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:	Lockly Guard Fingerprint Deadbolt 728FZ Z-Wave Smart Lock; Lockly Guard Deadbolt 728Z Z-Wave Smart Lock
Trade Name	LOCKLY
Model No.:	PGD728F ZU
Adding Model(s):	PGD728 ZU
Rated Voltage:	DC6V
Power Adapter:	/
Power Adapter:	/
FCC ID:	2ASIVPGD768FNU
Equipment Type:	Mobile device

Technical Characteristics of EUT:

Bluetooth

Bluetooth Version:	V5.0 (BLE mode)
Frequency Range:	2402-2480MHz
RF Output Power:	-3.842dBm (Conducted)
Data Rate:	1Mbps
Modulation:	GFSK
Quantity of Channels:	40
Channel Separation:	2MHz
Type of Antenna:	FPC Antenna
Antenna Gain:	1.8dBi

Z-Wave

Frequency Range:	908.42MHz
Max. Field Strength:	94.71dBuV/m
Modulation:	FSK
Quantity of Channels:	/
Channel Separation:	/
Antenna Type:	FPC Antenna
Antenna Gain:	0.86dBi

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 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	$19.2 R^2$

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	Output Power	Antenna Gain	Duty Cycle	Tune-Up Time-Averaged Power	ERP
	(MHz)	(dBm)	(dBi)	(%)	(dBm)	(dBm)
Bluetooth	2402	-3.842	1.8	100	-3.00	-3.35
Z-Wave	908.42	-1.41	0.86	100	-1.00	-2.29

Frequency	Option	Min. Distance	Max. Power		Exposure Limit	Ratio	Result
(MHz)		(cm)	(dBm)	(mW)	(mW)		Pass/Fail
2402	C	20.00	-3.35	0.46	768.00	0.01	Pass
908.42	C	20.00	-2.29	0.59	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