

## RF Exposure Report

**Report No.:** SA170816E06H

**FCC ID:** RYK-WNFQ261ACNIBT

**Test Model:** WNFQ-261ACNI(BT)

**Received Date:** Aug. 23, 2018

**Test Date:** Oct. 23, 2018

**Issued Date:** Nov. 07, 2018

**Applicant:** SparkLAN Communications, Inc.

**Address:** 8F., No.257, Sec. 2, Tiding Blvd., Neihu District, Taipei City 11493, Taiwan (R.O.C.)

**Issued By:** Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch  
Hsin Chu Laboratory

**Lab Address:** E-2, No.1, Li Hsin 1st Road, Hsinchu Science Park, Hsinchu City 300, Taiwan R.O.C.

**Test Location :** E-2, No.1, Li Hsin 1st Road, Hsinchu Science Park, Hsinchu City 300, Taiwan R.O.C.

**FCC Registration /  
Designation Number:** 723255 / TW2022

This report is for your exclusive use. Any copying or replication of this report to or for any other person or entity, or use of our name or trademark, is permitted only with our prior written permission. This report sets forth our findings solely with respect to the test samples identified herein. The results set forth in this report are not indicative or representative of the quality or characteristics of the lot from which a test sample was taken or any similar or identical product unless specifically and expressly noted. Our report includes all of the tests requested by you and the results thereof based upon the information that you provided to us. You have 60 days from date of issuance of this report to notify us of any material error or omission caused by our negligence, provided, however, that such notice shall be in writing and shall specifically address the issue you wish to raise. A failure to raise such issue within the prescribed time shall constitute your unqualified acceptance of the completeness of this report, the tests conducted and the correctness of the report contents. Unless specific mention, the uncertainty of measurement has been explicitly taken into account to declare the compliance or non-compliance to the specification. The report must not be used by the client to claim product certification, approval, or endorsement by any government agencies.

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### Release Control Record

| Issue No.    | Description       | Date Issued   |
|--------------|-------------------|---------------|
| SA170816E06H | Original release. | Nov. 07, 2018 |

## 1 Certificate of Conformity

**Product:** 802.11ac/a/b/g/n 2T2R Industrial-graded Wi-Fi / Bluetooth 4.2 Combo M.2 2230 Module

**Brand:** Sparklan

**Test Model:** WNFQ-261ACNI(BT)

**Sample Status:** R&D SAMPLE

**Applicant:** SparkLAN Communications, Inc.

**Test Date:** Oct. 23, 2018

**Standards:** FCC Part 2 (Section 2.1091)

KDB 447498 D01 General RF Exposure Guidance v06

IEEE C95.1-1992

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 EMC characteristics under the conditions specified in this report.

**Prepared by :**

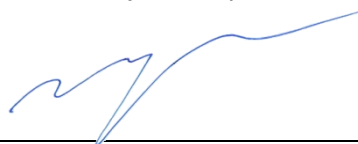


**Date:**

Nov. 07, 2018

Wendy Wu / Specialist

**Approved by :**



**Date:**

Nov. 07, 2018

May Chen / Manager

## 2 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 <sup>2</sup> ) | 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 <sup>2</sup> )*              | 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<sup>2</sup>

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 20cm away from the body of the user. So, this device is classified as **Mobile Device**.

## 2.4 Antenna Gain

| Ant. Set. | Transmitter Circuit    | Brand    | Model                 | Ant. Type | 2.4GHz Gain with cable loss (dBi) | 5GHz Gain with cable loss (dBi) | 2.4GHz Cable Loss (dBi)          | 5G Cable Loss (dBi) | Connector Type                                          | Cable Length (mm) |
|-----------|------------------------|----------|-----------------------|-----------|-----------------------------------|---------------------------------|----------------------------------|---------------------|---------------------------------------------------------|-------------------|
| 1         | Chain (0)              | WNC      | 81-EBJ15.005          | PIFA      | 3.00                              | Band 1&2: 2.56                  | 1.15                             | Band 1&2: 1.70      | IPEX                                                    | 300               |
|           |                        |          |                       |           |                                   | Band 3: 4.76                    |                                  | Band 3: 1.74        |                                                         |                   |
|           |                        |          |                       |           |                                   | Band 4: 4.76                    |                                  | Band 4: 1.79        |                                                         |                   |
|           | Chain (1)              | WNC      | 81-EBJ15.005          | PIFA      | 3.62                              | Band 1&2: 3.08                  | 1.15                             | Band 1&2: 1.70      | IPEX                                                    | 300               |
|           |                        |          |                       |           |                                   | Band 3: 3.31                    |                                  | Band 3: 1.74        |                                                         |                   |
|           |                        |          |                       |           |                                   | Band 4: 2.42                    |                                  | Band 4: 1.79        |                                                         |                   |
| Ant. Set. | Transmitter Circuit    | Brand    | Model                 | Ant. Type | 2.4GHz Gain with cable loss (dBi) | 5GHz Gain with cable loss (dBi) | 2.4GHz Cable Loss (dBi)          | 5G Cable Loss (dBi) | Connector Type                                          | Cable Length (mm) |
| 2         | Chain (0)              | INPAQ    | DAM-I6-H-DB-800-10-17 | Dipole    | 1.13                              | Band 1&2: 1.33                  | NA                               | NA                  | SMA RP Plug                                             | 900               |
|           |                        |          |                       |           |                                   | Band 3: -0.63                   |                                  |                     |                                                         |                   |
|           |                        |          |                       |           |                                   | Band 4: -0.97                   |                                  |                     |                                                         |                   |
|           | Chain (1)              | INPAQ    | DAM-I6-H-DB-800-10-17 | Dipole    | 1.29                              | Band 1&2: 1.94                  | NA                               | NA                  | SMA RP Plug                                             | 900               |
|           |                        |          |                       |           |                                   | Band 3: -0.49                   |                                  |                     |                                                         |                   |
|           |                        |          |                       |           |                                   | Band 4: -0.93                   |                                  |                     |                                                         |                   |
| Ant. Set. | Transmitter Circuit    | Brand    | Model                 | Ant. Type | 2.4GHz Gain with cable loss (dBi) |                                 | 5GHz Gain with cable loss (dBi)  |                     | Connector Type                                          | Cable Length (mm) |
| 3         | Chain (0)<br>Chain (1) | Sparklan | AD-301N               | Dipole    | 4.4                               |                                 | Band 1&2: 5.2<br>Band 3&4: 5.8   |                     | IPEX MHF 4 at modular side & RP-SMA (M) at antenna side | 150               |
| 4         | Chain (0)<br>Chain (1) | Sparklan | AD-103AG              | Dipole    | 2.02                              |                                 | Band 1&2: 1.93<br>Band 3&4: 2.03 |                     |                                                         | 150               |
| 5         | Chain (0)<br>Chain (1) | Sparklan | AD-305N               | Dipole    | 5.0                               |                                 | 5.0                              |                     |                                                         | 150               |
| 6         | Chain (0)<br>Chain (1) | Sparklan | AD-303N               | Dipole    | 3.0                               |                                 | 3.0                              |                     |                                                         | 150               |
| 7         | Chain (0)<br>Chain (1) | Sparklan | AD-302N               | Dipole    | 3.0                               |                                 | 2.0                              |                     |                                                         | 150               |

### 3 Calculation Result of Maximum Conducted Power

#### For WLAN:

| Frequency Band (MHz) | Max Power (mW) | Antenna Gain (dBi) | Distance (cm) | Power Density (mW/cm <sup>2</sup> ) | Limit (mW/cm <sup>2</sup> ) |
|----------------------|----------------|--------------------|---------------|-------------------------------------|-----------------------------|
| 2412-2462            | 514.66         | 8.01               | 20            | 0.64751                             | 1                           |
| 5180-5240            | 118.189        | 8.21               | 20            | 0.15571                             | 1                           |
| 5260-5320            | 117.661        | 8.21               | 20            | 0.15501                             | 1                           |
| 5500-5720            | 113.517        | 8.81               | 20            | 0.17171                             | 1                           |
| 5745-5825            | 113.606        | 8.81               | 20            | 0.17184                             | 1                           |

NOTE:

2.4GHz: Directional gain = 5dBi + 10log(2) = 8.01dBi

5GHz:

UNII-1, UNII-2A: Directional gain = 5.20dBi + 10log(2) = 8.21dBi

UNII-2C, UNII-3: Directional gain = 5.80dBi + 10log(2) = 8.81dBi

#### For Bluetooth:

##### BT-EDR:

| Frequency (MHz) | Max Power (mW) | Antenna Gain (dBi) | Distance (cm) | Power Density (mW/cm <sup>2</sup> ) | Limit (mW/cm <sup>2</sup> ) |
|-----------------|----------------|--------------------|---------------|-------------------------------------|-----------------------------|
| 2402-2480       | 6.637          | 5.00               | 20            | 0.00418                             | 1                           |

##### BT-LE:

| Frequency (MHz) | Max Power (mW) | Antenna Gain (dBi) | Distance (cm) | Power Density (mW/cm <sup>2</sup> ) | Limit (mW/cm <sup>2</sup> ) |
|-----------------|----------------|--------------------|---------------|-------------------------------------|-----------------------------|
| 2402-2480       | 1.442          | 5.00               | 20            | 0.00091                             | 1                           |

#### Conclusion:

Both of the Bluetooth and WLAN (5GHz) can transmit simultaneously, the formula of calculated the MPE is:

$$CPD_1 / LPD_1 + CPD_2 / LPD_2 + \dots \text{etc.} < 1$$

**CPD = Calculation power density**

**LPD = Limit of power density**

Therefore, the worst-case situation is  $0.17184 / 1 + 0.00418 / 1 = 0.17602$ , which is less than "1".

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