



RF Exposure Evaluation Declaration

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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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.

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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	<u>For 2.4GHz Band:</u> 802.11b/g/n: 2412 ~ 2462 MHz <u>For 5.0GHz Band:</u> For 802.11a/n-HT20/ac-VHT20: 5180~5240MHz, 5745~5825MHz For 802.11n-HT40/ac-VHT40: 5190~5230MHz, 5755~5795MHz For 802.11ac-VHT80: 5210MHz, 5775MHz
Type of Modulation	802.11b: DSSS 802.11g/a/n/ac: OFDM
Maximum Average Output Power	802.11b: 23.14dBm 802.11g: 23.24dBm 802.11n-HT20: 23.11dBm 802.11n-HT40: 22.66dBm 802.11a: 23.02dBm 802.11n-HT20: 22.96dBm 802.11n-HT40: 22.03dBm 802.11ac-VHT20: 23.03dBm 802.11ac-VHT40: 21.99dBm 802.11ac-VHT80: 17.28dBm
Adapter	M/N: RD1201000-C5-HOG P/N: JQ-HOG2-1210-21R5 Input: 100-240V ~ 50/60Hz 0.6A MAX 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

- The EUT supports Cyclic Delay Diversity (CDD) mode, and CDD signals are correlated. For CDD transmissions, directional gain is calculated as follows, $N_{ANT} = 2$, $N_{SS} = 1$.
 - 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 $N_{ANT} \leq 4$;
- 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 ²)	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: $P_d = (P_{out} \cdot G) / (4 \cdot \pi \cdot r^2)$

Where

P_d = power density in mW/cm²

P_{out} = output power to antenna in mW

G = gain of antenna in linear scale

π = 3.1416

r = distance between observation point and center of the radiator in cm

P_d is the limit of MPE, 1mW/cm². 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 ²)	Limit (mW/cm ²)
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 ²)	Limit (mW/cm ²)
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

CONCULISON:

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