

RF EXPOSURE REPORT

FCC

APPLICANT

Zipline International, Inc

MODEL NAME

EV2

FCC ID

2BML6P2EV1-0

REPORT NUMBER

HA241205-ZPL-002-R03

TEST REPORT

Date of Issue
December 19, 2024

Test Site
HCT America, Inc.
1726 Ringwood Ave, San Jose, CA 95131, USA

Applicant Zipline International, Inc

Applicant Address 333 Corey Way, South San Francisco, CA 94080

FCC ID 2BML6P2EV1-0

Model Name EV2

EUT Type Package Delivery Drone

FCC Classification Digital Transmission System (DTS)
PCS Licensed Transmitter

FCC Rule Part(s) Part 1 (§1.1310 / §1.1307)

Test Procedure KDB 447498 D01 v06

The device bearing the trade name and model specified above, has been shown to comply with the applicable technical standards as indicated in the measurement report and was tested in accordance with the measurement procedures required. The results of testing in this report apply only to the product which was tested. Other similar equipment will not necessarily produce the same results due to production tolerance and measurement uncertainties.

I attest to the accuracy of data. All measurements reported herein were performed by me or were made under my supervision and are correct to the best of my knowledge and belief. I assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them.

Hyundai C-Tech, Inc. dba HCT America, Inc. certifies that no party to application has been denied the FCC benefits pursuant to Section 5301 of the Anti-Drug Abuse Act of 1988, 21 U.S.C 862

Tested By



John Park

Test Engineer

Reviewed By



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Technical Manager

REVISION HISTORY

The revision history for this document is shown in table.

TEST REPORT NO.	DATE	DESCRIPTION
HA241205-ZPL-002-R03	December 19, 2024	Initial Issue

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1. EUT DESCRIPTION

Model	EV2
EUT Type	Package Delivery Drone
Serial Number	EV2-ZIP-225
Power Supply	48 V d.c. (Internal battery)
RF Specification	2xWIFI 2.4 GHz : 802.11b/g/ n(HT20, HT40) 2xLTE : B2, B4, B12, B13, B14, B66, B71
Transmitter Chain	WIFI 2.4 GHz: 2x2 MIMO LTE : 1 TRx, 1 Rx
Operating Environment	Outdoor
Operating Temperature	-31 °C ~ +46 °C

Note :

2. INTRODUCTION

2.1. RF Exposure Exemptions for Single Source

(A) 1-mW Blanket Exemption

Per § 1.1307(b)(3)(i)(A), a single RF source is exempt RF device if the available maximum time-averaged power is no more than 1 mW, regardless of separation distance. This exemption applies to all operating configurations and exposure conditions, for the frequency range 100 kHz - 100 GHz, regardless of fixed, mobile, or portable device exposure conditions. This is a standalone exemption, and it cannot be applied in conjunction with any other test exemption.

(B) SAR-Based Exemption

A more comprehensive exemption, considering a variable power threshold that depends on both the separation distance and power, is provided in § 1.1307(b)(3)(i)(B). This exemption is applicable to the frequency range between 300 MHz - 6 GHz, with test separation distances between 0.5 cm and 40 cm, and for all RF sources in fixed, mobile, and portable device exposure conditions. Accordingly, a RF source is considered an RF exempt device if its available maximum time-averaged (matched conducted) power or its effective radiated power (ERP), whichever is greater, are below a specified threshold (P_{th}).

$$P_{th}(mW) = ERP_{20cm} \left(\frac{d}{20} \right)^x, \text{ where } d \leq 20 \text{ cm}$$

$$P_{th}(mW) = ERP_{20cm} \quad , \text{ where } 20 \text{ cm} < d \leq 40 \text{ cm}$$

$$x = -\log_{10} \left(\frac{60}{ERP_{20cm} \sqrt{f}} \right)$$

$$ERP_{20cm}(mW) = 2040 f \quad , \text{ where } 0.3 \text{ GHz} \leq f(\text{GHz}) < 1.5 \text{ GHz}$$

$$ERP_{20cm}(mW) = 3060 \quad , \text{ where } 1.5 \text{ GHz} \leq f(\text{GHz}) \leq 6 \text{ GHz}$$

(C) MPE-Based Exemption

MPE-based exemption is provided in the table 1, § 1.1307(b)(3)(i)(C), for a much wider frequency range, from 300 kHz - 100 GHz. The table 1 applies to any RF source (i.e. single fixed, mobile, and portable transmitters) and specifies power and distance criteria for each of the five frequency ranges used for the MPE limits. These criteria apply at separation distances from any part of the radiating structure of at least $\lambda/2\pi$. The MPE-based test exemption condition is in terms of ERP, defined as the product of the maximum antenna gain and the delivered maximum time-averaged power.

RF Source Frequency f_L (MHz) – f_H (MHz)	Minimum Distance $\lambda/2\pi (f_L) - \lambda/2\pi (f_H)$	Threshold ERP (ERP _{th})
0.3 – 1.34	150 m – 35.6 m	1,920 R ²
1.34 – 30	35.6 m – 1.6 m	3,450 R ² / f ²
30 – 300	1.6 m – 159 mm	3.83 R ²
300 – 1,500	159 mm – 31.8 mm	0.0128 R ² f
1,500 – 100,000	31.8 mm – 0.5 mm	19.2 R ²

Table 1. § 1.1307(b)(3)(i)(C) – Single RF Source Subject to Routine Environmental Evaluation

2.2. RF Exposure Exemptions for Simultaneous Transmission

(A) 1-mW Blanket Exemption

Per § 1.1307(b)(3)(ii)(A), the 1-mW exemption may be also applied to simultaneous transmission conditions, within the same host device, according one of the following criteria:

- When maximum available power each individual transmitting antenna within the same time averaging period is ≤ 1 mW, and the nearest parts of the antenna structures of the simultaneously operating transmitters are separated by at least 2 cm.
- When the aggregate maximum available power of all transmitting antennas is ≤ 1 mW in the same time-averaging period.

This exemption cannot be combined with other options (B) or (C).

(B) SAR-Based Exemptions and MPE-Based Exemptions

As described in § 1.1307(b)(3)(ii)(B) and covers the situations where both SAR-based and MPE-based exemption may be considered for test exemption in fixed, mobile, or portable device exposure conditions. For these cases, a device with multiple RF sources transmitting simultaneously will be considered an RF exempt device if the condition of the following formula is satisfied :

$$\sum_{i=1}^a \frac{P_i}{P_{th,i}} + \sum_{j=1}^b \frac{ERP_j}{ERP_{th,j}} + \sum_{k=1}^c \frac{Evaluated_k}{Exposure\ Limit_k} \leq 1$$

3. RESULT

Wifi 2.4 GHz				
Frequency (GHz)	2.437	GHz	2.402 – 2.480	GHz
Separation Distance (cm)	20	cm		
ERP _{20cm} (mW)	3060.0	mW		
P _{th} (mW)	3060.00	mW		
Conducted Output Power	17.09	dBm	51.17	mW
Antenna Gain	5.00	dBi	3.16	-
EIRP	22.09	dBm	161.81	mW
ERP (P)	19.94	dBm	98.63	mW
P / P _{th} Ratio	0.03223	at 20 cm separation distance from the body		

Wifi 2.4 GHz				
Frequency (GHz)	2.437	GHz	2.402 – 2.480	GHz
Separation Distance (cm)	20	cm		
ERP _{20cm} (mW)	3060.0	mW		
P _{th} (mW)	3060.00	mW		
Conducted Output Power	17.5	dBm	56.23	mW
Antenna Gain	5.00	dBi	3.16	-
EIRP	22.50	dBm	177.83	mW
ERP (P)	20.35	dBm	108.39	mW
P / P _{th} Ratio	0.03542	at 1 cm separation distance from the body		

LTE B4				
Frequency (GHz)	1.745	GHz	0.777 – 0.787	GHz
Separation Distance (cm)	20	cm		
ERP _{20cm} (mW)	3060.0	mW		
P _{th} (mW)	3060.00	mW		
Conducted Output Power	23.2	dBm	209.89	mW
Antenna Gain	6.00	dBi	3.98	-
EIRP	29.22	dBm	835.60	mW
ERP (P)	27.07	dBm	509.33	mW
P / P _{th} Ratio	0.16645	at 20 cm separation distance from the body		

LTE B4				
Frequency (GHz)	1.745	GHz	0.777 – 0.787	GHz
Separation Distance (cm)	20	cm		
ERP _{20cm} (mW)	3060.0	mW		
P _{th} (mW)	3060.00	mW		
Conducted Output Power	23.2	dBm	209.89	mW
Antenna Gain	6.00	dBi	3.98	-
EIRP	29.22	dBm	835.60	mW
ERP (P)	27.07	dBm	509.33	mW
P / P _{th} Ratio	0.16645	at 20 cm separation distance from the body		

Two WIFI 2.4 GHz and Two LTE transmit simultaneously. Therefore, the worst-case RF exposure is simultaneous transmission of WIFI 2.4 GHz + WIFI 2.4GHz + LTE + LTE and the calculated MPE at 20 cm is 0.49918.

Sample Calculation

$$\text{TOTAL MPE (20cm distance)} = 0.03223 / 1.0 + 0.03542 / 1.0 + 0.16645 / 1.0 + 0.16645 / 1.0 = \mathbf{0.40055} < 1.0$$

Note :

1. The separation distance is 20 cm according to the operating description

END OF TEST REPORT