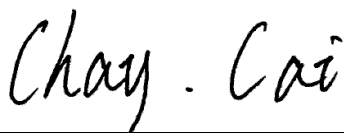


# FCC RF EXPOSURE REPORT

## FCC ID: TVE-120757

**Project No.** : 1909C046  
**Equipment** : PCIEV1.0-FRT01 WLAN 802.11AC 3x3 PCIE Module  
**Brand Name** : FORTINET  
**Test Model** : P25037-01  
**Series Model** : N/A  
**Applicant** : Fortinet, Inc.  
**Address** : 899 Kifer Road, Sunnyvale, CA 94086 USA  
**Manufacturer** : Fortinet, Inc.  
**Address** : 899 Kifer Road, Sunnyvale, CA 94086 USA  
**Date of Receipt** : Sep. 11, 2019  
**Date of Test** : Sep. 12, 2019 ~ Nov. 07, 2019  
**Issued Date** : Dec. 13, 2019  
**Report Version** : R00  
**Test Sample** : Engineering Sample No.: DG2019091147  
**Standard(s)** : FCC Guidelines for Human Exposure IEEE C95.1 & FCC Part 2.1091  
FCC Title 47 Part 2.1091, OET Bulletin 65 Supplement C

The above equipment has been tested and found compliance with the requirement of the relative standards by BTL Inc.



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**REPORT ISSUED HISTORY**

| Report Version | Description    | Issued Date   |
|----------------|----------------|---------------|
| R00            | Original Issue | Dec. 13, 2019 |

## 1. MPE CALCULATION METHOD

Calculation Method of RF Safety Distance:

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

where:

S = power density

P = power input to the antenna

G = power gain of the antenna in the direction of interest relative to an isotropic radiator

R = distance to the center of radiation of the antenna

Table for Filed Antenna

**For 2.4G:**

| Ant. | Brand                                                                             | Model Name | Antenna Type | Connector        | Gain (dBi) |
|------|-----------------------------------------------------------------------------------|------------|--------------|------------------|------------|
| 1    |  | W1800R     | Dipole       | SMA Male Reverse | 4.16       |
| 2    |  | W1800R     | Dipole       | SMA Male Reverse | 4.16       |
| 3    |  | W1800R     | Dipole       | SMA Male Reverse | 4.16       |

Note: This EUT supports CDD, and all antennas have the same gain,

(1) For Non Beamforming function, Directional gain =  $G_{ANT} + \text{Array Gain}$ ,

For output power measurements, Array Gain = 0 ( $N_{ANT} \leq 4$ ), so the Directional gain = 4.16.

For power spectral density measurements, Array Gain =  $10\log(N_{ANT}/N_{SS})$  dB, so the Directional gain =  $4.16 + 10\log(3/1) = 8.93$ . So, the power density limit is  $8 - 8.93 + 6 = 5.07$ .

(2) For Beamforming function, Beamforming gain: 4.5dB,

so the Directional gain =  $4.16 + 4.5 = 8.66$ , Then, the output Power limit is  $30 - 8.66 + 6 = 27.34$ .

**For 5G:**

For UNII-1:

| Ant. | Brand                                                                             | Model Name | Antenna Type | Connector        | Gain (dBi) |
|------|-----------------------------------------------------------------------------------|------------|--------------|------------------|------------|
| 1    |  | W1800R     | Dipole       | SMA Male Reverse | 3.06       |
| 2    |  | W1800R     | Dipole       | SMA Male Reverse | 3.06       |
| 3    |  | W1800R     | Dipole       | SMA Male Reverse | 3.06       |

Note: This EUT supports CDD, and all antennas have the same gain,

- (1) For Non Beamforming function, Directional gain= $G_{ANT}$ +Array Gain,  
For output power measurements, Array Gain=0 ( $N_{ANT} \leq 4$ ), so, Directional gain=3.06  
For power spectral density measurements, Array Gain= $10\log(N_{ANT}/N_{SS})$  dB  
Directional gain= $3.06+10\log(3/1)=7.83$ .  
So, the UNII-1 power density limit is  $17-7.83+6=15.17$
- (2) For Beamforming function, Beamforming gain: 4.5dB,  
so the Directional gain= $3.06+4.5=7.56$ , Then, the UNII-1 output Power limit is  $30-7.56+6=28.44$ .

For UNII-3:

| Ant. | Brand                                                                              | Model Name | Antenna Type | Connector        | Gain (dBi) |
|------|------------------------------------------------------------------------------------|------------|--------------|------------------|------------|
| 1    |   | W1800R     | Dipole       | SMA Male Reverse | 3.58       |
| 2    |   | W1800R     | Dipole       | SMA Male Reverse | 3.58       |
| 3    |  | W1800R     | Dipole       | SMA Male Reverse | 3.58       |

Note: This EUT supports CDD, and all antennas have the same gain,

- (1) For Non Beamforming function, Directional gain= $G_{ANT}$ +Array Gain,  
For output power measurements, Array Gain=0 ( $N_{ANT} \leq 4$ ), so, Directional gain=3.58  
For power spectral density measurements, Array Gain= $10\log(N_{ANT}/N_{SS})$  dB  
Directional gain= $3.58+10\log(3/1)=8.35$ .  
So, the UNII-3 power density limit is  $30-8.35+6=27.65$ .
- (2) For Beamforming function, Beamforming gain: 4.5dB,  
so the Directional gain= $3.58+4.5=8.08$ , Then, the UNII-3 output Power limit is  $30-8.08+6=27.92$

The worst case for 3TX as follow:

#### For 2.4G:

For Non Beamforming:

| Operating Mode     | TX Mode | 3TX                      |
|--------------------|---------|--------------------------|
| IEEE 802.11b       |         | V (Ant. 1+Ant. 2+Ant. 3) |
| IEEE 802.11g       |         | V (Ant. 1+Ant. 2+Ant. 3) |
| IEEE 802.11n(HT20) |         | V (Ant. 1+Ant. 2+Ant. 3) |
| IEEE 802.11n(HT40) |         | V (Ant. 1+Ant. 2+Ant. 3) |

For Beamforming:

| Operating Mode     | TX Mode | 3TX                      |
|--------------------|---------|--------------------------|
| IEEE 802.11n(HT20) |         | V (Ant. 1+Ant. 2+Ant. 3) |
| IEEE 802.11n(HT40) |         | V (Ant. 1+Ant. 2+Ant. 3) |

#### For 5G:

For Non Beamforming:

| Operating Mode       | TX Mode | 3TX                      |
|----------------------|---------|--------------------------|
| IEEE 802.11a         |         | V (Ant. 1+Ant. 2+Ant. 3) |
| IEEE 802.11n (HT20)  |         | V (Ant. 1+Ant. 2+Ant. 3) |
| IEEE 802.11n (HT40)  |         | V (Ant. 1+Ant. 2+Ant. 3) |
| IEEE 802.11ac(VHT20) |         | V (Ant. 1+Ant. 2+Ant. 3) |
| IEEE 802.11ac(VHT40) |         | V (Ant. 1+Ant. 2+Ant. 3) |
| IEEE 802.11ac(VHT80) |         | V (Ant. 1+Ant. 2+Ant. 3) |

For Beamforming:

| Operating Mode       | TX Mode | 3TX                      |
|----------------------|---------|--------------------------|
| IEEE 802.11n (HT20)  |         | V (Ant. 1+Ant. 2+Ant. 3) |
| IEEE 802.11n (HT40)  |         | V (Ant. 1+Ant. 2+Ant. 3) |
| IEEE 802.11ac(VHT20) |         | V (Ant. 1+Ant. 2+Ant. 3) |
| IEEE 802.11ac(VHT40) |         | V (Ant. 1+Ant. 2+Ant. 3) |
| IEEE 802.11ac(VHT80) |         | V (Ant. 1+Ant. 2+Ant. 3) |

## 2. TEST RESULTS

For 2.4GHz\_Non Beamforming:

| Directional Gain (dBi) | Directional Gain (numeric) | Max. Output Power (dBm) | Max. Output Power (mW) | Power Density (S) (mW/cm <sup>2</sup> ) | Limit of Power Density (S) (mW/cm <sup>2</sup> ) | Test Result |
|------------------------|----------------------------|-------------------------|------------------------|-----------------------------------------|--------------------------------------------------|-------------|
| 4.16                   | 2.6062                     | 29.67                   | 926.8298               | 0.30770                                 | 1                                                | Complies    |

For 2.4GHz\_With Beamforming:

| Directional Gain (dBi) | Directional Gain (numeric) | Max. Output Power (dBm) | Max. Output Power (mW) | Power Density (S) (mW/cm <sup>2</sup> ) | Limit of Power Density (S) (mW/cm <sup>2</sup> ) | Test Result |
|------------------------|----------------------------|-------------------------|------------------------|-----------------------------------------|--------------------------------------------------|-------------|
| 8.66                   | 7.3451                     | 26.33                   | 429.5364               | 0.40191                                 | 1                                                | Complies    |

For 5GHz UNII-1\_Non Beamforming:

| Directional Gain (dBi) | Directional Gain (numeric) | Max. Output Power (dBm) | Max. Output Power (mW) | Power Density (S) (mW/cm <sup>2</sup> ) | Limit of Power Density (S) (mW/cm <sup>2</sup> ) | Test Result |
|------------------------|----------------------------|-------------------------|------------------------|-----------------------------------------|--------------------------------------------------|-------------|
| 3.06                   | 2.0230                     | 26.58                   | 454.9881               | 0.11725                                 | 1                                                | Complies    |

For 5GHz UNII-1\_Beamforming:

| Directional Gain (dBi) | Directional Gain (numeric) | Max. Output Power (dBm) | Max. Output Power (mW) | Power Density (S) (mW/cm <sup>2</sup> ) | Limit of Power Density (S) (mW/cm <sup>2</sup> ) | Test Result |
|------------------------|----------------------------|-------------------------|------------------------|-----------------------------------------|--------------------------------------------------|-------------|
| 7.56                   | 5.7016                     | 26.39                   | 435.5119               | 0.31632                                 | 1                                                | Complies    |

For 5GHz UNII-3\_Non Beamforming:

| Directional Gain (dBi) | Directional Gain (numeric) | Max. Output Power (dBm) | Max. Output Power (mW) | Power Density (S) (mW/cm <sup>2</sup> ) | Limit of Power Density (S) (mW/cm <sup>2</sup> ) | Test Result |
|------------------------|----------------------------|-------------------------|------------------------|-----------------------------------------|--------------------------------------------------|-------------|
| 3.58                   | 2.2803                     | 29.24                   | 839.4600               | 0.24385                                 | 1                                                | Complies    |

For 5GHz UNII-3\_Beamforming:

| Directional Gain (dBi) | Directional Gain (numeric) | Max. Output Power (dBm) | Max. Output Power (mW) | Power Density (S) (mW/cm <sup>2</sup> ) | Limit of Power Density (S) (mW/cm <sup>2</sup> ) | Test Result |
|------------------------|----------------------------|-------------------------|------------------------|-----------------------------------------|--------------------------------------------------|-------------|
| 8.08                   | 6.4269                     | 27.11                   | 514.0437               | 0.42085                                 | 1                                                | Complies    |

**For the max simultaneous transmission MPE:**

| Power Density (S) (mW/cm <sup>2</sup> ) | Power Density (S) (mW/cm <sup>2</sup> ) | Total   | Limit of Power Density (S) (mW/cm <sup>2</sup> ) | Test Result |
|-----------------------------------------|-----------------------------------------|---------|--------------------------------------------------|-------------|
| 2.4GHz                                  | 5GHz                                    |         |                                                  |             |
| 0.40191                                 | 0.42085                                 | 0.82276 | 1                                                | Complies    |

Note: The calculated distance is 25 cm.

**End of Test Report**