



# **RF Exposure Evaluation Report**

**APPLICANT** : Hewlett Packard Enterprise Company  
**EQUIPMENT** : Wireless Access Point  
**BRAND NAME** : aruba  
**MODEL NAME** : APIN0304, APIN0305  
**MARKETING NAME** : APIN0304, APIN0305  
**FCC ID** : Q9DAPIN0304305  
**STANDARD** : 47 CFR Part 2.1091

We, SPORTON INTERNATIONAL (KUNSHAN) INC., would like to declare that the device has been evaluated in accordance with 47 CFR Part 2.1091, and pass the limit. Without written approval of SPORTON INTERNATIONAL (KUNSHAN) INC., the test report shall not be reproduced except in full.

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**Revision History**

| REPORT NO. | VERSION | DESCRIPTION             | ISSUED DATE   |
|------------|---------|-------------------------|---------------|
| FA670709   | Rev. 01 | Initial issue of report | Sep. 20, 2016 |
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**1. Administration Data****1.1. Testing Laboratory**

| Testing Laboratory |                                                                                                                       |
|--------------------|-----------------------------------------------------------------------------------------------------------------------|
| Test Site          | SPORTON INTERNATIONAL (KUNSHAN) INC.                                                                                  |
| Test Site Location | No. 3-2, PingXiang Road, Kunshan, Jiangsu Province, P. R. China<br>TEL: +86-0512-5790-0158<br>FAX: +86-0512-5790-0958 |

| Applicant    |                                          |
|--------------|------------------------------------------|
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| Manufacturer |                                          |
|--------------|------------------------------------------|
| Company Name | Hewlett Packard Enterprise Company       |
| Address      | 3000 Hanover Street, Palo Alto, CA 94304 |

## 2. General Information

### 2.1. Description of Equipment Under Test (EUT)

| Product Feature & Specification                                                                                                                 |                                                                                                                                         |                    |                         |                  |        |
|-------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------|--------------------|-------------------------|------------------|--------|
| EUT Type                                                                                                                                        | Wireless Access Point                                                                                                                   |                    |                         |                  |        |
| Brand Name                                                                                                                                      | aruba                                                                                                                                   |                    |                         |                  |        |
| Model Name                                                                                                                                      | APIN0304, APIN0305                                                                                                                      |                    |                         |                  |        |
| Marketing Name                                                                                                                                  | APIN0304, APIN0305                                                                                                                      |                    |                         |                  |        |
| FCC ID                                                                                                                                          | Q9DAPIN0304305                                                                                                                          |                    |                         |                  |        |
| Wireless Technology and Frequency Range                                                                                                         | WLAN 2.4GHz Band: 2412 MHz ~ 2462 MHz<br>WLAN 5.2GHz Band: 5180 MHz ~ 5240 MHz<br>WLAN 5.8GHz Band: 5745 MHz ~ 5825 MHz                 |                    |                         |                  |        |
| Mode                                                                                                                                            | • WLAN 2.4GHz 802.11b/g/n HT20/HT40<br>• WLAN 5GHz 802.11a/n HT20/HT40<br>• WLAN 5GHz 802.11ac VHT20/VHT40/VHT80<br>• Bluetooth v4.0 LE |                    |                         |                  |        |
| Antenna Type                                                                                                                                    | Model Name                                                                                                                              | Antenna Type       |                         |                  |        |
|                                                                                                                                                 |                                                                                                                                         | WLAN               | Omnidirectional Antenna |                  |        |
|                                                                                                                                                 | APIN0304                                                                                                                                |                    | Bluetooth               | Internal Antenna |        |
|                                                                                                                                                 |                                                                                                                                         | APIN0305           | WLAN                    | Internal Antenna |        |
|                                                                                                                                                 | Bluetooth                                                                                                                               |                    | Internal Antenna        |                  |        |
|                                                                                                                                                 | SW Version                                                                                                                              | 6.5.1.0 build56105 |                         |                  |        |
| Antenna Function for Transmitter                                                                                                                | <APIN0304>:                                                                                                                             |                    |                         |                  |        |
|                                                                                                                                                 |                                                                                                                                         | BT antenna         | Ant. 1                  | Ant. 2           | Ant. 3 |
|                                                                                                                                                 | Bluetooth                                                                                                                               | V                  | -                       | -                | -      |
|                                                                                                                                                 | WLAN 2.4GHz 802.11 b/g/n MIMO                                                                                                           | -                  | -                       | V                | V      |
|                                                                                                                                                 | WLAN 5GHz 802.11 a/n/ac MIMO                                                                                                            | -                  | V                       | V                | V      |
|                                                                                                                                                 | <APIN0305>:                                                                                                                             |                    |                         |                  |        |
|                                                                                                                                                 |                                                                                                                                         | Ant. 1             | Ant. 2                  | Ant. 3           |        |
|                                                                                                                                                 | Bluetooth                                                                                                                               | -                  | V                       | -                |        |
|                                                                                                                                                 | WLAN 2.4GHz 802.11 b/g/n MIMO                                                                                                           | V                  | -                       | V                |        |
|                                                                                                                                                 | WLAN 5GHz 802.11 a/n/ac MIMO                                                                                                            | V                  | V                       | V                |        |
| EUT Stage                                                                                                                                       | Identical Prototype                                                                                                                     |                    |                         |                  |        |
| Remark:                                                                                                                                         |                                                                                                                                         |                    |                         |                  |        |
| 1. The above EUT's information was declared by manufacturer. Please refer to the specifications or user's manual for more detailed description. |                                                                                                                                         |                    |                         |                  |        |
| 2. WLAN 2.4GHz and WLAN 5GHz can transmit in MIMO antenna mode only, and it has no SISO antenna mode.                                           |                                                                                                                                         |                    |                         |                  |        |

## 2.2. Sample List

There are two model names of EUT. Model APIN0305 is designed with built in antennas, and model APIN0304 with three RP-SMA connectors for external antennas. For model APIN0304, it has nine types of antenna as below table:

|   | type        | Description                                                | Gain                             | Polorization    |
|---|-------------|------------------------------------------------------------|----------------------------------|-----------------|
| 1 | AP-ANT-1W   | 2.4-2.5GHz/5GHz, 5.0dBi Tri-Band, Omni-Directional Antenna | 3.8dBi @2.4GHz;<br>5.8dB @5.8GHz | Linear vertical |
| 2 | AP-ANT-13B  | downtilt omni, dual-band                                   | 4.4dBi @2.4GHz;<br>3.3dB @5.8GHz | Linear vertical |
| 3 | AP-ANT-19,  | Dual Band Omnidirectional                                  | 3dBi @2.4GHz;<br>6dB @5.8GHz     | vertical        |
| 4 | AP-ANT-20W, | 2.4- and 5-GHz dual-band omni directional                  | 2dBi @2.4GHz;<br>2dB @5.8GHz     | Linear vertical |
| 5 | AP-ANT-16,  | Triple Element Downtilt Omni, Dual-Band                    | 3.9dBi @2.4GHz;<br>4.7dB @5.8GHz | vertical        |
| 6 | AP-ANT-25A  | 2.4- and 5-GHz dual polarized sector antenna               | 5dBi @2.4GHz;<br>5dB @5.8GHz     | slant +/-45°    |
| 7 | AP-ANT-35A  | 2.4- and 5-GHz dual polarized sector antenna               | 5dBi @2.4GHz;<br>5dB @5.8GHz     | slant +/-45°    |
| 8 | AP-ANT-28   | 2.4- and 5-GHz dual-polarized sector antenna               | 7.5dBi @2.4GHz;<br>7.5dB @5.8GHz | slant +/-45°    |
| 9 | AP-ANT-38   | 2.4- and 5-GHz dual-polarized sector antenna               | 7.5dBi @2.4GHz;<br>7.5dB @5.8GHz | slant +/-45°    |

For model APIN0304, we only evaluate the antenna (AP-ANT-19 and AP-ANT-28) with the maximum antenna gain for MPE evaluation.

### **3. Maximum RF average output power among production units**

#### **<WLAN 2.4GHz>**

| Model Name | Mode         | Maximum Average Power (dBm) |
|------------|--------------|-----------------------------|
| APIN0304   | 802.11b      | 21.5                        |
|            | 802.11g      | 21.0                        |
|            | 802.11n-HT20 | 17.0                        |
|            | 802.11n-HT40 | 17.0                        |
| APIN0305   | 802.11b      | 21.5                        |
|            | 802.11g      | 21.0                        |
|            | 802.11n-HT20 | 20.0                        |
|            | 802.11n-HT40 | 18.0                        |

#### **<WLAN 5GHz>**

| Model Name |             | Mode           | Maximum Average Power (dBm) |
|------------|-------------|----------------|-----------------------------|
| APIN0304   | WLAN 5.2GHz | 802.11a        | 23.5                        |
|            |             | 802.11n-HT20   | 23.0                        |
|            |             | 802.11n-HT40   | 21.0                        |
|            |             | 802.11ac-VHT20 | 23.0                        |
|            |             | 802.11ac-VHT40 | 21.0                        |
|            |             | 802.11ac-VHT80 | 17.5                        |
|            | WLAN 5.8GHz | 802.11a        | 23.5                        |
|            |             | 802.11n-HT20   | 23.0                        |
|            |             | 802.11n-HT40   | 23.5                        |
|            |             | 802.11ac-VHT20 | 23.0                        |
|            |             | 802.11ac-VHT40 | 23.5                        |
|            |             | 802.11ac-VHT80 | 23.0                        |
| APIN0305   | WLAN 5.2GHz | 802.11a        | 23.5                        |
|            |             | 802.11n-HT20   | 23.0                        |
|            |             | 802.11n-HT40   | 21.5                        |
|            |             | 802.11ac-VHT20 | 23.0                        |
|            |             | 802.11ac-VHT40 | 21.5                        |
|            |             | 802.11ac-VHT80 | 19.5                        |
|            | WLAN 5.8GHz | 802.11a        | 23.5                        |
|            |             | 802.11n-HT20   | 23.0                        |
|            |             | 802.11n-HT40   | 23.5                        |
|            |             | 802.11ac-VHT20 | 23.0                        |
|            |             | 802.11ac-VHT40 | 23.5                        |
|            |             | 802.11ac-VHT80 | 23.0                        |

#### **<Bluetooth>**

| Model Name | Mode              | Maximum Average Power (dBm) |
|------------|-------------------|-----------------------------|
| APIN0304   | Bluetooth v4.0 LE | 0.5                         |
| APIN0305   | Bluetooth v4.0 LE | 0.5                         |

#### 4. RF Exposure Limit Introduction

According to ANSI/IEEE C95.1-1992, the criteria listed in Table 1 shall be used to evaluate the environmental impact of human exposure to radio frequency (RF) radiation as specified in §1.1310.

| Frequency range (MHz)                                          | Electric field strength (V/m) | Magnetic field strength (A/m) | Power density (mW/cm <sup>2</sup> ) | Averaging time (minutes) |
|----------------------------------------------------------------|-------------------------------|-------------------------------|-------------------------------------|--------------------------|
| <b>(A) Limits for Occupational/Controlled Exposures</b>        |                               |                               |                                     |                          |
| 0.3-3.0                                                        | 614                           | 1.63                          | *(100)                              | 6                        |
| 3.0-30                                                         | 1842/f                        | 4.89/f                        | *(900/f <sup>2</sup> )              | 6                        |
| 30-300                                                         | 61.4                          | 0.163                         | 1.0                                 | 6                        |
| 300-1500                                                       |                               |                               | f/300                               | 6                        |
| 1500-100,000                                                   |                               |                               | 5                                   | 6                        |
| <b>(B) Limits for General Population/Uncontrolled Exposure</b> |                               |                               |                                     |                          |
| 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                       |

The MPE was calculated at 20 cm to show compliance with the power density limit.

The following formula was used to calculate the Power Density:

$$S = \frac{PG}{4\pi R^2}$$

Where:

S = Power Density

P = Output Power at Antenna Terminals

G = Gain of Transmit Antenna (linear gain)

R = Distance from Transmitting Antenna



## **5. Radio Frequency Radiation Exposure Evaluation**

### **5.1. Standalone Power Density Calculation**

| Model Name | Band        | Frequency (MHz) | Antenna Gain (dBi) | Maximum Power (dBm) | Maximum EIRP (dBm) | Maximum EIRP (W) | Average EIRP (mW) | Power Density at 20cm (mW/mW <sup>2</sup> ) | Limit (mW/mW <sup>2</sup> ) | Power Density / Limit |
|------------|-------------|-----------------|--------------------|---------------------|--------------------|------------------|-------------------|---------------------------------------------|-----------------------------|-----------------------|
| APIN0304   | WLAN 2.4GHz | 2412.0          | 7.50               | 21.5                | 29.000             | 0.794            | 794.328           | 0.158                                       | 1.000                       | <b>0.158</b>          |
|            | WLAN 5.2GHz | 5180.0          | 6.00               | 23.5                | 29.500             | 0.891            | 891.251           | 0.177                                       | 1.000                       | 0.177                 |
|            | WLAN 5.8GHz | 5745.0          | 6.00               | 23.5                | 29.500             | 0.891            | 891.251           | 0.177                                       | 1.000                       | 0.177                 |
|            | Bluetooth   | 2402.0          | 4.50               | 0.5                 | 5.000              | 0.003            | 3.162             | 0.001                                       | 1.000                       | <b>0.001</b>          |
| APIN0305   | WLAN 2.4GHz | 2412.0          | 2.40               | 21.5                | 23.900             | 0.245            | 245.471           | 0.049                                       | 1.000                       | 0.049                 |
|            | WLAN 5.2GHz | 5180.0          | 2.80               | 23.5                | 26.300             | 0.427            | 426.580           | 0.085                                       | 1.000                       | 0.085                 |
|            | WLAN 5.8GHz | 5745.0          | 2.80               | 23.5                | 26.300             | 0.427            | 426.580           | 0.085                                       | 1.000                       | 0.085                 |
|            | Bluetooth   | 2402.0          | 3.40               | 0.5                 | 3.900              | 0.002            | 2.455             | 0.000                                       | 1.000                       | <b>0.000</b>          |

**Note:**

1. For conservativeness, the lowest uplink frequency of each band is used to determine the MPE limit of that band.
2. In the above table have assessed WLAN 2.4GHz, WLAN 5GHz and Bluetooth by referring to their maximum antenna gain and maximum output power.

**<For Beamforming mode>**

| Model Name | Band        | Frequency (MHz) | Antenna Gain (dBi) | Maximum Power (dBm) | Maximum EIRP (dBm) | Maximum EIRP (W) | Average EIRP (mW) | Power Density at 20cm (mW/mW <sup>2</sup> ) | Limit (mW/mW <sup>2</sup> ) | Power Density / Limit |
|------------|-------------|-----------------|--------------------|---------------------|--------------------|------------------|-------------------|---------------------------------------------|-----------------------------|-----------------------|
| APIN0304   | WLAN 2.4GHz | 2412.0          | 7.50               | 17.0                | 24.500             | 0.282            | 281.838           | 0.056                                       | 1.000                       | 0.056                 |
|            | WLAN 5.2GHz | 5180.0          | 10.77              | 23.0                | 33.770             | 2.382            | 2382.319          | 0.474                                       | 1.000                       | 0.474                 |
|            | WLAN 5.8GHz | 5745.0          | 10.77              | 23.5                | 34.270             | 2.673            | 2673.006          | 0.532                                       | 1.000                       | <b>0.532</b>          |
| APIN0305   | WLAN 2.4GHz | 2412.0          | 5.41               | 20.0                | 25.410             | 0.348            | 347.536           | 0.069                                       | 1.000                       | <b>0.069</b>          |
|            | WLAN 5.2GHz | 5180.0          | 7.57               | 23.0                | 30.570             | 1.140            | 1140.250          | 0.227                                       | 1.000                       | 0.227                 |
|            | WLAN 5.8GHz | 5745.0          | 7.57               | 23.5                | 31.070             | 1.279            | 1279.381          | 0.255                                       | 1.000                       | <b>0.255</b>          |

**Note:**

1. For conservativeness, the lowest uplink frequency of each band is used to determine the MPE limit of that band.
2. This device support beamforming for WLAN 2.4GHz 802.11n HT20/HT40 and WLAN 5GHz 802.11n/ac HT20/HT40/VHT20/VHT40/VHT80.
3. In the above table have assessed WLAN 2.4GHz and WLAN 5GHz by referring to their maximum direction gain and maximum output power.
4. For model APIN0304 with WLAN 2.4GHz, the dual-polarized sector antenna with maximum antenna gain 7.5dBi which we choosed without beamforming antenna gain because of irrelevant of polarization. So for beamforming mode, we also use 7.5dBi to evaluate MPE test. For model APIN0304 with WLAN 5GHz on the maximum antenna gain 7.5dBi, the beamforming antenna gain is not equal to add  $10\log(3)=4.77$  dBi but 3.01 dBi because of the dual-polarization. So we choose the secondary antenna with antenna gain 6dBi to evaluate MPE test.
5. For model APIN0305, composited gain for each antenna is 2.4dBi in 2.4GHz and 2.8dBi in 5GHz. And the beamforming gain is equal to each antenna add  $10 \log (N)$  dB, where N is the number of outputs.

## 5.2. Collocated Power Density Calculation

| Model Name | Band            | Maximum WLAN Power Density / Limit | Maximum Bluetooth Power Density / Limit | $\Sigma$ (Power Density / Limit) of WLAN 2.4GHz + WLAN 5GHz + Bluetooth |
|------------|-----------------|------------------------------------|-----------------------------------------|-------------------------------------------------------------------------|
| APIN0304   | WLAN2.4GHz Band | 0.158                              | 0.001                                   | 0.691                                                                   |
|            | WLAN5GHz Band   | 0.532                              |                                         |                                                                         |
| APIN0305   | WLAN2.4GHz Band | 0.069                              | 0.000                                   | 0.324                                                                   |
|            | WLAN5GHz Band   | 0.255                              |                                         |                                                                         |

**Note:**

1.  $\Sigma$  (Power Density / Limit): This is a summation of [(power density for each transmitter/antenna included in the simultaneous transmission)/ (corresponding MPE limit)], for WLAN 2.4GHz+WLAN 5GHz + Bluetooth.
2. Considering the all antennas collocation of the EIRP performance listed in the table above, the aggregated (power density /limit) is smaller than 1, and MPE of 3 collocated transmitters is compliant.

## Conclusion:

According to 47 CFR §2.1091, the RF exposure analysis concludes that the RF Exposure is FCC compliant.