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/cm². 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.

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

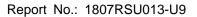
CONCULISON:

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

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

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

Therefore, the Minimum Safety Distance is 24cm.

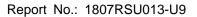




Appendix A - Test Setup Photograph

Refer to "1807RSU013-UT" file.

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Appendix B - EUT Photograph

Refer to "1807RSU013-UE" file.

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