RF Exposure Report

Report No.:	SA190807D08B
FCC ID:	TK4WLE1216V220 (For 2.4GHz) TK4WLE1216V520 (For 5.0GHz) N7NEM7455 (For LTE)
Test Model:	WLE1216V2-20, WLE1216V2-20-I (For 2.4GHz) WLE1216V5-20, WLE1216V5-20-I (For 5.0GHz) EM7455 (For LTE)
Received Date:	Nov. 18, 2019
Test Date:	Dec. 11 to 12, 2019
Issued Date:	Feb. 27, 2020
Applicant:	Compex Systems Pte Ltd
Address:	No 9 Harrison Road, Harrison Industrial Building, #05-01, 369651, Singapore
Issued By:	Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch Lin Kou Laboratories
Lab Address:	No. 47-2, 14th Ling, Chia Pau Vil., Lin Kou Dist., New Taipei City, Taiwan
FCC Registration / Designation Number:	198487 / TW2021

Testing Laboratory
2021

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Release Control Record

Issue No.	Description	Date Issued
SA190807D08B	Original release.	Feb. 27, 2020

1 Certificate of Conformity

Product:	4x4 Wave-2 802.11BGN Mini PCIe WiFi Module (For 2.4GHz) 4x4 Wave-2 802.11ac/a/n Mini PCIe WiFi Module (For 5.0GHz) Wireless Modules (For LTE)
Brand:	COMPEX (For WiFi) Sierra Wireless Inc. (For LTE)
Test Model:	WLE1216V2-20, WLE1216V2-20-I (For 2.4GHz) WLE1216V5-20, WLE1216V5-20-I (For 5.0GHz) EM7455 (For LTE)
Sample Status:	Pre-Production
Applicant:	Compex Systems Pte Ltd
Test Date:	Dec. 11 to 12, 2019
Standards:	FCC Part 2 (Section 2.1091) IEEE C95.3 -2002
References Test Guidance:	KDB 447498 D01 General RF Exposure Guidance v06

The above equipment has been tested by **Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch**, and found compliance with the requirement of the above standards. The test record, data evaluation & Equipment Under Test (EUT) configurations represented herein are true and accurate accounts of the measurements of the sample's RF characteristics under the conditions specified in this report.

Prepared by : Annie Chang , **Date:** Feb. 27, 2020

Annie Chang / Senior Specialist

Approved by : Rex. Lai , **Date:** Feb. 27, 2020

Rex Lai / Associate Technical Manager

2 General Information

2.1 General Description of EUT

2.4GHz WLAN Module (FCC ID: TK4WLE1216V220)

Product	4x4 Wave-2 802.11BGN Mini PCIe WiFi Module
Brand	COMPEX
Test Model	WLE1216V2-20, WLE1216V2-20-I
Status of EUT	Pre-Production
Modulation Type	CCK, DQPSK, DBPSK for DSSS 64QAM, 16QAM, QPSK, BPSK for OFDM
Modulation Technology	OFDM
Transfer Rate	802.11b: up to 11Mbps 802.11g: up to 54Mbps 802.11n: up to 600Mbps
Operating Frequency	2412~2462MHz
Number of Channel	11 for 802.11b, 802.11g, 802.11n (20MHz) 7 for 802.11n (40MHz)
Output Power	354.320mW
Antenna Type	Refer to note as below
Antenna Connector	Reverse SMA
Accessory Device	N/A
Data Cable Supplied	N/A

5.0GHz WLAN Module (FCC ID: TK4WLE1216V520)

Product	4x4 Wave-2 802.11ac/a/n Mini PCIe WiFi Module
Brand	COMPEX
Test Model	WLE1216V5-20, WLE1216V5-20-I
Status of EUT	Pre-Production
Modulation Type	64QAM, 16QAM, QPSK, BPSK for OFDM 256QAM for OFDM in 11ac mode only.
Modulation Technology	OFDM
Transfer Rate	802.11a: up to 54Mbps 802.11n: up to 600Mbps 802.11ac: up to 1733.2Mbps
Operating Frequency	5180~5240MHz, 5745~5825MHz
Number of Channel	**5180~5240MHz:** 4 for 802.11a, 802.11n (20MHz), 802.11ac (20MHz) 2 for 802.11n (40MHz), 802.11ac (40MHz) 1 for 802.11ac (80MHz) **5745~5825MHz:** 5 for 802.11a, 802.11n (20MHz) 802.11ac (20MHz) 2 for 802.11n (40MHz) 802.11ac (40MHz) 1 for 802.11ac (80MHz)
Output Power	**5180 ~ 5240MHz:** 54.353mW **5745 ~ 5825MHz:** 328.973mW
Antenna Type	Refer to note as below
Antenna Connector	Reverse SMA
Accessory Device	N/A
Data Cable Supplied	N/A

LTE Module (FCC ID: N7NEM7455)

Product	Wireless Modules	
Brand	Sierra Wireless Inc.	
Test Model	EM7455	
Status of EUT	MASS-PRODUCTION	
Power Supply Rating	3.3 Vdc (Host equipment)	
Modulation Type	WCDMA	QPSK
	LTE	QPSK, 16QAM
Frequency Range <WCDMA>	WCDMA	826.4 ~ 846.6 MHz, 1852.4 ~ 1907.6 MHz, 1712.4 ~ 1752.6 MHz
Frequency Range <LTE Band 4>	LTE Band 4 (Channel Bandwidth: 1.4 MHz)	1710.7 ~ 1754.3 MHz
	LTE Band 4 (Channel Bandwidth: 3 MHz)	1711.5 ~ 1753.5 MHz
	LTE Band 4 (Channel Bandwidth: 5 MHz)	1712.5 ~ 1752.5 MHz
	LTE Band 4 (Channel Bandwidth: 10 MHz)	1715.0 ~ 1750.0 MHz
	LTE Band 4 (Channel Bandwidth: 15 MHz)	1717.5 ~ 1747.5 MHz
	LTE Band 4 (Channel Bandwidth: 20 MHz)	1720.0 ~ 1745.0 MHz
Frequency Range <LTE Band 5>	LTE 5 (Channel Bandwidth: 1.4 MHz)	824.7 ~ 848.3 MHz
	LTE 5 (Channel Bandwidth: 3 MHz)	825.5 ~ 847.5 MHz
	LTE 5 (Channel Bandwidth: 5 MHz)	826.5 ~ 846.5 MHz
	LTE 5 (Channel Bandwidth: 10 MHz)	829 ~ 844 MHz
Frequency Range <LTE Band 7>	LTE Band 7 (Channel Bandwidth: 5 MHz)	2502.5 ~ 2567.5 MHz
	LTE Band 7 (Channel Bandwidth: 10 MHz)	2505 ~ 2565 MHz
	LTE Band 7 (Channel Bandwidth: 15 MHz)	2507.5 ~ 2562.5 MHz
	LTE Band 7 (Channel Bandwidth: 20 MHz)	2510 ~ 2560 MHz
Frequency Range <LTE Band 12>	LTE Band 12 (Channel Bandwidth: 1.4 MHz)	699.7 ~ 715.3 MHz
	LTE Band 12 (Channel Bandwidth: 3 MHz)	700.5 ~ 714.5 MHz
	LTE Band 12 (Channel Bandwidth: 5 MHz)	701.5 ~ 713.5 MHz
	LTE Band 12 (Channel Bandwidth: 10 MHz)	704.0 ~ 711.0 MHz
Frequency Range <LTE Band 13>	LTE Band 13 (Channel Bandwidth: 5 MHz)	779.5 ~ 784.5 MHz
	LTE Band 13 (Channel Bandwidth: 10 MHz)	782.0 MHz
Frequency Range <LTE Band 25>	LTE Band 25 (Channel Bandwidth: 1.4 MHz)	1850.7 ~ 1914.3 MHz
	LTE Band 25 (Channel Bandwidth: 3 MHz)	1851.5 ~ 1913.5 MHz
	LTE Band 25 (Channel Bandwidth: 5 MHz)	1852.5 ~ 1912.5 MHz
	LTE Band 25 (Channel Bandwidth: 10 MHz)	1855.0 ~ 1910.0 MHz
	LTE Band 25 (Channel Bandwidth: 15 MHz)	1857.5 ~ 1907.5 MHz
	LTE Band 25 (Channel Bandwidth: 20 MHz)	1860.0 ~ 1905.0 MHz
Frequency Range <LTE Band 26_Part 22>	LTE 26 (Channel Bandwidth: 1.4 MHz)	824.7 ~ 848.3 MHz
	LTE 26 (Channel Bandwidth: 3 MHz)	825.5 ~ 847.5 MHz
	LTE 26 (Channel Bandwidth: 5 MHz)	826.5 ~ 846.5 MHz
	LTE 26 (Channel Bandwidth: 10 MHz)	829 ~ 844 MHz
	LTE 26 (Channel Bandwidth: 15 MHz)	831.5 ~ 841.5 MHz

Frequency Range <LTE Band 26_Part 90S>	LTE Band 26 (Channel Bandwidth: 1.4 MHz)	814.7 ~ 823.3 MHz
	LTE Band 26 (Channel Bandwidth: 3 MHz)	815.5 ~ 822.5 MHz
	LTE Band 26 (Channel Bandwidth: 5 MHz)	816.5 ~ 821.5 MHz
	LTE Band 26 (Channel Bandwidth: 10 MHz)	819 MHz
Frequency Range <LTE Band 30>	LTE Band 30 (Channel Bandwidth: 5 MHz)	2307.5 ~ 2312.5 MHz
	LTE Band 30 (Channel Bandwidth: 10 MHz)	2310 MHz
Frequency Range <LTE Band 41>	LTE Band 41 (Channel Bandwidth: 5 MHz)	2498.5 ~ 2687.5 MHz
	LTE Band 41 (Channel Bandwidth: 10 MHz)	2501.0 ~ 2685.0 MHz
	LTE Band 41 (Channel Bandwidth: 15 MHz)	2503.5 ~ 2682.5 MHz
	LTE Band 41 (Channel Bandwidth: 20 MHz)	2506.0 ~ 2680.0 MHz
Antenna Type	LTE Band 5 & 26	Dipole Antenna with 3.2 dBi gain
	LTE Band 25	Dipole Antenna with 1.56 dBi gain
	LTE Band 4	Dipole Antenna with 1.62 dBi gain
	LTE Band 12	Dipole Antenna with 1.49 dBi gain
	LTE Band 13	Dipole Antenna with 1.66 dBi gain
	LTE Band 7 & 41	Dipole Antenna with 0.86 dBi gain
	LTE Band 30	Dipole Antenna with 2.27 dBi gain
	WCDMA_826.4 ~ 846.6 MHz	Dipole Antenna with 3.2 dBi gain
	WCDMA_1852.4 ~ 1907.6 MHz	Dipole Antenna with 1.56 dBi gain
	WCDMA_1712.4 ~ 1752.6 MHz	Dipole Antenna with 1.62 dBi gain
Accessory Device	Refer to Note as below	
Data Cable Supplied	Refer to Note as below	

Note:

1. The difference compared with original test report is adding a platform: Network Security Appliance (Brand: Check Point / Model: V-81WL).

2. Exhibit prepared for FCC Spot Check Verification report, the format, test items and amount of spot–check test data are decided by applicant's engineering judgment, for more details pleae refer to declaration letter exhibit.

3. The EUT provides 4 completed transmitter and 4 receiver.

Modulation Mode	TX Function
802.11a	1TX
802.11b	1TX
802.11g	1TX
802.11n (20MHz)	4TX
802.11n (40MHz)	4TX
802.11ac (20MHz)	4TX
802.11ac (40MHz)	4TX
802.11ac (80MHz)	4TX

4. Accessory device of Platform as follows.

Brand	Model	Rating
FSP	FSP060-DHAN3	AC I/P : 100-240V ~ 1.8A 50-60Hz DC O/P 12V===5.0A Power cord: AC 2 Pin, Non-shielded DC cable (1.2m) With one Core

5. This report is prepared for FCC class II permissive change.

6. 2.4GHz & 5GHz technologies can transmit at same time.

7. The antenna information is listed as below:

Description	Platform: Network Security Appliance (Brand: Check Point / Model: V-81WL)	
	2412-2462MHz	5180-5825MHz
Antenna Type	Dipole Antenna	Dipole Antenna
Maximum Gain (dBi)	2.22	4.29

The Platform is authorized for use frequency bands: 2412-2462MHz, 5180-5240MHz and 5745-5825MHz only.

8. The above EUT information is declared by manufacturer and for more detailed features description, please refer to the manufacturer's specifications or user's manual.

3 RF Exposure

2.1 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)
Limits For General Population / Uncontrolled Exposure				
0.3-1.34	614	1.63	(100)*	30
1.34-30	824/f	2.19/f	($180/f^2$)*	30
30-300	27.5	0.073	0.2	30
300-1500	…	…	f/1500	30
1500-100,000	…	…	1.0	30

f = Frequency in MHz ; *Plane-wave equivalent power density

2.2 MPE 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

2.3 Classification

The antenna of this product, under normal use condition, is at least 29cm away from the body of the user. So, this device is classified as **Mobile Device**.

2.4 Calculation Result of Maximum Conducted Power

WLAN 2.4GH Module (FCC ID: TK4WLE1216V220)

requency Band (MHz)	Max Power (dBm)	Antenna Gain (dBi)	Distance (cm)	Power Density (mW/cm^2)	Limit (mW/cm^2)
2412-2462	25.49	8.24	29	0.2234	1

Note:
1. Determining compliance based on the results of the compliance measurement, not taking into account measurement instrumentation uncertainty.
2. Directional gain = 2.22dBi + 10log(4) = 8.24dBi

WLAN 5GHz Module (FCC ID: TK4WLE1216V520)

Frequency Band (MHz)	Max Power (dBm)	Antenna Gain (dBi)	Distance (cm)	Power Density (mW/cm^2)	Limit (mW/cm^2)
5180~5240	17.35	10.31	29	0.0552	1
5745~5825	25.17	10.31	29	0.3342	1

Note:
1. Determining compliance based on the results of the compliance measurement, not taking into account measurement instrumentation uncertainty.
2. Directional gain = 4.29dBi + 10log(4) = 10.31dBi

LTE Module (FCC ID: N7NEM7455)

Frequency Band (MHz)	Max Power (dBm)	Antenna Gain (dBi)	Distance (cm)	Power Density (mW/cm^2)	Limit (mW/cm^2)
WCDMA: 826.4 ~ 846.6 MHz	23.45	3.2	29	0.0438	0.55
LTE Band 5: 824.7 ~ 848.3 MHz	23.15	3.2	29	0.0408	0.55
LTE Band 26_Part 22: 824.7 ~ 848.3 MHz	22.98	3.2	29	0.0393	0.55
WCDMA: 1852.4 ~ 1907.6 MHz	22.90	1.56	29	0.0264	1.00
LTE Band 25: 1850.7 ~ 1914.3 MHz	22.24	1.56	29	0.0227	1.00
WCDMA: 1712.4 ~ 1752.6 MHz	22.88	1.62	29	0.0267	1.00
LTE Band 4: 1710.7 ~ 1754.3 MHz	22.60	1.62	29	0.0250	1.00
LTE Band 12: 699.7 ~ 715.3 MHz	23.20	1.49	29	0.0279	0.47
LTE Band 13: 779.5 ~ 784.5 MHz	23.06	1.66	29	0.0281	0.52
LTE Band 7: 2502.5 ~ 2567.5 MHz	21.02	0.86	29	0.0146	1.00
LTE Band 41: 2498.5 ~ 2687.5 MHz	20.91	0.86	29	0.0142	1.00
LTE Band 30: 2307.5 ~ 2312.5 MHz	21.25	2.27	29	0.0213	1.00
LTE Band 26_Part 90S: 814.7 ~ 823.3 MHz	22.97	3.2	29	0.0392	0.54

Note: Determining compliance based on the results of the compliance measurement, not taking into account measurement instrumentation uncertainty.

Conclusion:

The formula of calculated the MPE is:

CPD1 / LPD1 + CPD2 / LPD2 + ……etc. < 1

CPD = Calculation power density

LPD = Limit of power density

Simultaneously transmitter condition:

WLAN 2.4GHz + WLAN 5GHz + LTE = 0.2234 + 0.3342 + 0.0438/0.55 = 0.6371

Therefore the maximum calculations of above situations are less than the "1" limit.

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