

1. RF Exposure Requirements

1.1 General Information

Client Information

Applicant: EcoFlow Inc.
Address of applicant: RM 401, Plant #1, Runheng Industrial Zone, Fuhai Street, Bao'an District, Shenzhen, 518000 China

Manufacturer: The same as Applicant
Address of manufacturer: The same as Applicant

General Description of EUT:

Product Name: EcoFlow 4G Dongle SEP
Trade Name: ECOFLOW; EF ECOFLOW
Model No.: EF-WM-001
Adding Model(s): /
Rated Voltage: DC 5V
Battery Capacity: /
Adapter Model: /
FCC ID: 2A2P9-EFHDP24GS1
Equipment Type: Mobile device

Technical Characteristics of EUT:	
4G	
Support Networks:	FDD-LTE
Support Band:	FDD-LTE Band 2, 4, 5, 12, 13, 25, 26
Uplink Frequency:	FDD-LTE Band 2 Tx: 1850-1910MHz, FDD-LTE Band 4 Tx: 1710-1755MHz, FDD-LTE Band 5 Tx: 824-849MHz, FDD-LTE Band 12 Tx: 699-716MHz, FDD-LTE Band 13 Tx: 777-787MHz, FDD-LTE Band 25 Tx: 1850-1915MHz FDD-LTE Band 26 Tx: 814-849MHz
Downlink Frequency:	FDD-LTE Band 2 Rx: 1930-1990MHz, FDD-LTE Band 4 Rx: 2110-2155MHz, FDD-LTE Band 5 Rx: 869-894MHz, FDD-LTE Band 12 Rx: 729-746MHz, FDD-LTE Band 13 Rx: 746-756MHz, FDD-LTE Band 25 Rx: 1930-1995MHz FDD-LTE Band 26 Rx: 859-894MHz
RF Output Power:	FDD-LTE Band 2: 24.36dBm, FDD-LTE Band 4: 23.81dBm, FDD-LTE Band 5: 23.98dBm,

	FDD-LTE Band 12: 23.71dBm, FDD-LTE Band 13: 23.45dBm, FDD-LTE Band 25: 23.99dBm FDD-LTE Band 26: 24.06dBm
Type of Emission:	FDD-LTE Band 2: 18M0G7D, 4M93W7D FDD-LTE Band 4: 18M0G7D, 4M93W7D FDD-LTE Band 5: 8M99G7D, 4M56W7D FDD-LTE Band 12: 8M99G7D, 4M56W7D FDD-LTE Band 13: 8M95G7D, 4M56W7D FDD-LTE Band 25: 18M0G7D, 4M93W7D FDD-LTE Band 26: 13M5G7D, 4M70W7D
Type of Modulation:	QPSK, 16QAM
Antenna Type:	PCB Antenna
Antenna Gain:	<p>RE305:</p> <p>FDD-LTE Band 2: 4.24dBi, FDD-LTE Band 4: 5.53dBi, FDD-LTE Band 5: 0.99dBi, FDD-LTE Band 12: 2.62dBi, FDD-LTE Band 13: 1.59dBi, FDD-LTE Band 25: 4.24dBi FDD-LTE Band 26: 0.99dBi</p> <p>RE306:</p> <p>FDD-LTE Band 2: 2.74dBi, FDD-LTE Band 4: 2.56dBi, FDD-LTE Band 5: -0.81dBi, FDD-LTE Band 12: -2.35dBi, FDD-LTE Band 13: -0.12dBi, FDD-LTE Band 25: 2.74dBi FDD-LTE Band 26: -0.81dBi</p>

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	Tune-up Power	Antenna Gain	Duty Cycle Factor	Tune-up Time-Averaged Power	ERP
	(MHz)	(dBm)	(dBi)	(dB)	(dBm)	(dBm)
LTE Band 2-RE305	1850	24.5	4.24	0	24.50	26.59
LTE Band 4-RE305	1710	24.0	5.53	0	24.00	27.38
LTE Band 5-RE305	824	24.0	0.99	0	24.00	22.84
LTE Band 12-RE305	699	24.0	2.62	0	24.00	24.47
LTE Band 13-RE305	777	23.5	1.59	0	23.50	22.94
LTE Band 25-RE305	1850	24.0	4.24	0	24.00	26.09
LTE Band 26-RE305	814	24.5	0.99	0	24.50	23.34
LTE Band 2-RE306	1850	24.5	2.74	0	24.50	25.09
LTE Band 4-RE306	1710	24.0	2.56	0	24.00	24.41
LTE Band 5-RE306	824	24.0	-0.81	0	24.00	21.04
LTE Band 12-RE306	699	24.0	-2.35	0	24.00	19.50
LTE Band 13-RE306	777	23.5	-0.12	0	23.50	21.23
LTE Band 25-RE306	1850	24.0	2.74	0	24.00	24.59
LTE Band 26-RE306	814	24.5	-0.81	0	24.50	21.54

Radio Access Technology	Option	Min. Distance	Max. Power		Exposure Limit	Ratio	Result
		(cm)	(dBm)	(mW)	(mW)		Pass/Fail
LTE Band 2-RE305	C	20.00	26.59	456.04	768.00	0.59	Pass
LTE Band 4-RE305	C	20.00	27.38	547.02	768.00	0.71	Pass
LTE Band 5-RE305	C	20.00	22.84	192.31	421.89	0.46	Pass

LTE Band 12-RE305	C	20.00	24.47	279.90	357.89	0.78	Pass
LTE Band 13-RE305	C	20.00	22.94	196.79	397.82	0.49	Pass
LTE Band 25-RE305	C	20.00	26.09	406.44	768.00	0.53	Pass
LTE Band 26-RE305	C	20.00	23.34	215.77	416.77	0.52	Pass
LTE Band 2-RE306	C	20.00	25.09	322.85	768.00	0.42	Pass
LTE Band 4-RE306	C	20.00	24.41	276.06	768.00	0.36	Pass
LTE Band 5-RE306	C	20.00	21.04	127.06	421.89	0.30	Pass
LTE Band 12-RE306	C	20.00	19.50	89.13	357.89	0.25	Pass
LTE Band 13-RE306	C	20.00	21.23	132.74	397.82	0.33	Pass
LTE Band 25-RE306	C	20.00	24.59	287.74	768.00	0.37	Pass
LTE Band 26-RE306	C	20.00	21.54	142.56	416.77	0.34	Pass

Note: 1. For GSM, Duty cycle factor = 9 dB for 1 Tx slot, 6 dB for 2 Tx slots, 4.25 dB for 3 Tx slots, 3 dB for 4 Tx slots;

2. Tune-up time-average power = Tune-up Power - Duty cycle factor in dB
2. Output Power= EIRP - Antenna Gain; ERP=EIRP-2.15dB
3. Option A, B and C refers as clause 1.2.
4. For option B, Max (time-averaged power, effective radiated power (ERP)) converts to Max. Power. For option C, ERP converts to Max. Power;
5. For option B, P_{th} (mW) converts to Exposure Limit (mW); For option C, ERP (W) converts to Exposure Limit (mW).
6. 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
/	/	/	/	/	/

Note: RE305 Antenna and RE306 Antenna can't transmit at the same time.

Result: Pass