RF Exposure Evaluation Declaration

FCC ID:	2AXJ4BE900
Applicant:	TP-Link Corporation Limited
Product:	BE24000 Quad-Band Wi-Fi 7 Router
Model No.:	Archer BE900
Brand Name:	tp-link
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
Received Date:	2023-01-26
Result:	Complies

Reviewed By: Kevin Guo

Approved By: Robin Wu

Revision History

Report No.	Version	Description	Issue Date	Note
2301RSU047-U5	V01	Initial Report	2023-03-01	Valid

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1. General Information

1.1. Applicant

TP-Link Corporation Limited

Room 901, 9/F. , New East Ocean Centre, 9 Science Museum Road, Tsim Sha Tsui, Kowloon, Hongkong

1.2. Manufacturer

TP-Link Corporation Limited

Room 901, 9/F. , New East Ocean Centre, 9 Science Museum Road, Tsim Sha Tsui, Kowloon, Hongkong

1.3. Testing Facility

☐	**Test Site – MRT Suzhou Laboratory**				
	Laboratory Location (Suzhou - Wuzhong) D8 Building, No.2 Tian'edang Rd., Wuzhong Economic Development Zone, Suzhou, China **Laboratory Location (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
		☐R-20141	☐G-20134	☐C-20103	☐T-20104
☐	**Test Site – MRT Shenzhen Laboratory**				
	Laboratory Location (Shenzhen) 1G, Building A, Junxiangda Building, Zhongshanyuan Road West, Nanshan District, Shenzhen, China				
	Laboratory Accreditations				
	A2LA: 3628.02		CNAS: L10551		
	FCC: CN1284		ISED: CN0105		
☐	**Test Site – MRT Taiwan Laboratory**				
	Laboratory Location (Taiwan) No. 38, Fuxing 2nd Rd., Guishan Dist., Taoyuan City 333, Taiwan (R.O.C.)				
	Laboratory Accreditations				
	TAF: L3261-190725				
	FCC: 291082, TW3261		ISED: TW3261		

1.4. Product Information

Product Name	BE24000 Quad-Band Wi-Fi 7 Router
Model No.	Archer BE900
Wi-Fi Specification	802.11a/b/g/n/ac/ax/be
Antenna Information	Refer to selection 1.5
Working Voltage	By Adapter
Accessory	
Adapter	Model: T150500-2-DT Input: 100-240V ~ 50/60Hz 2.0A Output: 15V=5.0A 75W
Note: 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 Band (MHz)	T_X Paths	Number of spatial streams	Max Antenna Gain (dBi)	Beamforming Directional Gain (dBi)	CDD Directional Gain (dBi)	
						For Power	For PSD
Dipole Antenna	2412 ~ 2462	4	1	2.91	8.93	2.91	8.93
	5150 ~ 5250	4	1	3.02	9.04	3.02	9.04
	5250 ~ 5350	4	1	3.08	9.10	3.08	9.10
	5470 ~ 5725	4	1	3.13	9.15	3.13	9.15
	5725 ~ 5850	4	1	2.97	8.99	2.97	8.99
	5925 ~ 6425	4	1	3.10	9.12	3.10	9.12
		4	4	3.10	--	3.10	3.10
	6425 ~ 6525	4	1	3.03	9.05	3.03	9.05
		4	4	3.03	--	3.03	3.03
	6525 ~ 6875	4	1	3.04	9.06	3.04	9.06
		4	4	3.04	--	3.04	3.04
	6875 ~ 7125	4	1	2.93	8.95	2.93	8.95
		4	4	2.93	--	2.93	2.93

Remark:

1. The EUT supports Cyclic Delay Diversity (CDD) mode, and CDD signals are correlated.
   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;

- For power measurements on IEEE 802.11 devices,
  Array Gain = 0 dB for $N_{ANT} \leq 4$;

2. The EUT also supports Beam Forming mode, and the Beam Forming support 802.11ac/ax/be, not include 802.11a/b/g/n. BF Directional gain = $G_{ANT} + 10 \log (N_{ANT})$.

Test Mode	T_X Paths	CDD Mode	Beamforming Mode
802.11b/g/n (DTS)	4	√	X
802.11ax/be (DTS)	4	√	√
802.11a/n (NII)	4	√	X
802.11ac/ax/be (NII)	4	√	√
802.11ax/be (6ID)	4	√	√

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:

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

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

Where

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

and

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

$\mathrm{ERP_{20cm}(mW)} = \{3060$ 1.5GHz ≤ f ≤ 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 λ/2π, 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 λ/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	$0.0128R^2f$
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 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.

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

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.

$\boldsymbol{P_i}$ = 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).

$\boldsymbol{P_{th,i}}$ = 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*.

$\boldsymbol{ERP_j}$ = 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 λ/2π 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	BE24000 Quad-Band Wi-Fi 7 Router
Test Item	RF Exposure Evaluation

Test Mode	Frequency Band (MHz)	Max. Conducted Power (dBm)	Tune-up Conducted Power (dBm)	Directional Gain (dBi)	Tune-up EIRP (dBm)
802.11b/g/n/ax/be	2412 ~ 2462	27.02	27.07	8.93	36.00
802.11a/n/ac/ax/be	5180 ~ 5320	26.85	26.96	9.04	36.00
802.11a/n/ac/ax/be	5500 ~ 5825	26.89	27.01	8.99	36.00
802.11ax/be	6115 ~ 7095	24.73	25.23	3.10	28.33

Note: Tune-up power was declared by manufacturer.

For single RF source, Option C

Test Mode	λ / 2 π (m)	R (m)	Tune-up ERP (mW)	Threshold ERP (mW)	Power Density (mW/cm^2)	Limit (mW/cm^2)
Wi-Fi (DTS)	0.0198	0.64	2426.6	7864.32	0.0773	< 1
Wi-Fi (NII-1/2a)	0.0092	0.64	2426.6	7864.32	0.0773	< 1
Wi-Fi (NII-2c/3)	0.0087	0.64	2426.6	7864.32	0.0773	< 1
Wi-Fi (6ID)	0.0078	0.64	415.0	7864.32	0.2322	< 1

Note 1: R is from user manual.

Note 2: ERP (mW) = 10^[(Tune-up EIRP(dBm)-2.15)/10]

For multiple RF sources

The EUT supports Wi-Fi 2.4GHz, Wi-Fi 5GHz (NII-1/2a), Wi-Fi 5GHz (NII-2c/3) and Wi-Fi 6G simultaneous transmissions.

So the Max Simultaneous Transmission = 2426.6/7864.32 (DTS) + 2426.6/7864.32 (NII-1/2a) + 2426.6/7864.32 (NII-2c/3) + 415.5/7864.32 (6ID) = 0.9784 < 1

Therefore, the device qualifies for RF exposure test exemption.

The End