

1. RF Exposure Requirements

1.1 General Information

Client Information

Applicant:	Dongguan Lingdu Electronic Technology Co., Ltd.
Address of applicant:	No.1, Longcheng Street, Qingxi Town, Dongguan City, Guangdong Province, China
Manufacturer:	Dongguan Lingdu Electronic Technology Co., Ltd.
Address of manufacturer:	No.1, Longcheng Street, Qingxi Town, Dongguan City, Guangdong Province, China

General Description of EUT:

Product Name:	Doorbell
Trade Name:	/
Model No.:	VD05
Adding Model(s):	VD06, VD03, VD07, VD02, VD08, VD01, VD09, VD05-SL, VD05-F, C710
Rated Voltage:	DC 5V
Battery Capacity:	Battery DC 3.6V
Power Adapter Model:	5200mAh
FCC ID:	/
Equipment Type:	2BEAP-VD05
	Fixed device

Technical Characteristics of EUT:

Bluetooth

Bluetooth Version:	V5.0 (LE mode)
Frequency Range:	2402-2480MHz
RF Output Power:	9.75dBm (Conducted)
Data Rate:	1Mbps
Modulation:	GFSK
Quantity of Channels:	40
Channel Separation:	2MHz
Type of Antenna:	PCB Antenna
Antenna Gain:	1.83dBi

Wi-Fi

Support Standards:	802.11b, 802.11g, 802.11n
Frequency Range:	2412-2462MHz for 802.11b/g/n(HT20)
RF Output Power:	16.65dBm (Conducted)
Type of Modulation:	CCK, OFDM, QPSK, BPSK, 16QAM, 64QAM
Quantity of Channels:	11 for 802.11b/g/n(HT20)
Channel Separation:	5MHz

Type of Antenna:	FPC Antenna
Antenna Gain:	3.47dBi
SRD	
Frequency Range:	433.92MHz
Max. Field Strength:	433.92MHz: 81.09dBuV/m(3m)
Data Rate:	/
Modulation:	FSK
Antenna Type:	PCB Antenna
Antenna Gain:	-3.37dBi

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	19.2R 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	Prediction Frequency (MHz)	Output Power (dBm)	Antenna Gain (dBi)	Duty Cycle (%)	Tune-Up Time-Averaged Power (dBm)	ERP (dBm)
Bluetooth	2402	9.75	1.83	100	10.00	9.68
Wi-Fi	2412	16.65	3.47	100	17.00	18.32
SRD	433.92	-10.80	-3.37	100	-10.00	-15.52

Frequency (MHz)	Option	Min. Distance (cm)	Max. Power (dBm) (mW)		Exposure Limit (mW)	Ratio	Result Pass/Fail
2402	C	20.00	9.68	9.29	768.00	0.01	Pass
2412	C	20.00	18.32	67.92	768.00	0.09	Pass
433.92	C	20.00	-15.52	0.03	222.17	0.01	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. $Ratio = \text{Tune-Up ERP (mW)} / \text{Exposure Limit (mW)}$

Mode for Simultaneous Multi-band Transmission:

Radio Access Technology	Ratio 1	Ratio 2	Ratio 3	Simultaneous Ratio	Limit	Result
						Pass/Fail
Bluetooth + WiFi + SRD	0.01	0.09	0.01	0.11	1	Pass

Result: Pass