

1. RF Exposure Requirements

1.1 General Information

Client Information

Applicant: SVEA(HK)LIMITED
Address of applicant: FLAT/RM520, 5/F, CORE BUILDING 1, PH 1,1 SCIENCE PARK EAST AVE, SHA TIN, NT, HK, CHINA

Manufacturer: Sveaverken Intelligent Technology (shenzhen) Co., Ltd.
Address of manufacturer: Room 401-501, Building 13, Nangang Second Industrial Park, No.1026, Songbai Road, Sunshine Community, Xili Street, Nanshan District, Shenzhen

General Description of EUT:

Product Name: RoboPusher Nimbo Plus
Trade Name: Sveaverken
Model No.: LF02
Adding Model(s): /
Rated Voltage: AC 120V for Adapter power
DC: 58.8V
Battery Capacity: 40000mAh
Model: H82-48V10A
Power Adapter: Input: 110-245VAC 45/65Hz
Battery: Ternary lithium battery 32celles
Output voltage : 51.2VDC
FCC ID: 2BPE2-LF02
Equipment Type: Fixed device

Technical Characteristics of EUT:

Bluetooth AP6275S

Bluetooth Version: V5.1 (BLE mode)
Frequency Range: 2402-2480MHz
RF Output Power: 3.74dBm (Conducted)
Data Rate: 1Mbps
Modulation: GFSK
Quantity of Channels: 40
Channel Separation: 2MHz
Type of Antenna: Glue stick antenna
Antenna Gain: 2.75dBi

Wi-Fi (2.4G) USB6111

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: | 15.75dBm (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: | Glue stick antenna |
| Antenna Gain: | 2.75dBi |
| Wi-Fi (2.4G) AP6275S | |
| Support Standards: | 802.11b, 802.11g, 802.11n, 802.11ax |
| Frequency Range: | 2412-2462MHz for 802.11b/g/n(ax)(HE20) |
| RF Output Power: | Antenna 0:16.12dBm (Conducted) Antenna 1:15.71dBm (Conducted) |
| Type of Modulation: | CCK, OFDM, QPSK, BPSK, 16QAM, 64QAM, 256QAM |
| Quantity of Channels: | 11 for 802.11b/g/n(ax)(HE20) |
| Channel Separation: | 5MHz |
| Type of Antenna: | Glue stick antenna |
| Antenna Gain: | 2.75dBi |
| Wi-Fi (5G) USB6111 | |
| Support Standards: | 802.11a, 802.11n(HT20), 802.11n-HT40 |
| Frequency Range: | 5180-5240MHz, 5745-5825MHz |
| Max. RF Output Power: | 5180-5240MHz:15.51dBm (Conducted) 5745-5825MHz:14.52dBm (Conducted) |
| Type of Modulation: | QPSK, 16QAM, 64QAM,256QAM |
| Type of Antenna: | Glue stick antenna |
| Antenna Gain: | 5180-5240MHz:2.64dBi 5745-5825MHz:3.20dBi |
| Wi-Fi (5G) AP6275S | |
| Support Standards: | 802.11a, 802.11n(HT20) , 802.11n-HT40, 802.11ac-VHT20/40/80, 802.11ax-HE20/40/80 |
| Frequency Range: | 5180-5240MHz, 5745-5825MHz |
| Max. RF Output Power: | 5180-5240MHz: Antenna 0: 16.23dBm (Conducted) Antenna 1:15.65dBm (Conducted) 5745-5825MHz: Antenna 0: 14.88dBm (Conducted) Antenna 1:15.07dBm (Conducted) |
| Type of Modulation: | QPSK, 16QAM, 64QAM, 256QAM, 1024QAM |
| Type of Antenna: | Glue stick antenna |
| Antenna Gain: | 5180-5240MHz:2.64dBi 5745-5825MHz:3.20dBi |

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 | $19.2 R^2$ |

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 (AP6275S-ANT 0) | 2402 | 3.74 | 2.75 | 100 | 4.00 | 4.60 |
| Wi-Fi (2.4G) (USB6111) | 2412 | 15.75 | 2.75 | 100 | 16.00 | 16.60 |
| Wi-Fi (2.4G) (AP6275S-ANT 0) | 2412 | 16.12 | 2.75 | 100 | 17.00 | 17.60 |
| Wi-Fi (2.4G) (AP6275S-ANT 1) | 2412 | 15.71 | 2.75 | 100 | 16.00 | 16.60 |
| Wi-Fi (5G) (USB6111) | 5180 | 15.51 | 2.64 | 100 | 16.00 | 16.49 |
| Wi-Fi (5G) (USB6111) | 5745 | 14.52 | 3.20 | 100 | 15.00 | 16.05 |
| Wi-Fi (5G) (AP6275S-ANT 0) | 5180 | 16.23 | 2.64 | 100 | 17.00 | 17.49 |
| Wi-Fi (5G) (AP6275S-ANT 0) | 5745 | 14.88 | 3.20 | 100 | 15.00 | 16.05 |
| Wi-Fi (5G) (AP6275S-ANT 1) | 5180 | 15.65 | 2.64 | 100 | 16.00 | 16.49 |
| Wi-Fi (5G) (AP6275S-ANT 1) | 5745 | 15.07 | 3.20 | 100 | 16.00 | 17.05 |

| Frequency | Option | Min. Distance | Max. Power | | Exposure Limit | Ratio | Result |
|-----------|--------|---------------|------------|-------|----------------|-------|-----------|
| (MHz) | | (cm) | (dBm) | (mW) | (mW) | | Pass/Fail |
| 2402 | C | 20.00 | 4.60 | 2.88 | 768.00 | 0.01 | Pass |
| 2412 | C | 20.00 | 16.60 | 45.71 | 768.00 | 0.06 | Pass |
| 2412 | C | 20.00 | 17.60 | 57.54 | 768.00 | 0.07 | Pass |
| 2412 | C | 20.00 | 16.60 | 45.71 | 768.00 | 0.06 | Pass |
| 5180 | C | 20.00 | 16.49 | 44.57 | 768.00 | 0.06 | Pass |

| | | | | | | | |
|------|---|-------|-------|-------|--------|------|------|
| 5745 | C | 20.00 | 16.05 | 40.27 | 768.00 | 0.05 | Pass |
| 5180 | C | 20.00 | 17.49 | 56.10 | 768.00 | 0.07 | Pass |
| 5745 | C | 20.00 | 16.05 | 40.27 | 768.00 | 0.05 | Pass |
| 5180 | C | 20.00 | 16.49 | 44.57 | 768.00 | 0.06 | Pass |
| 5745 | C | 20.00 | 17.05 | 50.70 | 768.00 | 0.07 | 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 | Ratio 3 | Simultaneous Ratio | Limit | Result |
|---|---------|---------|---------|--------------------|-------|-----------|
| | | | | | | Pass/Fail |
| USB6111 + (AP6275S-ANT 0) + (AP6275S-ANT 1) | 0.06 | 0.07 | 0.07 | 0.2 | 1 | Pass |

Result: Pass