



# TEST REPORT

## California Energy Commission's Appliance Efficiency Regulations

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Applicant's name .....	Purism SPC	
Address..... :	One Market Street, 36th Floor, San Francisco, CA 94105, USA	
Manufacturer's name .....	Purism SPC	
Address..... :	One Market Street, 36th Floor, San Francisco, CA 94105, USA	
Test specification:		
Standard .....	<input checked="" type="checkbox"/> California Code Of Regulations, Title 20: Division 2, Chapter 4, Article 4, Sections 1601 - 1609: Appliance Efficiency Regulations	
Test procedure..... :	10 CFR Section 430.23 (aa) (Appendix Y to Subpart B of Part 430) (As it appeared in the code of Federal Regulations on June 20, 2016)	
Non-standard test method.....:	N/A	
Test Report Form No..... :	CEC-BC-TRF	
Test Report Form(s) Originator.... :	Shenzhen LCS Compliance Testing Laboratory Ltd.	
Master TRF .....	2016-11-22	
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TRF No. CEC-BC-TRF

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**Appliance (Equipment) Detail**

Model Number	Librem 5
Brand	Purism
Regulatory Status	Federally-Regulated
Product Type	mobile phone
Serial Number	--
Product Description (as appropriate)	mobile phone
Rated voltage(s)	5V
Frequency (frequencies)	--
Number of charger ports	1
Location of marking or labeling	outside
Detail of manufacturer marked on the product (if any)	None
Compatible battery chemistries	Lithium Ion

**Unit Configuration**

<input checked="" type="checkbox"/> Small battery charger (single)
<input checked="" type="checkbox"/> USB Charger system
<input type="checkbox"/> Multi-port Charger
<input type="checkbox"/> Multi-voltage charger
<input type="checkbox"/> Batch charger

**For Battery information**

Battery manufacture:	Zhongshan Tianmao Battery Co.,Ltd.
Model of battery:	Librem 5
Number of battery:	1
Rated Battery Voltage:	3.8V
Rated charge capacity of the test battery:	4500mAh
Rated charge energy of the test battery:	17.1Wh

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**Possible test case verdicts**

- Test object does meet the requirement: .....	P (Pass)
- Test case does not apply to the test object: .....	N/A (Not applicable)
- Test object does not meet the requirement: .....	F (Fail)

**Testing:**

Date of receipt of test item .....	2021-04-21
Data(s) of performance of tests.....	2021-04-21 to 2021-06-11

**General product information**

- |  |
|--|
| <ol style="list-style-type: none"> <li>1. The product was charged by approved external Power Adapter. We performed the test the external Power Adapter.</li> <li>2. The weight of the product is 0.265kg.</li> </ol> |
|--|



## General conditions for measurements

### 1. Test Room

The tests shall be carried out in a room that has an air speed close to the appliance under test of  $\leq 0.5$  m/s. The ambient temperature shall be maintained at  $(20 \pm 5)$  °C throughout the test.

### 2. Power supply

Where this standard is referenced by an external standard or regulation that specifies a test voltage and frequency, the test voltage and frequency so defined shall be used for all tests. Where the test voltage and frequency are not defined by an external standard, the test voltage and the test frequency shall be the nominal voltage and the nominal frequency of the country for which the measurement is being determined  $\pm 1$  %.

### 3. Supply voltage waveform

The total harmonic content of the supply voltage when supplying the appliance under test in the specified mode shall not exceed 2 %; harmonic content is defined as the root-mean-square (r.m.s.) summation of the individual components using the fundamental as 100 %.

### 4. Power measurement accuracy

Precision measurement of energy consumption shall be made with a precision equal to the greater of 0.1 Watt-hour or 1% of full-scale measurement.

### 5. Testing Setup

Charge the battery with the UUT for the period specified by the UUT manufacturer as the time needed to fully charge the battery under test.

- 1) All limited time functions used to deliver the primary charge to the battery, including cell equalization, are to be excluded from the measurement of battery maintenance mode.
- 2) If these events are known to occur for a time period beyond the manufacturer specified charge time, the battery is to be left in place until all such functions are complete.
- 3) In cases where no charge time is specified, the batteries to be charged for a period of at least 24 hours.

**General conditions for measurements**

Test condition parameter	Requirements	Measured
Air speed close to the EUT	$\leq 0.5$ m/s	0.1 m/s
Ambient temperature	15-25°C	24.0°C
Relative Humidity	10-80%	57.0%
Test voltage	<input type="checkbox"/> 115 $\pm$ 1% <input checked="" type="checkbox"/> others	5Vdc
Test frequency	<input type="checkbox"/> 60 Hz $\pm$ 1%	--
Total harmonic content (up to and including the 13th harmonic)	$\leq 2$ %	--
Voltage crest factor of the power meter under test	1.34-1.49	--
Resolution of power meter	0.01 W (at least)	0.01W

**Test instruments**

Number	Model designation	Measurement	Calibration date	Next Calibration date
LCS-S-117	WT310	Digital Power Meter	2019-11-11	2020-11-10
LCS-S-081	RD-3010	DC source	2019-10-15	2020-10-14
LCS-S-104	CT-3008-15V3A-A	Battery charge tester	2019-11-14	2020-11-13
LCS-S-015	ZJ1-2B	Hydrograph	2019-10-15	2020-10-14
LCS-S-029	PC396	Stop Watch	2019-10-15	2020-10-14
LCS-S-122	AR866A	Anemometer	2019-11-11	2020-11-10

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**TEST DATA AND RESULT**

Measured Value				
Determination of represented values	Sample 1	Sample 2	Represented value mean	Units
24 - hour charge and maintenance energy ( $E_{24}$ = 24-hour energy)	28.727	28.635	28.681	Wh
Battery maintenance mode power ( $P_m$ = Maintenance mode power)	0.223	0.221	0.222	W
No battery mode power ( $P_{sb}$ = Standby mode power)	0	0	0	W
No battery mode power ( $P_{off}$ = Off mode power)	--	--	--	W
Battery capacity of tested battery (if more than 1 charger port report the total of all battery capacities connected during test) ( $E_{batt}$ = Measured battery energy)	13.691	13.685	13.688	Wh
$t_{cd}$ = Charge test duration	24	24	--	h
$t_{a\&m}$ , n, $t_{sb}$ and $t_{off}$	$t_{a\&m}$ =7.82 n=0.54 $t_{sb}$ =5.29 $t_{off}$ =0.00	$t_{a\&m}$ =7.82 n=0.54 $t_{sb}$ =5.29 $t_{off}$ =0.00	--	--

TABLE: BATTERY CHARGER USAGE PROFILES

Product class				Hours per day***			Charges (n)	Threshold charge time*
No.	Description	Rated battery energy ( $E_{batt}$ )**	Special characteristic or battery voltage	Active + maintenance ( $t_{a\&m}$ )	Standby ( $t_{sb}$ )	Off ( $t_{off}$ )	Number per day	Hours
1	Low-Energy	$\leq 5$ Wh	Inductive Connection****	20.66	0.10	0.00	0.15	137.73
2	Low-Energy, Low-Voltage	$< 100$ Wh	$< 4$ V	7.82	5.29	0.00	0.54	14.48
3	Low-Energy, Medium-Voltage	$< 100$ Wh	4-10 V	6.42	0.30	0.00	0.10	64.20
4	Low-Energy, High-Voltage	$< 100$ Wh	$> 10$ V	16.84	0.91	0.00	0.50	33.68
5	Medium-Energy, Low-Voltage	100-3000 Wh	$< 20$ V	6.52	1.16	0.00	0.11	59.27
6	Medium-Energy, High-Voltage	100-3000 Wh	$\geq 20$ V	17.15	6.85	0.00	0.34	50.44
7	High-Energy	$> 3000$ Wh		8.14	7.30	0.00	0.32	25.44

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Standards for Small Battery Charger Systems			Sample 1 (first sample)	
Performance Parameter	Requirements		Measured	Verdict
Maximum 24 hour charge and maintenance energy (Wh) ( $E_b$ = capacity of all batteries in ports and $N$ = number of charger ports)	For $E_b$ of 2.5 Wh or less: $16 \times N$	--	--	N.A
	For $E_b$ greater than 2.5 Wh and less than or equal to 100 Wh: $12 \times N + 1.6E_b$	33.906	28.727	P
	For $E_b$ greater than 100 Wh and less than or equal to 1000 Wh: $22 \times N + 1.5E_b$	--	--	N.A
	For $E_b$ greater than 1000 Wh: $36.4 \times N + 1.486E_b$	--	--	N.A
Maintenance Mode Power and No Battery Mode Power (W) ( $E_b$ = capacity of all batteries in ports and $N$ = number of charger ports)	The sum of maintenance mode power and no battery mode power must be less than or equal to: $1 \times N + 0.0021 \times E_b$ Watts	1.03	0.223	P
Note: measured $E_b$ of battery is 13.691Wh, Number of charger port is one.				

Standards for Small Battery Charger Systems			Sample 2 (second sample)	
Performance Parameter	Requirements		Measured	Verdict
Maximum 24 hour charge and maintenance energy (Wh) ( $E_b$ = capacity of all batteries in ports and $N$ = number of charger ports)	For $E_b$ of 2.5 Wh or less: $16 \times N$	--	--	N.A
	For $E_b$ greater than 2.5 Wh and less than or equal to 100 Wh: $12 \times N + 1.6E_b$	33.896	28.635	P
	For $E_b$ greater than 100 Wh and less than or equal to 1000 Wh: $22 \times N + 1.5E_b$	--	--	N.A
	For $E_b$ greater than 1000 Wh: $36.4 \times N + 1.486E_b$	--	--	N.A
Maintenance Mode Power and No Battery Mode Power (W) ( $E_b$ = capacity of all batteries in ports and $N$ = number of charger ports)	The sum of maintenance mode power and no battery mode power must be less than or equal to: $1 \times N + 0.0021 \times E_b$ Watts	1.03	0.221	P
Note: measured $E_b$ of battery is 13.685Wh, Number of charger port is one.				

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<b>Inductive Charger Systems</b>			
Mode	Requirement	Measured value	Verdict
Maintenance mode power	1W	--	N.A
No battery mode	1W	--	N.A
Average power consumption during of the charge and maintenance mode test	1W	--	N.A

<b>Battery Backup and Uninterruptible Power Supplies (consumer products manufactured on or after February 1, 2013) and Battery Backup and Uninterruptible Power Supplies (not consumer products manufactured on or after January 1, 2017 )</b>			
Mode	Requirement	Measured value	Verdict
Maintenance mode power	$0.8 + 0.0021 \times E_b$ watts =	--	N.A





Unit energy consumption (UEC) for a battery charger			
Formula	UEC		Verdict
	Sample1	Sample2	
(i) $UEC = 365(n(E_{24} - 5P_m - E_{batt})/t_{cd} + (P_m(t_{a\&m} - (t_{cd} - 5)n) + (P_{sb}t_{sb}) + (P_{off}t_{off}))$	--	--	N/A
(ii) $UEC = 365(n(E_{24} - 5P_m - E_{batt})/24/(t_{cd} - 5) + (P_{sb}t_{sb}) + (P_{off}t_{off}))$	3.466 kWh/yr	3.447 kWh/yr	Pass

Note: Calculate unit energy consumption (UEC) for a battery charger using one of the two equations (equation (i) or equation (ii)) listed. If a battery charger is tested and its charge duration as determined in section 5.2 of this appendix minus 5 hours is greater than the threshold charge time listed in table 5.3 below (i.e.  $(t_{cd}-5) * n > t_{a\&m}$ ), use equation (ii) to calculate UEC; otherwise calculate the battery charger's UEC using equation (i).

Maximum UEC limit					
Product class	Product class description	Rated battery energy (Ebatt**)	Special characteristic or battery voltage	Maximum UEC (kWh/yr) (as a function of Ebatt**)	Verdict
1	Low-Energy	≤5 Wh	Inductive Connection*	3.04	N/A
2	Low-Energy, Low-Voltage	<100 Wh	<4 V	$0.1440 * E_{batt} + 2.95$	Pass
3	Low-Energy, Medium-Voltage		4-10 V	For $E_{batt} < 10$ Wh, 1.42 kWh/y For $E_{batt} \geq 10$ Wh, $0.0255 * E_{batt} + 1.16$	N/A
4	Low-Energy, High-Voltage		>10 V	$0.11 * E_{batt} + 3.18$	N/A
5	Medium-Energy, Low-Voltage	100-3000 Wh	<20 V	$0.0257 * E_{batt} + 0.815$	N/A
6	Medium-Energy, High-Voltage		≥20 V	$0.0778 * E_{batt} + 2.4$	N/A
7	High-Energy	>3000 Wh		$0.0502 * E_{batt} + 4.53$	N/A

\*Inductive connection and designed for use in a wet environment (e.g. electric toothbrushes).  
 \*\* $E_{batt}$  = Rated battery energy as determined in 10 CFR part 429.39(a).  
 Maximum UEC (kWh/yr):  $0.1440 * E_{batt} + 2.95 = 4.921$  kWh/yr

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### Department of Energy (DOE) sampling plan for Battery chargers

*Determination of represented values.* Manufacturers must determine represented values, which include certified ratings, for each basic model of battery charger in accordance with the following sampling provisions.

*Represented values include:* the unit energy consumption (UEC) in kilowatt-hours per year (kWh/yr), battery discharge energy ( $E_{batt}$ ) in watt-hours (Wh), 24-hour energy consumption ( $E_{24}$ ) in watt-hours (Wh), maintenance mode power ( $P_m$ ) in watts (W), standby mode power ( $P_{sb}$ ) in watts (W), off mode power ( $P_{off}$ ) in watts (W), and duration of the charge and maintenance mode test ( $t_{cd}$ ) in hours (hrs).

For each basic model, a sample of sufficient size shall be randomly selected and tested to ensure that the represented value of UEC is greater than or equal to the higher of:

(A) The mean of the sample, where:

$$\bar{x} = \frac{1}{n} \sum_{i=1}^n x_i$$

and,  $\bar{x}$  is the sample mean;  $n$  is the number of samples; and  $x_i$  is the UEC of the  $i$ th sample or,

(B) The upper 97.5-percent confidence limit (UCL) of the true mean divided by 1.05, where:

$$UCL = \bar{x} + t_{0.975} \left( \frac{s}{\sqrt{n}} \right)$$

and  $\bar{x}$  is the sample mean;  $s$  is the sample standard deviation;  $n$  is the number of samples; and  $t_{0.975}$  is the  $t$ -statistic for a 97.5-percent one-tailed confidence interval with  $n-1$  degrees of freedom (from appendix A of this subpart).

FIGURE 1—T-DISTRIBUTION VALUES FOR CERTIFICATION TESTING

[One-Sided]

Degrees of freedom (from Appendix A)	Confidence Interval			
	90%	95%	97.5%	99%
1	3.078	6.314	12.71	31.82
2	1.886	2.920	4.303	6.965
3	1.638	2.353	3.182	4.541
4	1.533	2.132	2.776	3.747
5	1.476	2.015	2.571	3.365
6	1.440	1.943	2.447	3.143
7	1.415	1.895	2.365	2.998
8	1.397	1.860	2.306	2.896
9	1.383	1.833	2.262	2.821
10	1.372	1.812	2.228	2.764
11	1.363	1.796	2.201	2.718
12	1.356	1.782	2.179	2.681
13	1.350	1.771	2.160	2.650
14	1.345	1.761	2.145	2.624
15	1.341	1.753	2.131	2.602
16	1.337	1.746	2.120	2.583
17	1.333	1.740	2.110	2.567
18	1.330	1.734	2.101	2.552
19	1.328	1.729	2.093	2.539
20	1.325	1.725	2.086	2.528



While the sample standard deviation,  $s$ , is calculated using the formula below:

$$s = \sqrt{\frac{\sum_{i=0}^n (x_i - X)^2}{n - 1}}$$

where:

$X$  is the mean of sample

$n$  is the number of units tested

$x_i$  is the  $i^{\text{th}}$  test result

$\sum_{i=0}^n x_i$  is the sum of the results of  $n$  tests.

Test sample number	Active model energy consumption UEC (kWh/yr)	Product class	The represented value of Maximum UEC (kWh/yr)
1 (first)	3.466	2	3.466
2 (second)	3.447		
Mean	3.457		
UCL / 1.05	3.406		

Note 1: For calculate the upper 97.5-percent confidence limit (UCL) of the true mean divided by 1.05:  $n=2$ ,  $t_{0.975}=12.71$ , the sample mean energy consumption UEC is 2.989 with a standard deviation of  $s=0.005$ .

Note 2: The charging system was evaluated according to the 10 CFR Part 430 (the energy conservation standards specified in the Code of Federal Regulations at 10 CFR 430.32(z)) to meets the CEC and DOE energy efficiency requirements

Determination of represented values				
Test sample number	Maximum 24 hour charge and maintenance energy (Wh)	The represented value of Maximum (Wh)	Maintenance Mode Power and No Battery Mode Power (W)	The represented value of Maximum (W)
1	28.727	28.727	0.223	0.223
2	28.635		0.221	
Mean	28.681		0.222	
UCL / 1.05	28.681		0.222	

Note: Unless otherwise specified, the minimum number of units tested shall be no less than two.

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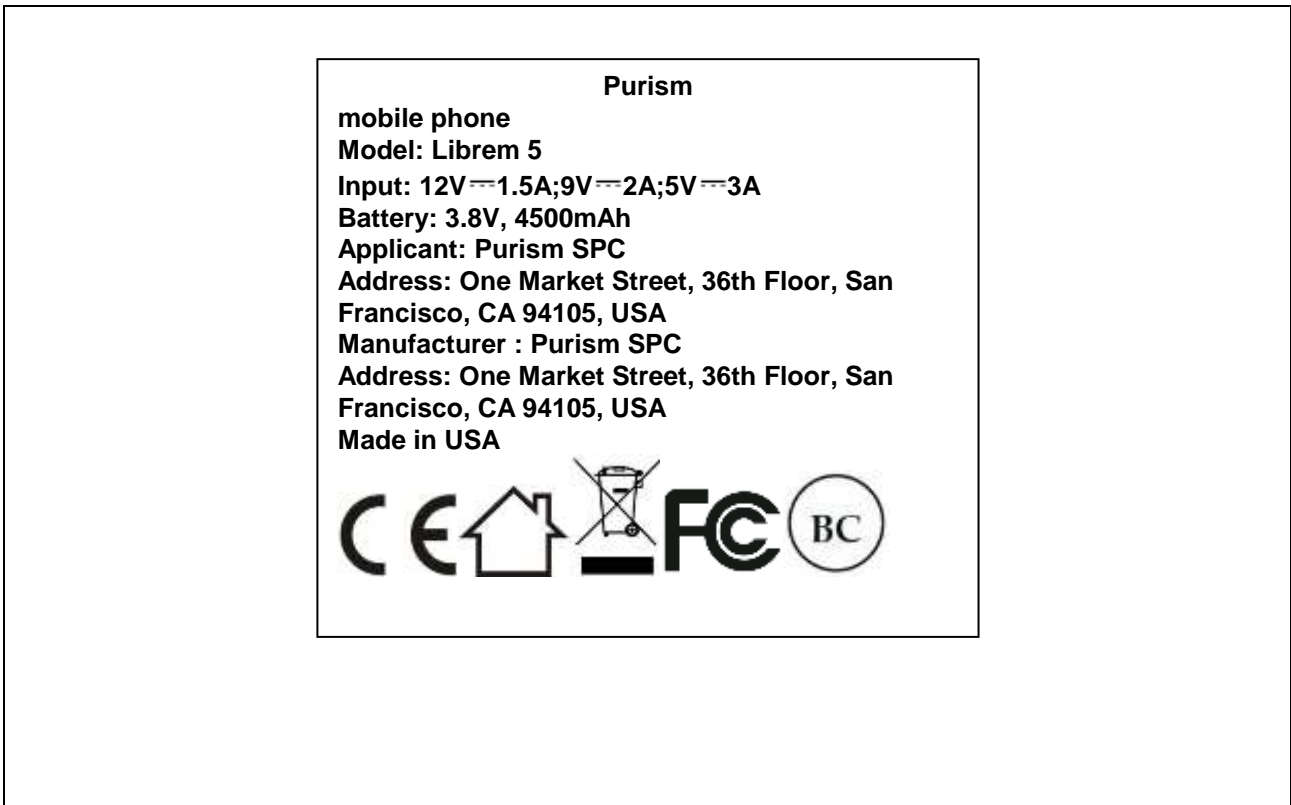
**View 1**



**View 2**



**Label**



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