

1. RF Exposure Requirements

1.1 General Information

Client Information

Applicant: Hangzhou BroadLink Technology Co., Ltd.
Address of applicant: Building C, 57 Jiang'er Road, Binjiang Hangzhou Zhejiang 310052
China

Manufacturer: Hangzhou BroadLink Technology Co., Ltd.
Address of manufacturer: Building C, 57 Jiang'er Road, Binjiang Hangzhou Zhejiang 310052
China

General Description of EUT:

Product Name: WiFi/BT Module
Trade Name: /
Model No.: BL33A1-P
Adding Model(s): /
Rated Voltage: DC 3.3V
Power Adapter Model: /
FCC ID: 2ATEV-BL33A1-P
Equipment Type: Mobile device

Technical Characteristics of EUT:

Bluetooth

Bluetooth Version: V4.2 (BLE mode)
Frequency Range: 2402-2480MHz
RF Output Power: 0.41dBm (Conducted)
Data Rate: 1Mbps
Modulation: GFSK
Quantity of Channels: 40
Channel Separation: 2MHz
Type of Antenna: PCB Antenna
Antenna Gain: 4.28dBi

Wi-Fi 2.4G

Support Standards: 802.11b, 802.11g, 802.11n
Frequency Range: 2412-2462MHz for 802.11b/g/n(HT20)
RF Output Power: 15.72dBm (Conducted)
Type of Modulation: CCK, OFDM, QPSK, BPSK, 16QAM, 64QAM
Quantity of Channels: 11 for 802.11b/g/n(HT20);
Channel Separation: 5MHz
Type of Antenna: PCB Antenna
Antenna Gain: 4.28dBi

1.2 RF Exposure Exemption

According to §1.1307(b)(3) and KDB 447498 D04 Interim General RF Exposure Guidance v01, system operating under the provisions of this section shall be operating in a manner that the public is not exposed to radio frequency energy level in excess limit for maximum permissible exposure.

Option A: FCC Rule Part 1.1307 (b)(3)(i)(A): The available maximum time-averaged power is no more than 1mW, regardless of separation distance.

Option B: FCC Rule Part 1.1307 (b)(3)(i)(B): The available maximum time-averaged power or effective radiated power (ERP), whichever is greater, is less than or equal to the threshold P_{th} (mW) described in the following formula. P_{th} is given by:

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

Where

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

and

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

d = the separation distance (cm);

Option C: FCC Rule Part 1.1307 (b)(3)(i)(C): 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. R must be at least $\lambda/2\pi$, where λ is the free-space operating wavelength in meters.

| Single RF Sources Subject to Routine Environmental Evaluation | |
|---|-----------------------|
| RF Source frequency (MHz) | Threshold ERP (watts) |
| 0.3-1.34 | $1,920 R^2$ |
| 1.34-30 | $3,450 R^2/f^2$ |
| 30-300 | $3.83 R^2$ |
| 300-1,500 | $0.0128 R^2 f$ |
| 1,500-100,000 | $19.2R^2$ |

For Multiple RF sources: FCC Rule Part 1.1307(b)(3)(ii):

(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).

(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.

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

1.3 Calculated Result

| Radio Access Technology | Prediction Frequency (MHz) | Output Power (dBm) | Antenna Gain (dBi) | Duty Cycle (%) | Tune-Up Time-Averaged Power (dBm) | ERP (dBm) |
|-------------------------|----------------------------|--------------------|--------------------|----------------|-----------------------------------|-----------|
| Bluetooth | 2402 | 6 | 4.28 | 100 | 7.00 | 9.13 |
| Wi-Fi | 2412 | 18.5 | 4.28 | 100 | 19.00 | 21.13 |

| Frequency (MHz) | Option | Min. Distance (cm) | Max. Power (dBm) | | Exposure Limit (mW) | Ratio | Result |
|-----------------|--------|--------------------|------------------|--------|---------------------|-------|--------|
| | | | (dBm) | (mW) | | | |
| 2402 | C | 20.00 | 9.13 | 8.18 | 768.00 | 0.01 | Pass |
| 2412 | C | 20.00 | 21.13 | 129.72 | 768.00 | 0.17 | Pass |

*Note: 1. Time-Averaged Power=Output Power * Duty Cycle; ERP= Time-Averaged Power+ Antenna gain-2.15dB*

2. Option A, B and C refers as clause 1.2.
3. For option B, Max (time-averaged power, effective radiated power (ERP)) converts to Max. Power. For option C, ERP converts to Max. Power;
4. For option B, P_{th} (mW) converts to Exposure Limit (mW); For option C, ERP (W) converts to Exposure Limit (mW).
5. Ratio= Tune-Up ERP (mW)/ Exposure Limit (mW)

Mode for Simultaneous Multi-band Transmission:

| Radio Access Technology | Ratio 1 | Ratio 2 | Simultaneous Ratio | Limit | Result | |
|-------------------------|---------|---------|--------------------|-------|-----------|----|
| | | | | | Pass/Fail | |
| -- | -- | -- | -- | -- | -- | -- |

Note: Bluetooth and WiFi can't transmit at the same time.

Result: Pass