

# 1. RF Exposure Requirements

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## 1.1 General Information

### Client Information

|                          |                                                                                                    |
|--------------------------|----------------------------------------------------------------------------------------------------|
| Applicant:               | Shelly Europe Ltd.                                                                                 |
| Address of applicant:    | 51 Cherni Vrah Blvd., building 3, floor 2 and 3, Lozenetz Region, Sofia 1407, Republic of Bulgaria |
| Manufacturer:            | Shelly Europe Ltd.                                                                                 |
| Address of manufacturer: | 51 Cherni Vrah Blvd., building 3, floor 2 and 3, Lozenetz Region, Sofia 1407, Republic of Bulgaria |

### General Description of EUT:

|                  |                                                                                   |
|------------------|-----------------------------------------------------------------------------------|
| Product Name:    | Bluetooth button                                                                  |
| Trade Name       |  |
| Model No.:       | Shelly BLU Button 1                                                               |
| Adding Model(s): | SBBT-001C                                                                         |
| Rated Voltage:   | DC 3V                                                                             |
| Power Adapter:   | /                                                                                 |
| FCC ID:          | 2BDC6-SBBT1                                                                       |
| Equipment Type:  | Portable device                                                                   |

### Technical Characteristics of EUT:

#### Bluetooth

|                       |                                                            |
|-----------------------|------------------------------------------------------------|
| Bluetooth Version:    | V4.2 (BLE mode)                                            |
| Frequency Range:      | 2402-2480MHz                                               |
| RF Output Power:      | 1Mbps: -3.80dBm (Conducted)<br>2Mbps: -3.68dBm (Conducted) |
| Data Rate:            | 1Mbps, 2Mbps                                               |
| Modulation:           | GFSK                                                       |
| Quantity of Channels: | 40                                                         |
| Channel Separation:   | 2MHz                                                       |
| Type of Antenna:      | PCB Antenna                                                |
| Antenna Gain:         | 4.76dBi                                                    |

## 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  $\lambda$  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                                                 | $19.2 R^2$            |

**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                       | -3.68              | 4.76               | 100            | -3.00                             | -0.39     |

| Frequency (MHz) | Option | Min. Distance (cm) | Max. Power (dBm) (mW) |      | Exposure Limit (mW) | Ratio | Result Pass/Fail |
|-----------------|--------|--------------------|-----------------------|------|---------------------|-------|------------------|
| 2402            | B      | 0.5                | -0.39                 | 0.91 | 2.788               | 0.33  | 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 |
|-------------------------|---------|---------|--------------------|-------|------------------|
| --                      | --      | --      | --                 | --    | --               |

Result: Pass