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:	Secure Link+WIFI-RF Hub
Trade Name:	LOCKLY
Model No.:	PGH200
Adding Model(s):	/
Rated Voltage:	DC5V
Power Adaptor :	MODEL:617058 INPUT: AC100-240V, 50/60Hz, 0.15A OUTPUT: DC5V,1A
FCC ID:	2ASIVPGH230U
Equipment Type:	Mobile device

Technical Characteristics of EUT:

Wi-Fi

Support Standards:	802.11b, 802.11g, 802.11n
Frequency Range:	2412-2462MHz for 802.11b/g/n(HT20) 2422-2452MHz for 802.11n(HT40)
RF Output Power:	17.68dBm (Conducted)
Type of Modulation:	CCK, OFDM, QPSK, BPSK, 16QAM, 64QAM
Quantity of Channels:	11 for 802.11b/g/n(HT20); 7 for 802.11n(HT40)
Channel Separation:	5MHz
Type of Antenna:	PCB Antenna
Antenna Gain:	2.76dBi

Bluetooth 1

Bluetooth Version:	V4.2 (BLE mode)
Frequency Range:	2402-2480MHz
RF Output Power:	1.28dBm (Conducted)
Data Rate:	1Mbps
Modulation:	GFSK
Quantity of Channels:	40
Channel Separation:	2MHz
Type of Antenna:	PCB Antenna

Antenna Gain:	2.76dBi
Bluetooth 2	
Bluetooth Version:	V5.0 (BLE mode)
Frequency Range:	2402-2480MHz
RF Output Power:	-1.05dBm (Conducted)
Data Rate:	1Mbps
Modulation:	GFSK
Quantity of Channels:	40
Channel Separation:	2MHz
Type of Antenna:	PCB Antenna
Antenna Gain:	2.76dBi
SRD:	
Frequency Range:	433.97-443.97MHz
Max. Field Strength:	74.94dBuV/m(3m)
Data Rate:	/
Modulation:	FSK
Antenna Type:	Integral Antenna
Antenna Gain:	1.63dBi

1.2 RF Exposure Exemption

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:

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

Where

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

and

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

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 λ/2π, 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^2f
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	Min. Frequency	Max. Output Power	Max. Tune-Up Output Power	Antenna Gain	Duty Cycle	Tune-Up EIRP
	(MHz)	(dBm)	(dBm)	(dBi)	(%)	(dBm)
Wi-Fi	2412	17.68	18.0	2.76	100	20.76
Bluetooth 1	2402	1.28	2.0	2.76	100	4.76
Bluetooth 2	2402	-1.05	-1.0	2.76	100	1.76
SRD	433.97	--	--	1.63	39.20	-20.00

Frequency	Option	Min. Distance	Max. Output Power		Exposure Limit	Ratio	Result
(MHz)		(cm)	(dBm)	(mW)	(mW)		Pass/Fail
2412	C	20.00	18.61	72.61	768.00	0.09	Pass
2402	C	20.00	2.61	1.82	768.00	0.01	Pass
2402	C	20.00	-0.39	0.91	768.00	0.01	Pass
433.97	C	20.00	-22.15	0.01	222.19	0.01	Pass

Note: 1. ERP=EIRP-2.15dB; EIRP= Output Power + Antenna gain

2. Option A, B and C refers as clause 1.2.

3. For option B, Pth(mW) convert to Exposure Limit(mW); For option C, ERP(W) convert to Exposure Limit(mW).

4. Ratio= Tune-Up ERP(mW)/ Exposure Limit (mW)

Mode for Simultaneous Multi-band Transmission:

Radio Access Technology	Ratio 1	Ratio 2	Ratio 3	Simultaneous Ratio	Limit	Result
						Pass/Fail
Wi-Fi+ Bluetooth 2+ SRD	0.09	0.01	0.01	0.11	1	Pass
Bluetooth 1+ Bluetooth 2+ SRD	0.01	0.01	0.01	0.03	1	Pass

Note: Wi-Fi and Bluetooth 1 are used the same Antenna, not support simultaneous transmission.

Result: Pass