

# 1. RF Exposure Requirements

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## 1.1 General Information

### Client Information

Applicant: Shenzhen Tuozhu Technology Co., Ltd.  
903,West Zone,Hengchang Science and Technology Building, No.2228  
Address of applicant: Linhai Avenue,Nanshan Street,Qianhai Shengang Cooperation  
Zone,Shenzhen

Manufacturer: Shenzhen Tuozhu Technology Co., Ltd.  
903,West Zone,Hengchang Science and Technology Building, No.2228  
Address of manufacturer: Linhai Avenue,Nanshan Street,Qianhai Shengang Cooperation  
Zone,Shenzhen

### General Description of EUT:

Product Name: CyberBrick Lift n Load Combo - ZK001  
CyberBrick Soccer Game Combo - ZK002  
Trade Name: CyberBrick  
Model No.: ZK001  
Adding Model(s): ZK002  
Rated Voltage: DC7.4V  
Battery Capacity: 800mAh  
Power Adapter Model: /  
FCC ID: 2A6J8-EPK0011  
Equipment Type: Mobile device

### Technical Characteristics of EUT:

#### Bluetooth

Bluetooth Version: V5.0 (BLE mode)  
Frequency Range: 2402-2480MHz  
RF Output Power: 1Mbps:5.40dBm (Conducted)  
2Mbps:3.40dBm (Conducted)  
Data Rate: 1Mbps, 2Mbps  
Modulation: GFSK  
Quantity of Channels: 40  
Channel Separation: 2MHz  
Type of Antenna: PCB Antenna  
Antenna Gain: 3.64dBi

#### Wi-Fi

Support Standards: 802.11b, 802.11g, 802.11n  
2412-2462MHz for 802.11b/g/n(HT20)  
2422-2452MHz for 802.11n(HT40)  
RF Output Power: 15.92dBm (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: 3.64dBi

## 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  $\lambda$  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 <sup>2</sup> /f <sup>2</sup>
30-300	3.83 R <sup>2</sup>
300-1,500	0.0128 R <sup>2</sup> f
1,500-100,000	19.2R <sup>2</sup>

**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	5.40	3.64	100	6.00	7.49
Wi-Fi	2412	15.92	3.64	100	16.00	17.49

Frequency (MHz)	Option	Min. Distance	Max. Power		Exposure Limit	Ratio	Result
		(cm)	(dBm)	(mW)	(mW)		Pass/Fail
2402	C	20.00	7.49	5.61	768.00	0.01	Pass
2412	C	20.00	17.49	56.10	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	Simultaneous Ratio	Limit	Result
	Pass/Fail				

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*Note: BT and Wi-Fi can't transmit at the same time; The above 20CM evaluation is based on the product without a casing.*

Result: Pass