

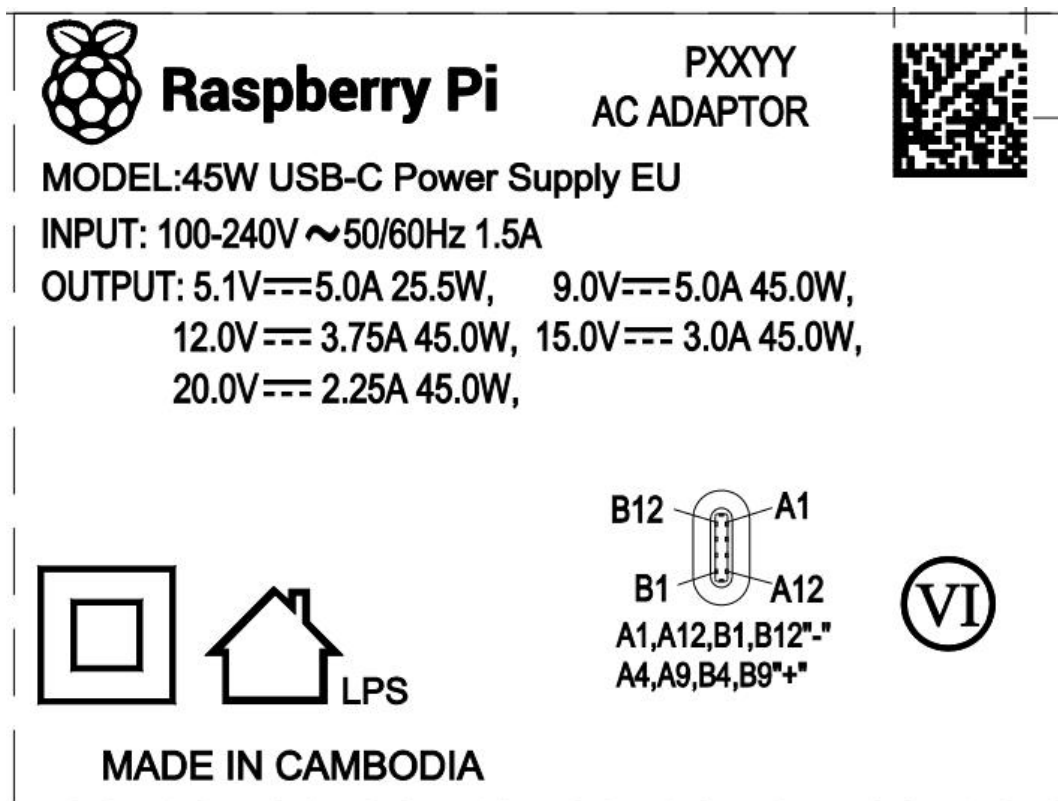
	<b>EST Technology Co., Ltd.</b> Address: Chilingxiang, Qishantou, Santun, Houjie, Dongguan, Guangdong, China Tel: +86-769-83081888 Fax: +86-769-83081878	<b>Ref. Report No.</b> <b>ESTS-G24082708</b>
	<b>TEST REPORT</b> <b>Energy Efficiency Regulations</b> <b>Energy Efficiency of External Power Supplies</b>	
Applicant.....: KUANTECH CO., LTD. Address.....: 11TH FL 868-3 ZHONGZHENG RD, ZHONGHE DISTRICT, NEW TAIPEI, 235 TAIWAN Manufacturer.....: Same as applicant Address.....: Same as applicant Factory .....: Kuantech (Cambodia) International Co., Ltd Address .....: Phum Chormpul, Khum P'pel, Srok Tramkork, Takeo Province, Cambodia Product name.....: Switching Mode Power Supply /AC Adaptor Output Cord Length (cm).....: 150(17 AWG) Trade mark.....: Raspberry Pi Model No.....: 45W USB-C Power Supply EU Ratings.....: See 2 page Standard.....: EU Energy-related Products (ErP) directive COMMISSION REGULATION (EU) 2019/1782 of 1 October 2019 laying down ecodesign requirements for external power supplies pursuant to Directive 2009/125/EC of the European Parliament and of the Council and repealing Commission Regulation (EC) No 278/2009 EN 50563:2011+A1:2013, IEC 62301:2011 and EN 50564: 2011 EU Code of Conduct Version 5, published on Oct. 29, 2013 (Level VI) Date of Receiver.....: August 27, 2024 Date of Test.....: September 05, 2024 Date of Issue.....: November 21, 2024 Testing Laboratory.....: EST Technology Co., Ltd. Address .....: Chilingxiang, Qishantou, Santun, Houjie, Dongguan, Guangdong, China Test Report No.....: ESTS-G24082708 Test Result.....: PASS This Test Report is Issued Under the Authority of:		
<div style="display: flex; justify-content: space-between;"> <div style="text-align: center;"> <p><b>Tested By</b></p>  <p><b>Black Liu/Engineer</b></p> </div> <div style="text-align: center;"> <p><b>Approved By</b></p>  <p><b>Jimmy Liang/Reviewer</b></p> </div> </div>		

**Test Report issued under the responsibility of:**

**EST Technology Co., Ltd.**

**Copy of marking plate(Representative):**

The artwork below may be only a draft.

**General product information:**

1. The submitted samples were found to comply with the above standard.
2. This test results relate only to the submit sample.

Note: This report shall not be reproduced except for authorized by testing laboratory.

## General condition

### 1. Test Room

The test was carried out in a room that has an air speed close to the UUT of  $\leq 0.5$  m/s. The ambient temperature was maintained at  $20^{\circ}\text{C} \pm 5^{\circ}\text{C}$  throughout the test.

### 2. Test Voltage

The input voltage is within the specified voltage  $\pm 1\%$  and the specified frequency  $\pm 1\%$ . The UUT was tested at rated supply as mentioned in Summary of testing. The input power source is capable of delivering at least 10 times the nameplate input power of the UUT. The THD of the supply voltage when supplying the UUT in the specified mode was not exceeding 2%, up to and including the 13th harmonic.

### 3. Test Setup

The UUT was operated at 100% of rated current output for at least 30 minutes immediately prior to conducting efficiency measurements.

### 4. THD

The THD of the input voltage shall be  $\leq 2$  percent, up to and including the 13th harmonic. The crest factor of the input voltage shall be between 1.34 and 1.49.

### 5. Load Conditions

The UUT was tested at four active mode load conditions and the no-load condition according to table below by using electronic load.

Percentage of Nameplate Output Current	
Load Condition 1	100% $\pm$ 2%
Load Condition 2	75% $\pm$ 2%
Load Condition 3	50% $\pm$ 2%
Load Condition 4	25% $\pm$ 2%
Load Condition 5	10% $\pm$ 1%
Load Condition 6	0%

The 2% allowance is of nameplate output current, not of the calculated current value. For example, a UUT at Load Condition 3 may be tested in a range from 48% to 52% of rated output current.

## International Efficiency Marking Protocol for External Power Supplies Version 3.0, September 2013

Version 4.0, September 2016

Mark	Performance Requirements				
	Nameplate Output Power (P <sub>no</sub> )	No-Load Mode Power	Nameplate Output Power (P <sub>no</sub> )	Average Efficiency in Active Mode	Power Factor
I	Used if none of the other criteria are met.				
II	0 to ≤ 10 watts	≤ 0.75	0 to < 1 watt	≥ 0.39 * P <sub>no</sub>	Not applicable
	> 10 to 250 watts	≤ 1.0	1 to < 49 watts	≥ 0.107 x Ln(P <sub>no</sub> ) + 0.39	
			> 49 watts	≥ 0.82	
III	0 to < 10 watts	≤ 0.5	0 to 1 watt	≥ 0.49 * P <sub>no</sub>	Not applicable
	10 to 250 watts	≤ 0.75	> 1 to < 49 watts	≥ 0.09 * Ln(P <sub>no</sub> ) + 0.49	
			>49 to 250 watts	≥ 0.84	
IV	0 to 250 watts	≤ 0.5	0 to 1 watt	≥ 0.5 * P <sub>no</sub>	Not applicable
			1 to 51 watts	≥ 0.09 * Ln(P <sub>no</sub> ) + 0.5	
			>51 to 250 watts	≥ 0.85	
V	0 to < 50 watts	≤ 0.5 for ac-ac; ≤ 0.3 for ac-dc	0 to ≤ 1 watt	Standard: ≥ 0.480 *P <sub>no</sub> + 0.140 Low Voltage: ≥0.497 * P <sub>no</sub> + 0.067	EPSs with ≥ 100 watts input power must have a true power factor ≥ 0.9 at 100% of rated load when tested at 115 volts/60Hz.
	≥ 50 to ≤ 250 watts	≤ 0.5	> 1 to 49 watts	Standard: ≥ [0.0626* Ln(P <sub>no</sub> )] + 0.622 Low Voltage: ≥[0.0750 * Ln(P <sub>no</sub> )]+ 0.561	
			> 49 to 250 watts	Standard: ≥ 0.870 Low Voltage: ≥ 0.860	
VI	Single-Voltage				Not Applicable
	0 to ≤ 49 W	AC-DC: ≤ 0.100 AC-AC: ≤ 0.210	0 to ≤ 1 W	Basic Voltage: ≥ 0.5 * P <sub>no</sub> + 0.16 Low Voltage: ≥ 0.517 * P <sub>no</sub> + 0.087	
			1 to ≤ 49 W	Basic Voltage: ≥ 0.071* Ln(P <sub>no</sub> ) – 0.0014*P <sub>no</sub> + 0.67 Low Voltage: ≥ 0.0834 * Ln(P <sub>no</sub> ) – 0.0014 * P <sub>no</sub> + 0.609	
	>49 to ≤ 250 W	≤ 0.210	>49 to ≤ 250 W	Basic Voltage: ≥ 0.880 Low Voltage: ≥ 0.870	
	> 250 W	≤ 0.500	>250 W	≥ 0.875	
	Multiple-Voltage				
	Any	≤ 0.300	0 to ≤ 1 W	≥ 0.497 * P <sub>no</sub> + 0.067	
			1 to ≤ 49 W	≥ 0.075 * Ln(P <sub>no</sub> ) + 0.561	
			>49 W	≥ 0.860	
VII	Reserved for future use				

## EU Energy-related Products (ErP) directive

### Ecodesign requirements

set out in Annex II, 1 a) & b) of COMMISSION REGULATION (EU) 2019/1782

for no-load electric power consumption and average active efficiency of external power supplies

Single-Voltage External AC-DC or AC-AC Power Supply, Basic-Voltage		
Nameplate Output Power (P <sub>no</sub> )	Minimum Average Efficiency in Active Mode	Verdict
≤ 1W	$\geq 0.5 \times P_{no} + 0.16$	N/A
1 W < to ≤ 49 W	$\geq 0.071 \times \ln(P_{no}) - 0.0014 \times P_{no} + 0.67$	P
49W <to ≤ 250W	$\geq 0.880$	N/A
Nameplate Output Power (P <sub>no</sub> )	Maximum Power in No-Load Mode	
	<input type="checkbox"/> Ac-Ac EPS	<input checked="" type="checkbox"/> Ac-Dc EPS
≤ 49 W	≤ 0.21W	≤ 0.10W
49W <to ≤ 250W	≤ 0.21W	
		Verdict
		P
		N/A

Single-Voltage External AC-DC or AC-AC Power Supply, Low-Voltage		
Nameplate Output Power (P <sub>no</sub> )	Minimum Average Efficiency in Active Mode	Verdict
≤ 1W	$\geq 0.517 \times P_{no} + 0.087$	N/A
1 W < to ≤ 49 W	$\geq 0.0834 \times \ln(P_{no}) - 0.0014 \times P_{no} + 0.609$	P
49W <to ≤ 250W	$\geq 0.870$	N/A
Nameplate Output Power (P <sub>no</sub> )	Maximum Power in No-Load Mode	
	<input type="checkbox"/> Ac-Ac EPS	<input checked="" type="checkbox"/> Ac-Dc EPS
≤ 49 W	≤ 0.10W	≤ 0.10W
49W <to ≤ 250W	≤ 0.21W	
		Verdict
		P
		N/A

Multiple-Voltage		
Nameplate Output Power (P <sub>no</sub> )	Minimum Average Efficiency in Active Mode	Verdict
0 to ≤ 1 W	$\geq 0.497 * P_{no} + 0.067$	N/A
1 to ≤ 49 W	$\geq 0.075 * \ln(P_{no}) + 0.561$	N/A
49 W	$\geq 0.860$	N/A
Nameplate Output Power (P <sub>no</sub> )	Maximum Power in No-Load Mode	Verdict
Any	$\leq 0.30$	N/A
Notes:		

#### Supplementary information to test procedure for multiple-voltage:

According to Annex II, 3 Measurements and calculations of COMMISSION REGULATION (EU) 2019/1782

For the purposes of compliance and verification of compliance with the requirements of this Regulation, measurements and calculations shall be made using harmonised standards the reference numbers of which have been published for this purpose in the Official Journal of the European Union, or other reliable, accurate and reproducible methods, which take into account the generally recognised state of the art.

Measurements and calculations have been made using harmonised standards US DOE:Appendix Z to Subpart B of 10 CFR Part 430 for multiple-voltage in this report.



## Test data

Sample Model:45W USB-C Power Supply EU				115Vac/ 60Hz		
Load condition	No Load	Active load of the nameplate (5.1Vdc, 5.0A )				
Percent of Nameplate Current	0%	10%	25%	50%	75%	100%
Actual voltage(Vac)	115.0	115.0	115.0	115.0	115.0	115.0
Actual frequency(Hz)	60.00	60.00	60.00	60.00	60.00	60.00
Output voltage(Vdc)	5.20	5.13	5.15	5.16	5.15	5.15
Output Current(mA)	--	500	1250	2500	3750	5000
Active Output Power(W)	--	2.57	6.44	12.90	19.32	25.75
Input Power(W)	0.026	2.976	7.320	14.916	22.884	31.488
Total Harmonic Distortion(THD A%)	7.74	227.73	213.74	187.30	169.45	115.40
Total Harmonic Distortion(THD,V%)	0.124	0.152	0.149	0.192	0.197	0.223
True Power Factor(W/VA)	0.025	0.376	0.412	0.460	0.495	0.522
Power Consumed by UUT(W)	0.026	0.406	0.880	2.016	3.564	5.738
Efficiency(%)		86.36	87.98	86.48	84.43	81.78
Average Efficiency(%)	--	--	85.17			

Sample Model:45W USB-C Power Supply EU				230Vac/ 50Hz		
Load condition	No Load	Active load of the nameplate (5.1Vdc, 5.0A )				
Percent of Nameplate Current	0%	10%	25%	50%	75%	100%
Actual voltage(Vac)	230.0	230.0	230.0	230.0	230.0	230.0
Actual frequency(Hz)	50.00	50.00	50.00	50.00	50.00	50.00
Output voltage(Vdc)	5.25	5.13	5.18	5.16	5.16	5.17
Output Current(mA)	--	500	1250	2500	3750	5000
Active Output Power(W)	--	2.57	6.48	12.91	19.35	25.85
Input Power(W)	0.058	3.168	7.572	15.084	22.920	31.164
Total Harmonic Distortion(THD A%)	11.20	250.13	236.03	184.44	166.82	162.35
Total Harmonic Distortion(THD,V%)	1.213	1.557	1.641	1.211	1.289	1.343
True Power Factor(W/VA)	0.010	0.262	0.359	0.456	0.501	0.512
Power Consumed by UUT(W)	0.058	0.598	1.092	2.174	3.570	5.314
Efficiency(%)		81.12	85.58	85.59	84.42	82.95
Average Efficiency(%)	--	--	84.64			

## TEST RESULTS AND REQUIREMENT:

**Test Results:** (5.1Vdc 5.0A)

	Model No.	Test at 115V, 60Hz	Test at 230V, 50Hz	Energy Efficiency: VI
No load power (W)	45W USB-C Power Supply EU	0.026	0.058	≤0.100
Average Efficiency (%) at 10%	45W USB-C Power Supply EU	86.36	81.12	N/A
Average Efficiency (%)	45W USB-C Power Supply EU	85.17	84.64	≥84.341
Verdict	---	PASS	PASS	---

### Limit for efficiency mark level VI:

Minimum Efficiency Average active mode efficiency limit greater than or equal to  $\geq 0.0834 * \ln(P_{no}) - 0.0014 * P_{no} + 0.609 = 0.84341$ ;  
no-load condition consumption shall not exceed 0.100W.

Note: The results reflect only the worst group of data.



Sample Model:45W USB-C Power Supply EU				230Vac/ 50Hz		
Load condition	No Load	Active load of the nameplate (20.0Vdc, 2.25A )				
Percent of Nameplate Current	0%	10%	25%	50%	75%	100%
Actual voltage(Vac)	230.0	230.0	230.0	230.0	230.0	230.0
Actual frequency(Hz)	50.00	50.00	50.00	50.00	50.00	50.00
Output voltage(Vdc)	19.95	19.93	19.93	19.89	19.85	19.82
Output Current(mA)	--	225	562.5	1125	1687.5	2250
Active Output Power(W)	--	4.48	11.21	22.38	33.50	44.60
Input Power(W)	0.058	5.400	12.528	24.540	36.576	48.636
Total Harmonic Distortion(THD A%)	14.85	246.41	199.81	176.19	167.73	163.54
Total Harmonic Distortion(THD,V%)	1.211	1.208	1.219	1.276	1.317	1.394
True Power Factor(W/VA)	0.011	0.309	0.424	0.484	0.505	0.517
Power Consumed by UUT(W)	0.058	0.920	1.318	2.160	3.076	4.036
Efficiency(%)		82.96	89.48	91.20	91.59	91.70
Average Efficiency(%)	--	--	90.99			

Sample Model:45W USB-C Power Supply EU				115Vac/ 60Hz		
Load condition	No Load	Active load of the nameplate (20.0Vdc, 2.25A)				
Percent of Nameplate Current	0%	10%	25%	50%	75%	100%
Actual voltage(Vac)	115.0	115.0	115.0	115.0	115.0	115.0
Actual frequency(Hz)	60.00	60.00	60.00	60.00	60.00	60.00
Output voltage(Vdc)	19.97	19.95	19.93	19.89	19.85	19.82
Output Current(mA)	--	225	562.5	1125	1687.5	2250
Active Output Power(W)	--	4.49	11.21	22.37	33.50	44.59
Input Power(W)	0.026	5.184	12.372	24.552	36.804	49.152
Total Harmonic Distortion(THD A%)	9.95	219.89	191.14	165.69	147.42	134.15
Total Harmonic Distortion(THD,V%)	0.107	0.132	0.147	0.192	0.240	0.258
True Power Factor(W/VA)	0.024	0.404	0.453	0.501	0.540	0.566
Power Consumed by UUT(W)	0.026	0.694	1.162	2.182	3.304	4.562
Efficiency(%)		86.61	90.61	91.11	91.02	90.72
Average Efficiency(%)	--	--	90.87			

### TEST RESULTS AND REQUIREMENT:

**Test Results:** (20.0Vdc, 2.25A )

	Model No.	Test at 115V, 60Hz	Test at 230V, 50Hz	Energy Efficiency: VI
No load power (W)	45W USB-C Power Supply EU	0.026	0.058	≤0.100
Average Efficiency (%) at 10%	45W USB-C Power Supply EU	82.96	86.61	N/A
Average Efficiency (%)	45W USB-C Power Supply EU	90.87	90.99	≥87.727
Verdict	---	PASS	PASS	---

#### Limit for efficiency mark level VI:

Minimum Efficiency Average active mode efficiency limit greater than or equal to  $\geq 0.071 \cdot \ln(P_{no}) - 0.0014 \cdot P_{no} + 0.67 = 0.87727$ ;

no-load condition consumption shall not exceed 0.100W.

Note: The results reflect only the worst group of data.

**Photo documentation:****Photo 1****Photo 2**

**Equipments used for measurement**

Test Equipments List					
Equipment Name	Manufacturer	Model #	Reg. No.	Cal. Date	Next Cal.
Digital Power Meter	YOKOGAWA	WT310	EST-S015-036	2024/5/18	2025/5/17
Digital Multimeter	FLUKE	Fluke17B	EST-S001-009	2024/5/18	2025/5/17
Meter ruler	Jieyang rongshen	7.5m	EST-S110-003	2024/5/21	2025/5/20
Temperature-Humidity Recorder	KTJ	TA218	EST-S019-004	2024/5/20	2025/5/19
Anemometer	TESTO	405-V1	EST-S031-001	2024/5/21	2025/5/20
Electric load	PRODIGIT	3302F(331 1F)	EST-S016-043	2024/5/18	2025/5/17

-----End of Report-----