

MRT Technology (Suzhou) Co., Ltd Phone: +86-512-66308358 Web: www.mrt-cert.com Report No.: 2305RSU058-U5 Report Version: V01 Issue Date: 2023-08-12

# **RF Exposure Evaluation Declaration**

FCC ID: LNQWF660AG

**Applicant:** Actiontec Electronics Inc.

**Product:** Wi-Fi 6 Outdoor AP

Model No.: WF-660AG, WF-660A

Brand Name: Actiontec

FCC Classification: Digital Transmission System (DTS)

Unlicensed National Information Infrastructure (NII)

FCC Rule Part(s): FCC Part 2.1091

**Received Date:** 2023-02-09

Result: Complies

Reviewed By:

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ACCREDITED

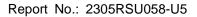
TESTING LABORATORY
CERTIFICATE #3628.01

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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Template Version:0.0 1 of 10





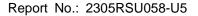
# **Revision History**

Report No.	Version	Description	Issue Date	Note
2305RSU058-U5	V01	Initial Report	2023-08-12	Valid



# **CONTENTS**

	cription		Page
1.	Gene	ral Information	4
	1.1.	Applicant	4
	1.2.	Manufacturer	4
	1.3.	Testing Facility	4
	1.4.	Product Information	5
	1.5.	Antenna Details	5
	1.6.	Device Classification	6
	1.7.	Applied Standards	6
2.	RF E	xposure Evaluation	7
	2.1.	Test Limits	
	2.2.	MPE Exemptions	8
	23	Calculated Result	11





## 1. General Information

## 1.1. Applicant

Actiontec Electronics Inc.

3301 Olcott St. Santa Clara, CA 95054

## 1.2. Manufacturer

Actiontec Electronics Inc.

3301 Olcott St. Santa Clara, CA 95054

## 1.3. Testing Facility

Test Site - MRT S	Suzhou Laborator	У					
Laboratory Locat	ion (Suzhou - Wu	zhong)					
D8 Building, No.2	Tian'edang Rd., W	uzhong Economic De	velopment Zone, Su	zhou, China			
Laboratory Locat	ion (Suzhou - SIP	)					
4b Building, Liando U Valley, No.200 Xingpu Rd., Shengpu Town, Suzhou Industrial Park, China							
Laboratory Accreditations							
A2LA: 3628.01 CNAS: L10551							
FCC: CN1166 ISED: CN0001							
VCCI:	□R-20025	□G-20034	□C-20020	□T-20020			
VCCI:	□R-20141	□G-20134	□C-20103	□T-20104			
Test Site – MRT Shenzhen Laboratory							
Laboratory Location (Shenzhen)							
1G, Building A, Jui	nxiangda Building,	Zhongshanyuan Roa	d West, Nanshan Di	strict, Shenzhen,			
China							
Laboratory Accre	ditations						
A2LA: 3628.02		CNAS	: L10551				
FCC: CN1284		ISED:	CN0105				
Test Site - MRT T	aiwan Laboratory	•					
Laboratory Location (Taiwan)							
No. 38, Fuxing 2nd Rd., Guishan Dist., Taoyuan City 333, Taiwan (R.O.C.)							
Laboratory Accre	editations						
TAF: L3261-19072	25						
FCC: 291082, TW	3261	ISED:	TW3261				



#### 1.4. Product Information

Product Name	Wi-Fi 6 Outdoor AP
Model No.	WF-660AG, WF-660A
Wi-Fi Specification	802.11b/g/n/ac/ax
Bluetooth Specification	V5.0 single mode, BLE only
Antenna Information	Refer to section 1.5
Working Voltage	By PoE

#### Note:

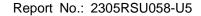
- 1. The information of EUT was provided by the manufacturer, and the accuracy of the information shall be the responsibility of the manufacturer.
- 2. The model difference is the WF-660A removes the GPS circuit from the WF-66AG, others are exactly the same.

#### 1.5. Antenna Details

Antenna	Frequency	TX	Antenna Gain		Directional Gain		Directional Gain	
Туре	(MHz)	Paths	(dBi)		(Elevation a	ngle above 30	(0	dBi)
					degrees)			
					(dBi)			
			Ant 0	Ant 1	Correlated	Uncorrelated	Correlated	Uncorrelated
Wi-Fi Anten	Wi-Fi Antenna							
	2400 ~ 2500	2	4.47	5.80	1		7.92	4.95
PIFA	5150 ~ 5350	2	5.45	5.28	7.04	4.07	8.31	5.30
FIFA	5470 ~ 5725	2	6.56	6.45	I		9.49	6.48
	5725 ~ 5850	2	7.03	6.95			10.00	6.99
Bluetooth A	Bluetooth Antenna							
PIFA	2400 ~ 2500	1	4.	34				

#### Note:

- 1. The antenna gain and directional gain refer to manufacturer's antenna specification.
- 2. The device supports CDD Mode and STBC mode, details refer to the table as below.
- 3. CDD signals are correlated, the directional gain as follows, the max directional gain (each angle) =  $10 \log[(10^{G1/20} + 10^{G2/20} + ... + 10^{GN/20})^2/N_{ANT}]$
- 4. STBC signals are uncorrelated, the directional gain as follows, the max directional gain (each angle) =  $10 \log[(10^{G1/10} + 10^{G2/10} + ... + 10^{GN/10})/N_{ANT}]$





Test Mode Tx Paths CDD Mode STBC Mode								
Wi-Fi 2.4G								
802.11b/g	2	√	X					
802.11n/ax 2 X √								
Wi-Fi 5G								
802.11a 2 √ X								
802.11n/ac/ax 2 X √								
Note: "√" means "Support", "X"	means "Not support".							

#### 1.6. Device Classification

According to the user manual, the antenna of this device is at least 20cm away from the body of the user, this device is classified as a Mobile Device. So, the RF exposure evaluation requirements of § 2.1091 for mobile device exposure conditions subject to MPE limits.

## 1.7. Applied Standards

According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

• FCC Part 2.1091 & KDB 447498 D04 Interim General RF Exposure Guidance v01



# 2. RF Exposure Evaluation

## 2.1. Test 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	Electric Field	Magnetic Field	Power Density	Average Time
(MHz)	Strength (V/m)	Strength (A/m)	(mW/cm <sup>2</sup> )	(Minutes)
	(A) Limits fo	r Occupational/ Contro	l Exposures	
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
300-1,500			f/300	<6
1,500-100,000			5	<6
	(B) Limits for Gen	eral Population/ Uncor	trolled Exposures	
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
300-1,500			f/1500	<30
1,500-100,000			1.0	<30

f= frequency in MHz. \* = Plane-wave equivalent power density.



#### 2.2. MPE Exemptions

**For single RF sources** (i.e., any single fixed RF source, mobile device, or portable device, as defined in paragraph §1.1307(b)(2) of this section): A single RF source is exempt if:

**(Option A)** The available maximum time-averaged power is no more than 1 mW, regardless of separation distance. This exemption may not be used in conjunction with other exemption criteria other than those in paragraph §1.1307(b)(3)(ii)(A) of this section.

Medical implant devices may only use this exemption and that in paragraph §1.1307(b)(3)(ii)(A);

**(Option B)** Or the available maximum time-averaged power or effective radiated power (ERP), whichever is greater, is less than or equal to the threshold P (mW) described in the following formula. This method shall only be used at separation distances (cm) from 0.5 centimeters to 40 centimeters and at frequencies from 0.3 GHz to 6 GHz (inclusive). P is given by:

$$P th(mW) = \{ERP_{20cm}(d / 20cm)^x d \le 20cm\}$$

$$P th(mW) = \{ERP_{20cm} 20cm < d \le 40cm\}$$

Where

$$x = -\log_{10}\left(\frac{60}{ERP_{20cm}\sqrt{f}}\right)$$
 and f is in GHz;

and

$$ERP_{20cm}(mW) = \{2040f \ 0.3GHz \le f < 1.5GHz\}$$

$$ERP_{20cm}(mW) = \{3060 \ 1.5GHz \le f \le 6GHz \$$

(Option C) Or using Table 1 and the minimum separation distance (R in meters) from the body of a nearby person for the frequency (f in MHz) at which the source operates, the ERP (watts) is no more than the calculated value prescribed for that frequency. For the exemption in Table 1 to apply, R must be at least  $\lambda/2\pi$ , where  $\lambda$  is the free-space operating wavelength in meters. If the ERP of a single RF source is not easily obtained, then the available maximum time-averaged power may be used in lieu of ERP if the physical dimensions of the radiating structure(s) do not exceed the electrical length of  $\lambda/4$  or if the antenna gain is less than that of a half-wave dipole (1.64 linear value).



Table 1 to 91.1307 (b)(3)(1)(c) = Siliule IXI Soulces Subject to Noutlife Elivirollifiental Evaluation	Table 1 to	§1.1307(b)(3)(i)(C)	- Single RF Sources Subi	ject to Routine Environmental Evaluation
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RF Source Frequency (MHz)	Threshold ERP (watts)
0.3-1.34	1920R <sup>2</sup>
1.34-30	3450R²/f²
30-300	3.83R <sup>2</sup>
300-1,500	0.0128R <sup>2</sup> f
1,500-100,000	19.2R <sup>2</sup>

For multiple RF sources: Multiple RF sources are exempt if:

(A) The available maximum time-averaged power of each source is no more than 1 mW and there is a separation distance of two centimeters between any portion of a radiating structure operating and the nearest portion of any other radiating structure in the same device, except if the sum of multiple sources is less than 1 mW during the time-averaging period, in which case they may be treated as a single source (separation is not required). This exemption may not be used in conjunction with other exemption criteria other than those is paragraph §1.1307(b)(3)(i)(A) of this section. Medical implant devices may only use this exemption and that in paragraph §1.1307(b)(3)(i)(A).

(B) in the case of fixed RF sources operating in the same time-averaging period, or of multiple mobile or portable RF sources within a device operating in the same time averaging period, if the sum of the fractional contributions to the applicable thresholds is less than or equal to 1 as indicated in the following equation.

$$\sum_{i=1}^{a} \frac{P_i}{P_{th,i}} + \sum_{j=1}^{b} \frac{ERP_j}{ERP_{th,j}} + \sum_{k=1}^{c} \frac{Evaluated_k}{Exposure\ Limit_k} \le 1$$

### Where:

a = number of fixed, mobile, or portable RF sources claiming exemption using paragraph §1.1307(b)(3)(i)(B) of this section for  $P_{th}$ , including existing exempt transmitters and those being added.

b = number of fixed, mobile, or portable RF sources claiming exemption using paragraph 1.1307(b)(3)(i)(C) of this section for Threshold ERP, including existing exempt transmitters and those being added.

c = number of existing fixed, mobile, or portable RF sources with known evaluation for the specified minimum distance including existing evaluated transmitters.

 $P_i$  = the available maximum time-averaged power or the ERP, whichever is greater, for fixed, mobile, or portable RF source i at a distance between 0.5 cm and 40 cm (inclusive).

 $P_{th,i}$  = the exemption threshold power ( $P_{th}$ ) according to paragraph §1.1307(b)(3)(i)(B) of this section for fixed, mobile, or portable RF source i.

 $ERP_j$  = the ERP of fixed, mobile, or portable RF source j.



 $ERP_{th,j}$  = exemption threshold ERP for fixed, mobile, or portable RF source j, at a distance of at least  $\lambda/2\pi$  according to the applicable formula of paragraph §1.1307(b)(3)(i)(C) of this section.

**Evaluated**<sub>k</sub> = the maximum reported SAR or MPE of fixed, mobile, or portable RF source k either in the device or at the transmitter site from an existing evaluation at the location of exposure.

**Exposure Limit**<sub>k</sub> = either the general population/uncontrolled maximum permissible exposure (MPE) or specific absorption rate (SAR) limit for each fixed, mobile, or portable RF source k, as applicable from §1.1310 of this chapter.



Report No.: 2305RSU058-U5

## 2.3. Calculated Result

Product	Wi-Fi 6 Outdoor AP
Test Item	RF Exposure Evaluation

Test Mode	Frequency Band (MHz)	Max. Conducted Power (dBm)	Tune-up Conducted Power (dBm)	Antenna Gain (dBi)	Tune-up EIRP (dBm)
BLE	2402 ~ 2480	5.39	5.89	4.34	10.23
802.11b/g/n/ax	2412 ~ 2462	27.63	28.08	7.92	36.00
802.11a/n/ac/ax	5180 ~ 5825	25.70	26.00	10.00	36.00

#### Note:

- 1. Tune-up power was declared by manufacturer.
- 2. Tune-up EIRP = Tune-up Conducted Power + Antenna Gain.

## For single RF source, Option C

Test Mode	λ/2π	R	Tune-up ERP	Threshold ERP	Power Density	Limit
	(m)	(m)	(mW)	(mW)	(mW/cm <sup>2</sup> )	(mW/cm <sup>2</sup> )
BLE (DTS)	0.0199	0.51	6.4	4993.92	0.0003	< 1
Wi-Fi (DTS)	0.0198	0.51	2426.6	4993.92	0.1218	< 1
Wi-Fi (NII)	0.0092	0.51	2426.6	4993.92	0.1218	< 1

Note 1: R is from user manual.

Note 2: ERP (mW) =  $10^{(Tune-up EIRP(dBm)-2.15)/10}$  (mW)

## For multiple RF sources

The EUT supports Wi-Fi 2.4GHz + Wi-Fi 5GHz + BLE simultaneous transmissions.

So the Max Simultaneous Transmission = 6.4/4993.92 (DTS) + 2426.6/4993.92 (DTS) + 2426.6/4993.92 (NII) = 0.9731 < 1

Therefore, the device qualifies for RF exposure test exemption.

———— The End
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