

RF Exposure Evaluation Declaration

FCC ID: LNQ-WF810G-2
Applicant: Actiontec Electronics Inc.
Product: Wi-Fi 6E Mesh Extender
Model No.: GE6E220C, WF-810G
FCC Classification: Digital Transmission System (DTS)
Unlicensed National Information Infrastructure (NII)
15E 6GHz Low Power Indoor Access Point (6ID)
FCC Rule Part(s): FCC Part 2.1091
Evaluated Date: 2024-02-28
Result: Complies

Reviewed By:

Kevin Guo

Approved By:

Robin Wu



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	Note
2401RSU026-U7	V01	Initial Report	2024-03-11	Valid

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1. General Information

1.1. Applicant

Actiontec Electronics Inc.
2445 Augustine Drive Suite 501, Santa Clara, California 95054, United States

1.2. Manufacturer

Actiontec Electronics Inc.
2445 Augustine Drive Suite 501, Santa Clara, California 95054, United States

1.3. Testing Facility

<input type="checkbox"/>	<p>Test Site – MRT Suzhou Laboratory</p> <p>Laboratory Location (Suzhou - Wuzhong) D8 Building, No.2 Tian'edang Rd., Wuzhong Economic Development Zone, Suzhou, China</p> <p>Laboratory Location (Suzhou - SIP) 4b Building, Liando U Valley, No.200 Xingpu Rd., Shengpu Town, Suzhou Industrial Park, China</p> <p>Laboratory Accreditations</p> <p>A2LA: 3628.01 CNAS: L10551 FCC: CN1166 ISED: CN0001</p> <p>VCCI: <input type="checkbox"/>R-20025 <input type="checkbox"/>G-20034 <input type="checkbox"/>C-20020 <input type="checkbox"/>T-20020 <input type="checkbox"/>R-20141 <input type="checkbox"/>G-20134 <input type="checkbox"/>C-20103 <input type="checkbox"/>T-20104</p>
<input type="checkbox"/>	<p>Test Site – MRT Shenzhen Laboratory</p> <p>Laboratory Location (Shenzhen) 1G, Building A, Junxiangda Building, Zhongshanyuan Road West, Nanshan District, Shenzhen, China</p> <p>Laboratory Accreditations</p> <p>A2LA: 3628.02 CNAS: L10551 FCC: CN1284 ISED: CN0105</p>
<input type="checkbox"/>	<p>Test Site – MRT Taiwan Laboratory</p> <p>Laboratory Location (Taiwan) No. 38, Fuxing 2nd Rd., Guishan Dist., Taoyuan City 333, Taiwan (R.O.C.)</p> <p>Laboratory Accreditations</p> <p>TAF: L3261-190725 FCC: 291082, TW3261 ISED: TW3261</p>

1.4. Product Information

Product Name	Wi-Fi 6E Mesh Extender
Model No.	GE6E220C, WF-810G
Wi-Fi Specification	802.11a/b/g/n/ac/ax
Bluetooth Specification	V5.0 (Single mode, LE only)
Antenna Information	Refer to Section 1.5
Accessories	
Adapter #1	Model No.: ADT-38FKJ-PCU00F Input: 100-240V, 50/60Hz, Max. 1.0A Output: 5.0V=3.0A or 12.0V=3.0A
Adapter #2	Model No.: MS-V3000R150-038B0-US Input: 100-240V ~ 50-60Hz, 1.3A Output: 5.0V=3.0A or 9.0V=3.0A or 12.0V=3.0A or 15.0V=3.0A
Notes:	
1. There is not any hardware or software differences between GE6E220C and WF-810G, only for different brand.	
2. The information of EUT was provided by the manufacturer, and the accuracy of the information shall be the responsibility of the manufacturer.	

1.5. Antenna Details

Antenna Type	Frequency (MHz)	TX Paths	Antenna Gain (dBi)				Directional Gain (dBi)	
			Ant 0	Ant 1	Ant 2	Ant 3	Correlated	Uncorrelated
Wi-Fi Antenna								
PIFA	2412 ~ 2462	2	3.90	4.25	--	--	4.0	1.6
	5180 ~ 5825	2	5.42	4.47	--	--	6.3	3.6
	5925 ~ 7125	4	4.60	4.89	4.62	5.47	9.0	3.1
Bluetooth Antenna								
PCB	2402 ~ 2480	1	1.66				--	--

Remark:

- The antenna gain and directional gain refer to manufacturer's antenna specification.
- The device supports CDD Mode and STBC mode, details refer to the table as below.
- CDD signals are correlated, the directional gain as follows,
 For power measurements: Array Gain = 0 dB for $N_{ANT} \leq 4$, the directional gain = max antenna gain + array gain
 For power spectral density (PSD) measurements: the max directional gain (each angle) = $10 \log[(10^{G1/20} + 10^{G2/20} + \dots + 10^{GN/20})^2 / N_{ANT}]$

4. STBC signals are uncorrelated, the directional gain as follows,
 the max directional gain (each angle) = $10 \log[(10^{G1/10} + 10^{G2/10} + \dots + 10^{GN/10})/N_{ANT}]$

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	√
Wi-Fi 6G			
802.11a	4	√	X
802.11ax	4	X	√
Remark: "√" 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 (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				
0.3-3.0	614	1.63	*(100)	≤6
3.0-30	1842/f	4.89/f	*(900/f ²)	<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 General Population/ Uncontrolled Exposures				
0.3-1.34	614	1.63	*(100)	<30
1.34-30	824/f	2.19/f	*(180/f ²)	<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:

$$P_{th}(mW) = \{ERP_{20cm}(d / 20cm)^x \quad d \leq 20cm$$

$$P_{th}(mW) = \{ERP_{20cm} \quad 20cm < d \leq 40cm$$

Where

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

and

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

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

(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 λ 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 §1.1307(b)(3)(i)(C) - Single RF Sources Subject to Routine Environmental Evaluation

RF Source Frequency (MHz)	Threshold ERP (watts)
0.3-1.34	1920R ²
1.34-30	3450R ² /f ²
30-300	3.83R ²
300-1,500	0.0128R ² f
1,500-100,000	19.2R ²

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 in 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.

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

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.

$Evaluated_k$ = 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.

$Exposure Limit_k$ = 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.

2.3. Calculated Result

Product	Wi-Fi 6E Mesh Extender
Test Item	RF Exposure Evaluation

Test Mode	Frequency Band (MHz)	Maximum Conducted Power (dBm)	Tune-up Conducted Power (dBm)	Antenna Gain (dBi)	Tune-up ERP (dBm)
BLE	2402 ~ 2480	-0.94	-0.44	1.66	-0.93
802.11b/g/n/ax	2412 ~ 2462	28.88	29.38	4.25	31.48
802.11a/n/ac/ax	5180 ~ 5825	27.26	27.76	5.42	31.03
802.11a/ax	5955 ~ 7095	--	--	--	25.43

Note:

1. Tune-up power and the tune-up EIRP of 5955 ~ 7095 band were declared by manufacturer.
2. Tune-up ERP = Tune-up Conducted Power + Antenna Gain – 2.15, for 5955 ~ 7095MHz band, the Turn-up ERP = Max. EIRP (dBm) + 0.5dB – 2.15, Max. EIRP is from 2401RSU026-U5.

For single RF source, Option B

Test Mode	$\lambda / 2 \pi$ (m)	R (m)	Tune-up ERP (mW)	Threshold ERP (mW)
BLE (DTS)	0.0199	0.2	0.81	3060.00
Wi-Fi (DTS)	0.0198	0.2	1406.05	3060.00
Wi-Fi (NII)	0.0092	0.2	1267.65	3060.00
Wi-Fi (6ID)	0.0080	0.2	349.14	3060.00

Note 1: R is from user manual.

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

For multiple RF sources

The EUT supports Wi-Fi 2.4GHz + Wi-Fi 5GHz + Wi-Fi 6GHz + Bluetooth simultaneous transmissions.

So the Max Simultaneous Transmission = $0.81/3060 (DTS) + 1406.05/3060 (DTS) + 1267.65/3060 (NII) + 349.14/3060 (6ID) = 0.9881 < 1$

Therefore, the device qualifies for RF exposure test exemption.

_____ The End _____