

# TEST REPORT

**Applicant:** Libre Wireless Technologies, Inc.  
**Address:** 17835 Newhope Street, Ste A, Fountain Valley, CA  
92708, US  
**Equipment Type:** High Performance Wireless Media Module  
**Model Name:** LS8 (refer to section 2.3)  
**Brand Name:** LIBRE  
**FCC ID:** 2ADBM-LS8  
**Test Standard:** 47 CFR Part 2.1091  
KDB 447498 D04 v01  
**Sample Arrival Date:** Sep. 09, 2024  
**Test Date:** Sep. 19, 2024 - Oct. 13, 2024  
**Date of Issue:** Nov. 04, 2024

**ISSUED BY:**

Shenzhen BALUN Technology Co., Ltd.

**Tested by:** Xiong Lining**Checked by:** Xu Rui**Approved by:** Tolan Tu

(Testing Director)

**Revision History**

| <u>Version</u> | <u>Issue Date</u>    | <u>Revisions Content</u> |
|----------------|----------------------|--------------------------|
| <u>Rev. 01</u> | <u>Nov. 04, 2024</u> | <u>Initial Issue</u>     |

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# 1 GENERAL INFORMATION

## 1.1 Test Laboratory

|              |                                                                                                                              |
|--------------|------------------------------------------------------------------------------------------------------------------------------|
| Name         | Shenzhen BALUN Technology Co., Ltd.                                                                                          |
| Address      | Block B, 1/F, Baisha Science and Technology Park, Shahe Xi Road, Nanshan District, Shenzhen, Guangdong Province, P. R. China |
| Phone Number | +86 755 6685 0100                                                                                                            |

## 1.2 Test Location

|                           |                                                                                                                                                                                                                                    |
|---------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Name                      | Shenzhen BALUN Technology Co., Ltd.                                                                                                                                                                                                |
| Location                  | <input type="checkbox"/> Block B, 1/F, Baisha Science and Technology Park, Shahe Xi Road, Nanshan District, Shenzhen, Guangdong Province, P. R. China                                                                              |
|                           | <input checked="" type="checkbox"/> 1/F, Building B, Ganghongji High-tech Intelligent Industrial Park, No. 1008, Songbai Road, Yangguang Community, Xili Sub-district, Nanshan District, Shenzhen, Guangdong Province, P. R. China |
| Accreditation Certificate | The laboratory is a testing organization accredited by FCC as a accredited testing laboratory. The designation number is CN1196.                                                                                                   |

## 2 PRODUCT INFORMATION

### 2.1 Applicant Information

|           |                                                            |
|-----------|------------------------------------------------------------|
| Applicant | Libre Wireless Technologies, Inc.                          |
| Address   | 17835 Newhope Street, Ste A, Fountain Valley, CA 92708, US |

### 2.2 Manufacturer Information

|              |                                                            |
|--------------|------------------------------------------------------------|
| Manufacturer | Libre Wireless Technologies, Inc.                          |
| Address      | 17835 Newhope Street, Ste A, Fountain Valley, CA 92708, US |

### 2.3 General Description for Equipment under Test (EUT)

|                                           |                                                                                                                                                                                                                    |
|-------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| EUT Name                                  | High Performance Wireless Media Module                                                                                                                                                                             |
| Model Name Under Test                     | LS8                                                                                                                                                                                                                |
| Series Model Name                         | LS8-NFK-22G-S, LS8-NFK-24G-S, LS8-NFK-44G-S, LS8-NFK-22G-R, LS8-NFK-24G-R, LS8-NFK-44G-R, LS8-NFK-11G-R, LS8-NFK-12G-R, LS8-NFK-21G-R, LS8-NFK-42G-R                                                               |
| Description of Model name differentiation | All models are same with electrical parameters and internal circuit structure, but only differ in model name and memory, the R series WIFI only has one IPEX port.<br>(this information provided by the applicant) |
| Hardware Version                          | 8118                                                                                                                                                                                                               |
| Software Version                          | N/A                                                                                                                                                                                                                |
| Dimensions (Approx.)                      | N/A                                                                                                                                                                                                                |
| Weight (Approx.)                          | N/A                                                                                                                                                                                                                |

## 2.4 Technical Information

|                                   |                                                                                |
|-----------------------------------|--------------------------------------------------------------------------------|
| Network and Wireless connectivity | Bluetooth (BR+EDR+BLE)<br>WIFI 802.11a, 802.11b, 802.11g, 802.11n and 802.11ac |
|-----------------------------------|--------------------------------------------------------------------------------|

The requirement for the following technical information of the EUT was tested in this report:

|                   |                                          |                 |
|-------------------|------------------------------------------|-----------------|
| Operating Mode    | Bluetooth, 2.4G WLAN, 5G WLAN            |                 |
| Frequency Range   | Bluetooth                                | 2402 ~ 2480 MHz |
|                   | 802.11b/g/n(HT20/HT40)                   | 2412 ~ 2462 MHz |
|                   | 802.11a/<br>n(HT20/HT40)                 | 5150 ~ 5250 MHz |
|                   |                                          | 5250 ~ 5350 MHz |
|                   |                                          | 5470 ~ 5725 MHz |
|                   |                                          | 5725 ~ 5850 MHz |
|                   | 802.11ac<br>(VHT20/VHT40/VHT80)          | 5150 ~ 5250 MHz |
|                   |                                          | 5250 ~ 5350 MHz |
|                   |                                          | 5470 ~ 5725 MHz |
|                   |                                          | 5725 ~ 5850 MHz |
| Antenna Type      | Bluetooth                                | PCB Antenna     |
|                   | WLAN                                     | PCB Antenna     |
| Exposure Category | General Population/Uncontrolled Exposure |                 |
| Product Type      | Mobile Device                            |                 |

### 3 SUMMARY OF TEST RESULT

#### 3.1 Test Standards

| No. | Identity           | Document Title                                      |
|-----|--------------------|-----------------------------------------------------|
| 1   | KDB 447498 D04 v01 | 447498 D04 Interim General RF Exposure Guidance v01 |

#### 3.2 Limit Standards

| No. | Identity           | Document Title                                               |
|-----|--------------------|--------------------------------------------------------------|
| 1   | 47 CFR Part 2.1091 | Radiofrequency radiation exposure evaluation: mobile devices |

## 4 DEVICE CATEGORY AND LEVELS LIMITS

### Mobile Devices:

CFR Title 47 §2.1091(b)

(b) For purposes of this section, a mobile device is defined as a transmitting device designed to be used in other than fixed locations and to generally be used in such a way that a separation distance of at least 20 centimeters is normally maintained between the transmitter's radiating structure(s) and the body of the user or nearby persons.

### FCC KDB 447498 D04 General RF Exposure Guidance v01 Limit

Evaluation of compliance with the exposure limits in § 1.1310 is necessary if the ERP of the device is greater than ERP<sub>20cm</sub> in Formula (B.1) [repeated from § 2.1091(c)(1) and § 1.1307(b)(1)(i)(B)].

$$P_{th} \text{ (mW)} = ERP_{20 \text{ cm}} \text{ (mW)} = \begin{cases} 2040f & 0.3 \text{ GHz} \leq f < 1.5 \text{ GHz} \\ 3060 & 1.5 \text{ GHz} \leq f \leq 6 \text{ GHz} \end{cases} \quad (\text{B.1})$$

If the ERP is not easily obtained, then the available maximum time-averaged power may be used (i. e., without consideration of ERP only 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.

SAR-based exemptions are constant at separation distances between 20 cm and 40 cm to avoid discontinuities in the threshold when transitioning between SAR-based and MPE-based exemption criteria at 40 cm, considering the importance of reflections.

The SAR-based exemption formula of § 1.1307(b)(3)(i)(B), repeated here as Formula (B.2), applies for single fixed, mobile, and portable RF sources with available maximum time-averaged power or effective radiated power (ERP), whichever is greater, of less than or equal to the threshold  $P_{th}$  (mW).

This method shall only be used at separation distances from 0.5 cm to 40 cm and at frequencies from 0.3 GHz to 6 GHz (inclusive).  $P_{th}$  is given by Formula (B.2).

$$P_{th} \text{ (mW)} = \begin{cases} ERP_{20 \text{ cm}} (d/20 \text{ cm})^x & d \leq 20 \text{ cm} \\ ERP_{20 \text{ cm}} & 20 \text{ cm} < d \leq 40 \text{ cm} \end{cases} \quad (\text{B. 2})$$

where

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

and  $f$  is in GHz,  $d$  is the separation distance (cm), and  $ERP_{20 \text{ cm}}$  is per Formula (B.1). The example values shown in Table B.2 are for illustration only.

Table B.2—Example Power Thresholds (mW)

| Frequency (MHz) | Distance (mm) |    |    |    |     |     |     |     |     |     |     |
|-----------------|---------------|----|----|----|-----|-----|-----|-----|-----|-----|-----|
|                 |               | 5  | 10 | 15 | 20  | 25  | 30  | 35  | 40  | 45  | 50  |
| 300             |               | 39 | 65 | 88 | 110 | 129 | 148 | 166 | 184 | 201 | 217 |
| 450             |               | 22 | 44 | 67 | 89  | 112 | 135 | 158 | 180 | 203 | 226 |
| 835             |               | 9  | 25 | 44 | 66  | 90  | 116 | 145 | 175 | 207 | 240 |
| 1900            |               | 3  | 12 | 26 | 44  | 66  | 92  | 122 | 157 | 195 | 236 |
| 2450            |               | 3  | 10 | 22 | 38  | 59  | 83  | 111 | 143 | 179 | 219 |
| 3600            |               | 2  | 8  | 18 | 32  | 49  | 71  | 96  | 125 | 158 | 195 |
| 5800            |               | 1  | 6  | 14 | 25  | 40  | 58  | 80  | 106 | 136 | 169 |

## 5 ASSESSMENT RESULT

### 5.1 Output Power

| Mode                                                                                                                              | Bluetooth |
|-----------------------------------------------------------------------------------------------------------------------------------|-----------|
| Conducted Power (dBm)                                                                                                             | 6.96      |
| Antenna Gain (dBi)                                                                                                                | 3.50      |
| EIRP (dBm)                                                                                                                        | 10.46     |
| Note: This report listed the maximal case power value, please refer to BL-SZ2490059-601&BL-SZ2490059-602 report for more details. |           |

| Mode                                                                                                             | 2.4G WIFI |
|------------------------------------------------------------------------------------------------------------------|-----------|
| Conducted Power (dBm)                                                                                            | 18.86     |
| Antenna Gain (dBi)                                                                                               | 3.50      |
| EIRP (dBm)                                                                                                       | 22.36     |
| Note: This report listed the maximal case power value, please refer to BL-SZ2490059-603 report for more details. |           |

| Mode                                                                                                             | 5.2G WIFI | 5.3G WIFI | 5.6G WIFI | 5.8G WIFI |
|------------------------------------------------------------------------------------------------------------------|-----------|-----------|-----------|-----------|
| Conducted Power (dBm)                                                                                            | 16.95     | 16.97     | 16.99     | 16.98     |
| Antenna Gain (dBi)                                                                                               | 5.90      | 5.90      | 5.90      | 5.90      |
| EIRP (dBm)                                                                                                       | 22.85     | 22.87     | 22.89     | 22.88     |
| Note: This report listed the maximal case power value, please refer to BL-SZ2490059-604 report for more details. |           |           |           |           |

### 5.2 Tune-up power

| Mode                                                                                                                          | Conducted Power Range (dBm) | EIRP Range (dBm) | ERP Range (dBm) |
|-------------------------------------------------------------------------------------------------------------------------------|-----------------------------|------------------|-----------------|
| Bluetooth                                                                                                                     | [5.00, 7.00]                | [9.00, 11.00]    | [6.85, 8.85]    |
| 2.4G WIFI                                                                                                                     | [17.00, 19.00]              | [21.00, 23.00]   | [18.85, 20.85]  |
| 5.2G WIFI                                                                                                                     | [14.00, 16.00]              | [20.00, 22.00]   | [17.85, 19.85]  |
| 5.3G WIFI                                                                                                                     | [15.00, 17.00]              | [21.00, 23.00]   | [18.85, 20.85]  |
| 5.6G WIFI                                                                                                                     | [15.00, 17.00]              | [21.00, 23.00]   | [18.85, 20.85]  |
| 5.8G WIFI                                                                                                                     | [15.00, 17.00]              | [21.00, 23.00]   | [18.85, 20.85]  |
| Note1: ERP= EIRP -2.15dB.                                                                                                     |                             |                  |                 |
| Note2: According KDB 447498 D04, used the greater of maximum conducted power and ERP to compare with the threshold value Pth. |                             |                  |                 |

### 5.3 RF Exposure Evaluation Result

| Evolution mode | Maximum power (dBm) | Maximum power (mw) | Distance (mm) | Threshold Power (mW) | Power / Limit | Verdict |
|----------------|---------------------|--------------------|---------------|----------------------|---------------|---------|
| Bluetooth      | 8.85                | 7.67               | 200           | 3060.00              | 0.003         | Pass    |
| 2.4G WIFI      | 20.85               | 121.62             | 200           | 3060.00              | 0.040         | Pass    |
| 5.2G WIFI      | 19.85               | 96.61              | 200           | 3060.00              | 0.032         | Pass    |
| 5.3G WIFI      | 20.85               | 121.62             | 200           | 3060.00              | 0.040         | Pass    |
| 5.6G WIFI      | 20.85               | 121.62             | 200           | 3060.00              | 0.040         | Pass    |
| 5.8G WIFI      | 20.85               | 121.62             | 200           | 3060.00              | 0.040         | Pass    |

### 5.4 Collocated Power Calculation

| Evolution mode | Frequency(MHz) | Power / Limit | $\Sigma$ (Power / Limit) of Bluetooth + 2.4G WIFI + Max. 5G WIFI | Verdict |
|----------------|----------------|---------------|------------------------------------------------------------------|---------|
| Bluetooth      | 2480           | 0.003         | <b>0.083</b>                                                     | Pass    |
| 2.4G WIFI      | 2462           | 0.040         |                                                                  |         |
| 5.3G WIFI      | 5250           | 0.040         |                                                                  |         |

Note:

- $\Sigma$ (Power / Limit): This is a summation of [(power for each transmitter/ antenna included in the simultaneous transmission)/ (corresponding Power limit)], for Bluetooth + 2.4G WIFI + Max. 5G WIFI.
- Both of the Bluetooth/WIFI can transmit simultaneously, the formula of calculated the Power is  $CP1 / LP1 + CP2 / LP2 + \dots \text{etc.} < 1$   
 CP = Calculation power  
 LP = Limit of power
- The worst-case situation is 0.083, which is less than "1". This confirmed that the device comply with FCC KDB 447498 D04 Power limit.
- The DUT work frequency range used is 2402 ~ 2480 MHz, 2412 ~ 2462 MHz, 5150 MHz~ 5250 MHz, 5250 MHz~ 5350 MHz, 5470 ~ 5725 MHz and 5725 MHz ~ 5850 MHz the result close to the limit by the above formula, so we select worst case power to calculate the exclusion power threshold.

### 5.5 Conclusion

This EUT is deemed to comply with the reference level limits, therefore the basic restrictions are compliant with human exposure limits.

## Statement

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--END OF REPORT--