

# RF Exposure Evaluation Report

APPLICANT : TP-LINK CORPORATION PTE. LTD.  
EQUIPMENT : AX1800 Wi-Fi 6 Range Extender  
BRAND NAME : tp-link  
MODEL NAME : RE605X  
FCC ID : 2BCGWRE605XV2  
STANDARD : 47 CFR Part 2.1091

The product evaluation date was started from Mar. 04, 2024 and completed on Mar. 04, 2024. We, Sporton International Inc. (Shenzhen), would like to declare that the device has been evaluated in accordance with 47 CFR Part 2.1091 and FCC KDB 447498 D01 v06, and pass the limit. Without written approval of Sporton International Inc. (Shenzhen), the test report shall not be reproduced except in full.



Approved by: Si Zhang

**Sporton International Inc. (Shenzhen)**

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**People's Republic of China**



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## **1. Administration Data**

### **1.1. Testing Laboratory**

Sporton International Inc. (Shenzhen) is accredited to ISO/IEC 17025:2017 by American Association for Laboratory Accreditation with Certificate Number 5145.01.

| <b>Testing Laboratory</b> |   |                    |                       |
|---------------------------|---|--------------------|-----------------------|
| <b>Test Firm</b>          | Sporton International Inc. (Shenzhen)   |                    |                       |
| <b>Test Site Location</b> | 1/F, 2/F, Bldg 5, Shiling Industrial Zone, Xinwei Village, Xili, Nanshan, Shenzhen, 518055 People's Republic of China<br>TEL: +86-755-86379589<br>FAX: +86-755-86379595 |                    |                       |
| <b>Test Site No.</b>      | <b>Sporton Site No.</b>   | <b>Company No.</b> | <b>CAB identifier</b> |
|                           | SAR01-SZ  | 4086F              | CN0058                |

| <b>Applicant</b>    |   |
|---------------------|---|
| <b>Company Name</b> | TP-LINK CORPORATION PTE. LTD.                                 |
| <b>Address</b>      | 7 Temasek Boulevard #29-03 Suntec Tower One, Singapore 038987 |

| <b>Manufacturer</b> |   |
|---------------------|---|
| <b>Company Name</b> | TP-LINK CORPORATION PTE. LTD.                                 |
| <b>Address</b>      | 7 Temasek Boulevard #29-03 Suntec Tower One, Singapore 038987 |

## 2. Description of Equipment Under Test (EUT)

| Product Feature & Specification         |  |
|---|--|
| EUT Type                                | AX1800 Wi-Fi 6 Range Extender  |
| Brand Name                              | tp-link  |
| Model Name                              | RE605X   |
| FCC ID                                  | 2BCGWRE605XV2  |
| Wireless Technology and Frequency Range | WLAN 2.4GHz Band: 2412 MHz ~ 2462 MHz<br>WLAN 5.2GHz Band: 5180 MHz ~ 5240 MHz<br>WLAN 5.3GHz Band: 5260 MHz ~ 5320 MHz<br>WLAN 5.5GHz Band: 5500 MHz ~ 5720 MHz<br>WLAN 5.8GHz Band: 5745 MHz ~ 5825 MHz  |
| Mode                                    | WLAN 2.4GHz 802.11b/g<br>WLAN 2.4GHz 802.11n HT20/HT40<br>WLAN 2.4GHz 802.11ax HE20/HE40<br>WLAN 5GHz 802.11a<br>WLAN 5GHz 802.11n HT20/HT40<br>WLAN 5GHz 802.11ac VHT20/VHT40/VHT80<br>WLAN 5GHz 802.11ax HE20/HE40/HE80  |
| Antenna Gain                            | <b>Ant 1:</b><br>WLAN 2.4GHz Gain: 2.00 dBi<br>WLAN 5.2GHz Gain: 3.00 dBi<br>WLAN 5.3GHz Gain: 3.00 dBi<br>WLAN 5.5GHz Gain: 3.00 dBi<br>WLAN 5.8GHz Gain: 3.00 dBi<br><b>Ant 2:</b><br>WLAN 2.4GHz Gain: 2.00 dBi<br>WLAN 5.2GHz Gain: 3.00 dBi<br>WLAN 5.3GHz Gain: 3.00 dBi<br>WLAN 5.5GHz Gain: 3.00 dBi<br>WLAN 5.8GHz Gain: 3.00 dBi |
| Antenna Type                            | WLAN: Dipole antenna   |
| HW Version                              | V2.20  |
| SW Version                              | re605xv2.2_us-up-ver1-0-2-P1[20230914-rel58320]  |
| EUT Stage                               | Identical Prototype  |

**Remark:**

- The above EUT's information was declared by manufacturer. Please refer to the specifications or user's manual for more detailed description.
- WLAN2.4GHz /WLAN5GHz all support SISO and MIMO mode, we chose MIMO tune up power to perform MPE calculation conservatively.
- The device supports WLAN MIMO CDD mode and TX Beamforming mode, TX Beamforming mode is only supported in 2.4GHz WLAN 802.11ax and 5GHz WLAN 802.11ac/ax.

**Comments and Explanations:**

- The declared of product specification for EUT presented in the report are provided by the manufacturer, and the manufacturer takes all the responsibilities for the accuracy of product specification.
- The maximum RF output tune up power, antenna gain also the safe distance used for evaluate RF exposure were declared by manufacturer.



**3. Maximum RF average output tune up power among production units**

<For CDD/MIMO mode>

**<2.4GHz WLAN >**

| Mode   |               | Maximum Average Power (dBm) |
|--------|---------------|-----------------------------|
|        |               | Ant.1+2                     |
| 2.4GHz | 802.11b       | 26.00                       |
|        | 802.11g       | 26.00                       |
|        | 802.11n-HT20  | 25.00                       |
|        | 802.11n-HT40  | 21.00                       |
|        | 802.11ax-HE20 | 26.00                       |
|        | 802.11ax-HE40 | 21.00                       |

**<5GHz WLAN >**

| Mode   |                | Maximum Average Power (dBm) |
|--------|----------------|-----------------------------|
|        |                | Ant.1+2                     |
| 5.2GHz | 802.11a        | 26.00                       |
|        | 802.11n-HT20   | 26.00                       |
|        | 802.11n-HT40   | 25.00                       |
|        | 802.11ac-VHT20 | 26.00                       |
|        | 802.11ac-VHT40 | 25.00                       |
|        | 802.11ac-VHT80 | 18.00                       |
|        | 802.11ax-HE20  | 26.00                       |
|        | 802.11ax-HE40  | 25.00                       |
| 5.3GHz | 802.11a        | 22.00                       |
|        | 802.11n-HT20   | 23.00                       |
|        | 802.11n-HT40   | 23.50                       |
|        | 802.11ac-VHT20 | 23.00                       |
|        | 802.11ac-VHT40 | 23.50                       |
|        | 802.11ac-VHT80 | 17.50                       |
|        | 802.11ax-HE20  | 23.00                       |
|        | 802.11ax-HE40  | 23.50                       |
| 5.5GHz | 802.11a        | 22.00                       |
|        | 802.11n-HT20   | 22.50                       |
|        | 802.11n-HT40   | 23.98                       |
|        | 802.11ac-VHT20 | 22.50                       |
|        | 802.11ac-VHT40 | 23.98                       |
|        | 802.11ac-VHT80 | 23.98                       |
|        | 802.11ax-HE20  | 22.50                       |
|        | 802.11ax-HE40  | 23.98                       |
| 5.8GHz | 802.11a        | 25.00                       |
|        | 802.11n-HT20   | 25.00                       |
|        | 802.11n-HT40   | 25.00                       |
|        | 802.11ac-VHT20 | 25.00                       |



|  |                |       |
|--|----------------|-------|
|  | 802.11ac-VHT40 | 25.00 |
|  | 802.11ac-VHT80 | 24.00 |
|  | 802.11ax-HE20  | 25.00 |
|  | 802.11ax-HE40  | 25.00 |
|  | 802.11ax-HE80  | 24.00 |

Note: WLAN2.4GHz /WLAN5GHz all support SISO/MIMO mode, we only chose MIMO tune up power to perform MPE calculation conservatively for MIMO power is higher.

**<For Beamforming mode>**

**<2.4GHz WLAN >**

|        | Mode          | Maximum Average Power (dBm) |
|--------|---------------|-----------------------------|
|        |               | Ant.1+2                     |
| 2.4GHz | 802.11ax-HE20 | 26.00                       |
|        | 802.11ax-HE40 | 21.00                       |

**<5GHz WLAN >**

|        | Mode           | Maximum Average Power (dBm) |
|--------|----------------|-----------------------------|
|        |                | Ant.1+2                     |
| 5.2GHz | 802.11ac-VHT20 | 26.00                       |
|        | 802.11ac-VHT40 | 25.00                       |
|        | 802.11ac-VHT80 | 18.00                       |
|        | 802.11ax-HE20  | 26.00                       |
|        | 802.11ax-HE40  | 25.00                       |
|        | 802.11ax-HE80  | 18.00                       |
| 5.3GHz | 802.11ac-VHT20 | 23.00                       |
|        | 802.11ac-VHT40 | 23.50                       |
|        | 802.11ac-VHT80 | 17.00                       |
|        | 802.11ax-HE20  | 23.00                       |
|        | 802.11ax-HE40  | 23.50                       |
|        | 802.11ax-HE80  | 17.00                       |
| 5.5GHz | 802.11ac-VHT20 | 23.00                       |
|        | 802.11ac-VHT40 | 23.97                       |
|        | 802.11ac-VHT80 | 23.97                       |
|        | 802.11ax-HE20  | 23.00                       |
|        | 802.11ax-HE40  | 23.97                       |
|        | 802.11ax-HE80  | 23.97                       |
| 5.8GHz | 802.11ac-VHT20 | 25.00                       |
|        | 802.11ac-VHT40 | 25.00                       |
|        | 802.11ac-VHT80 | 24.00                       |
|        | 802.11ax-HE20  | 25.00                       |
|        | 802.11ax-HE40  | 25.00                       |
|        | 802.11ax-HE80  | 24.00                       |

Note: This device support beamforming for WLAN 2.4GHz 802.11ax HE20/HE40, WLAN 5GHz 802.11ac/ax VHT20/VHT40/VHT80/HE20/HE40/HE80.

**4. RF Exposure Limit Introduction**



According to ANSI/IEEE C95.1-1992, the criteria listed in Table 1 shall be used to evaluate the environmental impact of human exposure to radio frequency (RF) radiation as specified in §1.1310.

| Frequency range (MHz)  | Electric field strength (V/m) | Magnetic field strength (A/m) | Power density (mW/cm <sup>2</sup> ) | Averaging time (minutes) |
|--|-------------------------------|-------------------------------|-------------------------------------|--------------------------|
| <b>(A) Limits for Occupational/Controlled Exposures</b>        |                               |                               |                                     |                          |
| 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                        |
| 300-1500   |                               |                               | f/300                               | 6                        |
| 1500-100,000   |                               |                               | 5                                   | 6                        |
| <b>(B) Limits for General Population/Uncontrolled Exposure</b> |                               |                               |                                     |                          |
| 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                       |
| 300-1500   |                               |                               | f/1500                              | 30                       |
| 1500-100,000   |                               |                               | 1.0                                 | 30                       |

The MPE was calculated at 20 cm to show compliance with the power density limit.

The following formula was used to calculate the Power Density:

$$S = \frac{PG}{4\pi R^2}$$

Where:

- S = Power Density
- P = Output Power at Antenna Terminals
- G = Gain of Transmit Antenna (linear gain)
- R = Distance from Transmitting Antenna



## **5. Radio Frequency Radiation Exposure Evaluation**

### **5.1. Standalone Power Density Calculation**

**<For CDD/MIMO mode>**

| Band        | Frequency (MHz) | Antenna Gain (dBi) | Maximum Power (dBm) | Maximum EIRP (dBm) | Average EIRP (mW) | Power Density at 20cm (mW/cm <sup>2</sup> ) | Limit (mW/cm <sup>2</sup> ) | Power Density / Limit |
|-------------|-----------------|--------------------|---------------------|--------------------|-------------------|---|-----------------------------|-----------------------|
| 2.4GHz WLAN | 2412.0          | 2.00               | 26.00               | 28.000             | 630.957           | 0.126                                       | 1.000                       | <b>0.126</b>          |
| 5.2GHz WLAN | 5180.0          | 3.00               | 26.00               | 29.000             | 794.328           | 0.158                                       | 1.000                       | <b>0.158</b>          |
| 5.3GHz WLAN | 5260.0          | 3.00               | 23.50               | 26.500             | 446.684           | 0.089                                       | 1.000                       | 0.089                 |
| 5.5GHz WLAN | 5500.0          | 3.00               | 23.98               | 26.980             | 498.884           | 0.099                                       | 1.000                       | 0.099                 |
| 5.8GHz WLAN | 5745.0          | 3.00               | 25.00               | 28.000             | 630.957           | 0.126                                       | 1.000                       | 0.126                 |

**<For Beamforming mode>**

| Band        | Frequency (MHz) | Antenna Gain (dBi) | Maximum Power (dBm) | Maximum EIRP (dBm) | Average EIRP (mW) | Power Density at 20cm (mW/cm <sup>2</sup> ) | Limit (mW/cm <sup>2</sup> ) | Power Density / Limit |
|-------------|-----------------|--------------------|---------------------|--------------------|-------------------|---|-----------------------------|-----------------------|
| 2.4GHz WLAN | 2412.0          | 5.01               | 26.00               | 31.010             | 1261.828          | 0.251                                       | 1.000                       | <b>0.251</b>          |
| 5.2GHz WLAN | 5180.0          | 6.01               | 26.00               | 32.010             | 1588.547          | 0.316                                       | 1.000                       | <b>0.316</b>          |
| 5.3GHz WLAN | 5260.0          | 6.01               | 23.50               | 29.510             | 893.305           | 0.178                                       | 1.000                       | 0.178                 |
| 5.5GHz WLAN | 5500.0          | 6.01               | 23.97               | 29.980             | 995.405           | 0.198                                       | 1.000                       | 0.198                 |
| 5.8GHz WLAN | 5745.0          | 6.01               | 25.00               | 31.010             | 1261.828          | 0.251                                       | 1.000                       | 0.251                 |

**Note:**

1. For conservativeness, the lowest frequency of each band is used to determine the MPE limit of that band.
2. WLAN2.4GHz , WLAN5GHz chose the higher SISO gain as MIMO gain to perform MPE calculation.
3. Chose the maximum power to do MPE analysis.
4. The gain calculation method of WLAN beamforming mode is referenced to KDB 662911.



**5.2. Collocated Power Density Calculation**

<For CDD/MIMO mode>

| WLAN 2.4GHz<br>Power Density / Limit | WLAN 5GHz<br>Power Density / Limit | $\Sigma$ (Power Density / Limit) of<br>WLAN 2.4GHz + WLAN 5GHz |
|--------------------------------------|------------------------------------|--|
| 0.126                                | 0.158                              | 0.284  |

<For Beamforming mode>

| WLAN 2.4GHz<br>Power Density / Limit | WLAN 5GHz<br>Power Density / Limit | $\Sigma$ (Power Density / Limit) of<br>WLAN 2.4GHz + WLAN 5GHz |
|--------------------------------------|------------------------------------|--|
| 0.251                                | 0.316                              | 0.567  |

**Note:**

1.  $\Sigma$ (Power Density / Limit): This is a summation of [(power density for each transmitter/antenna included in the simultaneous transmission) / (corresponding MPE limit)], for WLAN2.4GHz +WLAN5GHz.
2. Considering all transmitter of the EIRP performance listed in the table above, the aggregated (power density /limit) is smaller than 1.

**Conclusion:**

According to 47 CFR §2.1091, the RF exposure analysis concludes that the RF Exposure is FCC compliant.

-----THE END-----