

1. RF Exposure Requirements

1.1 General Information

Client Information

Applicant: ShenZhen Rapoo Technology Co., Ltd.
Address of applicant: 22,Jinxiu Road East,Pingshan District,Shenzhen,China

Manufacturer: ShenZhen Rapoo Technology Co., Ltd.
Address of manufacturer: 22,Jinxiu Road East,Pingshan District,Shenzhen,China

General Description of EUT:

Product Name: Multi-mode Wireless Mouse
Trade Name: RAPOO
Model No.: M650 Silent
Adding Model(s): M660 Silent
Rated Voltage: Battery DC 1.5V
Battery Capacity: /
FCC ID: PP23112
Equipment Type: Portable device

Technical Characteristics of EUT:

Bluetooth

Bluetooth Version: V4.0 (BLE mode)
Frequency Range: 2402-2480MHz
RF Output Power: -4.50dBm (Conducted)
Data Rate: 1Mbps
Modulation: GFSK
Quantity of Channels: 40
Channel Separation: 2MHz
Type of Antenna: PCB Antenna
Antenna Gain: -2.85dBi

SRD

Frequency Range: 2402MHz-2479MHz
Max. Field Strength: 95.28dBuV/m
Modulation: GFSK
Antenna Type: PCB Antenna
Antenna Gain: -2.85dBi

1.2 RF Exposure Exemption

According to §1.1307(b)(3) and 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	Min. Frequency	Max. Output Power	Max. Tune-Up Output Power	Antenna Gain	Duty Cycle	Tune-Up EIRP
	(MHz)	(dBm)	(dBm)	(dBi)	(%)	(dBm)
Bluetooth	2402	-4.50	-4.0	-2.85	100	-6.85

Frequency (MHz)	Option	Min. Distance	Tune-Up ERP		Exposure Limit	Ratio	Result
		(cm)	(dBm)	(mW)	(mW)		Pass/Fail
2402	B	0.5	-9.00	0.13	2.79	0.05	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, $P_{th}(mW)$ 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	Simultaneous Ratio	Limit	Result
					Pass/Fail
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Result: Pass