



## RF Exposure Evaluation Declaration

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**FCC ID:** SFK-WF1801

**APPLICANT:** CIG Shanghai Co., Ltd.

**Application Type:** Certification

**Product:** 2x2 dual band 802.11ac indoor AP

**Model No.:** WF-180

**FCC Classification:** Digital Transmission System (DTS)  
Unlicensed National Information Infrastructure (UNII)

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( Marlin Chen )



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.

The test report shall not be reproduced except in full without the written approval of MRT Technology (Suzhou) Co., Ltd.

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## Revision History

| Report No.   | Version | Description    | Issue Date |
|--------------|---------|----------------|------------|
| 1507RSU00104 | Rev. 01 | Initial report | 07-20-2015 |
|              |         |                |            |

## 1. PRODUCT INFORMATION

### 1.1. Equipment Description

|                              |   |
|------------------------------|---|
| Product Name                 | 2x2 dual band 802.11ac indoor AP  |
| Model No.                    | WF-180  |
| Frequency Range              | <p><b><u>For 2.4GHz Band:</u></b><br/>       802.11b/g/n:<br/>       2412 ~ 2462 MHz</p> <p><b><u>For 5.0GHz Band:</u></b><br/>       For 802.11a/n-HT20/ac-VHT20:<br/>       5180~5240MHz, 5745~5825MHz<br/>       For 802.11n-HT40/ac-VHT40:<br/>       5190~5230MHz, 5755~5795MHz<br/>       For 802.11ac-VHT80:<br/>       5210MHz, 5775MHz</p> |
| Type of Modulation           | 802.11b: DSSS<br>802.11g/a/n/ac: OFDM   |
| Maximum Average Output Power | 802.11b: 23.14dBm<br>802.11g: 23.24dBm<br>802.11n-HT20: 23.11dBm<br>802.11n-HT40: 22.66dBm<br>802.11a: 23.02dBm<br>802.11n-HT20: 22.96dBm<br>802.11n-HT40: 22.03dBm<br>802.11ac-VHT20: 23.03dBm<br>802.11ac-VHT40: 21.99dBm<br>802.11ac-VHT80: 17.28dBm   |
| Adapter                      | M/N: RD1201000-C5-HOG<br>P/N: JQ-HOG2-1210-21R5<br>Input: 100-240V ~ 50/60Hz 0.6A MAX<br>OUTPUT: 12Vdc, 1A  |

## 1.2. Antenna Description

| Antenna Type | Frequency Band (GHz) | Tx Paths | Max Peak Gain (dBi) | Beam Forming Directional Gain (dBi) | CDD Directional Gain (dBi) |         |
|--------------|----------------------|----------|---------------------|-------------------------------------|----------------------------|---------|
|              |                      |          |                     |                                     | For Power                  | For PSD |
| PCB Antenna  | 2.4                  | 2        | 3                   | 6                                   | 3                          | 6       |
|              | 5                    | 2        | 3                   | 6                                   | 3                          | 6       |

1. The EUT supports Cyclic Delay Diversity (CDD) mode, and CDD signals are correlated. For CDD transmissions, directional gain is calculated as follows,  $N_{ANT} = 2$ ,  $N_{SS} = 1$ .
  - 1) If all antennas have the same gain,  $G_{ANT}$ , Directional gain =  $G_{ANT} + \text{Array Gain}$ , where Array Gain is as follows.
    - For power spectral density (PSD) measurements on all devices, Array Gain =  $10 \log (N_{ANT} / N_{SS})$  dB = 6.02;
    - For power measurements on IEEE 802.11 devices, Array Gain = 0 dB for  $N_{ANT} \leq 4$ ;
2. The EUT supports Beam Forming mode, and the Beam Forming mode support 802.11n/ac, not include 802.11a. Correlated signals include, but are not limited to, signals transmitted in any of the following modes:
 

Any transmit Beam Forming mode, whether fixed or adaptive (e.g., phased array modes, closed loop MIMO modes, Transmitter Adaptive Antenna modes, Maximum Ratio Transmission (MRT) modes, and Statistical Eigen Beam Forming (EBF) modes).

  - Unequal antenna gains, with equal transmit powers. For antenna gains given by  $G_1, G_2, \dots, G_N$  dBi transmit signals are correlated, then
  - Directional gain =  $10 \log [(10^{G_1/20} + 10^{G_2/20} + \dots + 10^{G_N/20})^2 / N_{ANT}]$  dBi [Note the “20”s in the denominator of each exponent and the square of the sum of terms; the object is to combine the signal levels coherently.]

## 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 (MHz)                                     | Electric Field Strength (V/m) | Magnetic Field Strength (A/m) | Power Density (mW/cm <sup>2</sup> ) | Average Time (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:  $P_d = (P_{out} * G) / (4 * \pi * r^2)$

Where

$P_d$  = power density in mW/cm<sup>2</sup>

$P_{out}$  = 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

$P_d$  is the limit of MPE, 1mW/cm<sup>2</sup>. 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.

## 2.2. Test Result of RF Exposure Evaluation

|           |                                  |
|-----------|----------------------------------|
| Product   | 2x2 dual band 802.11ac indoor AP |
| Test Item | RF Exposure Evaluation           |

Antenna Gain: The maximum Gain measured in fully anechoic chamber is 6dBi for 2.4GHz, 6dBi for 5.2GHz, and 6dBi for 5.8GHz in logarithm scale.

### For 2.4GHz ISM Band:

| Test Mode    | Frequency Band (MHz) | Maximum Average Output Power (dBm) | Power Density at R = 20 cm (mW/cm <sup>2</sup> ) | Limit (mW/cm <sup>2</sup> ) |
|--------------|----------------------|------------------------------------|--|-----------------------------|
| 802.11b      | 2412 ~ 2462          | 23.14                              | 0.1632   | 1                           |
| 802.11g      | 2412 ~ 2462          | 23.24                              | 0.1670   | 1                           |
| 802.11n-HT20 | 2412 ~ 2462          | 23.11                              | 0.1621   | 1                           |
| 802.11n-HT40 | 2422 ~ 2452          | 22.66                              | 0.1461   | 1                           |

### For 5GHz UNII Band:

| Test Mode      | Frequency Band (MHz) | Maximum Average Output Power (dBm) | Power Density at R = 20 cm (mW/cm <sup>2</sup> ) | Limit (mW/cm <sup>2</sup> ) |
|----------------|----------------------|------------------------------------|--|-----------------------------|
| 802.11a        | 5180 ~ 5240          | 22.68                              | 0.1468   | 1                           |
|                | 5745 ~ 5825          | 23.02                              | 0.1588   | 1                           |
| 802.11n-HT20   | 5180 ~ 5240          | 22.46                              | 0.1395   | 1                           |
|                | 5745 ~ 5825          | 22.96                              | 0.1566   | 1                           |
| 802.11n-HT40   | 5190 ~ 5230          | 21.28                              | 0.1063   | 1                           |
|                | 5755 ~ 5795          | 22.03                              | 0.1264   | 1                           |
| 802.11ac-VHT20 | 5180 ~ 5240          | 22.50                              | 0.1408   | 1                           |
|                | 5745 ~ 5825          | 23.03                              | 0.1591   | 1                           |
| 802.11ac-VHT40 | 5190 ~ 5230          | 21.40                              | 0.1093   | 1                           |
|                | 5755 ~ 5795          | 21.99                              | 0.1252   | 1                           |
| 802.11ac-VHT80 | 5210                 | 17.28                              | 0.0423   | 1                           |
|                | 5775                 | 16.42                              | 0.0347   | 1                           |

**CONCLUSION:**

Both of the WLAN 2.4GHz Band and WLAN 5GHz Band can transmit simultaneously. Therefore, the Max Power Density at R (20 cm) =  $0.1670\text{mW}/\text{cm}^2 + 0.1591\text{mW}/\text{cm}^2 = 0.3261\text{mW}/\text{cm}^2 < 1\text{mW}/\text{cm}^2$ . So the EUT complies with the requirement.