# 1. RF Exposure Requirements

## 1.1 General Information

**Client Information**

| | |
|---|---|
| Applicant: | PIN GENIE, INC. DBA LOCKLY |
| Address of applicant: | 676 Transfer Rd., St. Paul, MN 55114 |
| Manufacturer: | Smart Electronic Industrial (Dong Guan) Co., Ltd. |
| Address of manufacturer: | Qing Long Road, Long Jian Tian Village, Huang Jiang Town, Dong Guan, Guang Dong, China |

**General Description of EUT:**

| | |
|---|---|
| Product Name: | Latch 628FZ Z-Wave Smart Lock |
| Trade Name: | LOCKLY |
| Model No.: | PGD628FZ |
| Adding Model(s): | / |
| Rated Voltage: | DC1.5V*4 |
| FCC ID: | 2ASIVPGD668FN1 |
| Equipment Type: | Mobile device |

**Technical Characteristics of EUT:**

**Bluetooth**

| | |
|---|---|
| Bluetooth Version: | V5.0 (BLE mode) |
| Frequency Range: | 2402-2480MHz |
| RF Output Power: | -1.14dBm (Conducted) |
| Data Rate: | 1Mbps |
| Modulation: | GFSK |
| Quantity of Channels: | 40 |
| Channel Separation: | 2MHz |
| Type of Antenna: | FPC Antenna |
| Antenna Gain: | 0.5 dBi |

**Z-Wave**

| | |
|---|---|
| Frequency Range: | 908.42MHz |
| Max. Field Strength: | 87.53dBuV/m |
| Modulation: | FSK |
| Quantity of Channels: | / |
| Channel Separation: | / |
| Antenna Type: | FPC Antenna |
| Antenna Gain: | -1.0dBi |

## 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:

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

Where

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

and

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

$d$ = 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 | -1.14 | 0.5 | 100 | -1.00 | -2.65 |
| Z-Wave | 908.42 | -6.73 | -1.00 | / | -6.00 | -9.15 |

| Frequency (MHz) | Option | Min. Distance (cm) | Max. Power (dBm) | Max. Power (mW) | Exposure Limit (mW) | Ratio | Result Pass/Fail |
|---|---|---|---|---|---|---|---|
| 2402 | C | 20.00 | -2.65 | 0.54 | 768.00 | 0.01 | Pass |
| 908.42 | C | 20.00 | -9.15 | 0.12 | 465.11 | 0.01 | Pass |

*Note: 1.* a. *Time-Averaged Power=Output Power * Duty Cycle;*

*ERP= Time-Averaged Power+ Antenna gain-2.15dB;*

*b. EIRP= E-104.8+20logD; Output Power=EIRP- Antenna Gain;*

*ERP=EIRP-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 |
|---|---|---|---|---|---|
| Bluetooth + Z-Wave | 0.01 | 0.01 | 0.02 | 1 | Pass |

Result: Pass