RF Exposure Evaluation Declaration

FCC ID:	SFK-WF802
APPLICANT:	CIG Shanghai Co., Ltd.

Application Type:	Certification
Product:	Wi-Fi Extender
Model No.:	WF-802W
Brand Name:	CIG
Test Procedure(s):	KDB 447498 D01v06
FCC Classification:	Digital Transmission System (DTS) Unlicensed National Information Infrastructure (UNII)

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Revision History

Report No.	Version	Description	Issue Date	Note
1703RSU02005	Rev. 01	Initial report	07-13-2017	Valid

1. PRODUCT INFORMATION

1.1. Equipment Description

Product Name:	Wi-Fi Extender
Model No.:	WF-802W
Brand Name:	CIG
Wi-Fi Specification:	802.11a/b/g/n/ac
Frequency Range:	**2.4GHz:** 802.11b/g/n-HT20: 2412 ~ 2462MHz 802.11n-HT40: 2422 ~ 2452MHz **5GHz:** For 802.11 a/n-HT20/ac-VHT20: 5180~5320MHz, 5500~5720MHz, 5745~5825MHz For 802.11 n-HT40/ac-VHT40: 5190~5310MHz, 5510~5710MHz, 5755~5795MHz For 802.11ac-VHT80: 5210MHz, 5290MHz, 5530MHz, 5610MHz, 5690MHz, 5775MHz

Note: Differences between all models are for different marketing requirement.

1.2. Antenna Description

Antenna Type	Frequency Band (MHz)	TX Paths	Per Chain Max Antenna Gain (dBi)		Directional Gain (dBi)	Beam-Forming Gain (dBi)
			Ant 0	Ant 0		
PIFA Antenna	2412 ~ 2462	1	2.24	2.66	N/A	N/A
		2	2.24	2.66	5.46	5.46
	5150 ~ 5850	1	3.44	3.66	N/A	N/A
		2	3.44	3.66	6.56	6.56

Note:

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} + 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 = 3.01;
   - For power measurements on IEEE 802.11 devices,
     Array Gain = 0 dB for $N_{ANT} \leq 4$;
   2) If antenna gains are not equal, the user may use either of the following methods to

calculate directional gain, provided that each transmit antenna is driven by only one spatial stream:

- Directional gain may be calculated by using the formulas applicable to equal gain antennas with G_{ANT} set equal to the gain of the antenna having the highest gain;
- $$DirectionalGain = 10 \cdot \log\left[\frac{\sum_{j=1}^{N_{SS}}\left\{\sum_{k=1}^{N_{ANT}} g_{j,k}\right\}^2}{N_{ANT}}\right]$$

$g_{j,k} = 10^{G_k/20}$ if the kth antenna is being fed by spatial stream j, or zero if it is not;

G_k is the gain in dBi of the kth antenna.

2. The EUT also supports Beam Forming mode, and the Beam Forming support 802.11n, not include 802.11a/ac.

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, …, G_N dBi.

- transmit signals are correlated, then
- Directional gain = $10*\log[(10^{G1/20} + 10^{G2/20} + \ldots + 10^{GN/20})^2/N_{ANT}]$ 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: $Pd = (Pout*G)/(4*pi*r^2)$

Where
Pd = power density in mW/cm^2
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

Pd is the limit of MPE, $1mW/cm^2$. 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	Wi-Fi Extender
Test Item	RF Exposure Evaluation

Antenna Gain: Refer to clause 1.2.

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/g/n	2412 ~ 2462	25.57	0.0717	1
802.11a/n/ac	5180 ~ 5825	28.80	0.1509	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) = $0.0717mW/cm^2$+ $0.1509mW/cm^2$ = $0.2226mW/cm^2$ < $1mW/cm^2$.

So the EUT complies with the requirement.

The End