CEC Test Report
External Power Supplies Energy Efficiency Test Report

Report reference No. ..... :	TR20060342-S-000
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Date of issue ..... :	2020-06-19
Total number of page(s) ..... :	13
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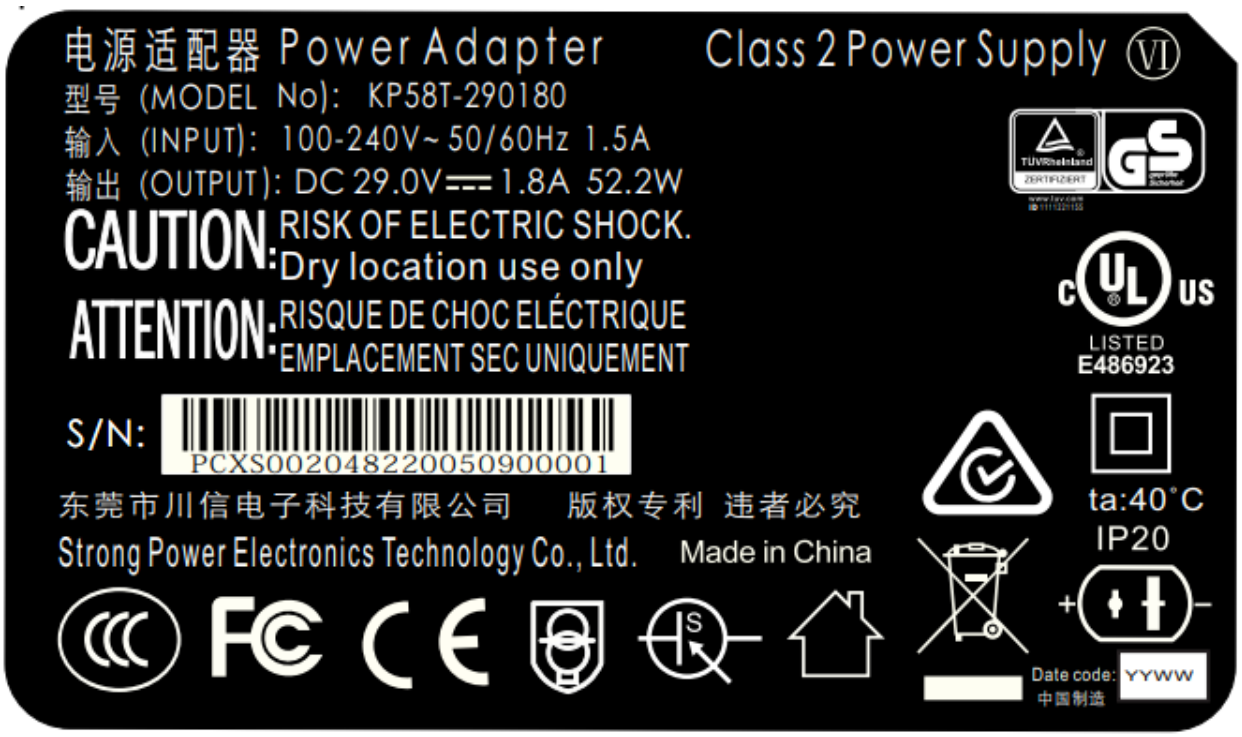
Applicant ..... :	STRONG POWER ELECTRONICS TECHNOLOGY CO., LTD.
Address ..... :	NO.63 TANGZHONG ROAD, TANGJIAO VILLAGE, CHASHAN TOWN, DONGGUAN CITY, GUANGDONG PROVINCE, CHINA.
Manufacturer ..... :	STRONG POWER ELECTRONICS TECHNOLOGY CO., LTD.
Address ..... :	NO.63 TANGZHONG ROAD, TANGJIAO VILLAGE, CHASHAN TOWN, DONGGUAN CITY, GUANGDONG PROVINCE, CHINA.
Standards ..... :	CEC-140-2019-002: CALIFORNIA CODE OF REGULATIONS Title 20. Public Utilities and Energy; 10 CFR part 430, Subpart B, Appendix Z- Uniform Test Method for Measuring The Energy Consumption of External Power Supplies; International Efficiency Marking Protocol for External Power Supplies, Version 3.0; IEC 62301:2011 Household electrical appliances - Measurement of standby power;
Energy performance mark ..... :	**VI**
Test item description ..... :	Power Adapter
Trade mark ..... :	None
Model/Type reference ..... :	KP58T-290180
Ratings ..... :	I/P: 100-240V~, 50/60Hz, 1.5A; O/P: 29.0Vdc, 1.8A, 52.2W
Samples Received Date ..... :	2020-06-11
Tested Date ..... :	2020-06-11 to 2020-06-15

Copy of marking plate:
The artwork below may be only a draft. The use of certification marks on a product must be authorized by the respective NCBs that own these marks.



Note:
Date Code: YYWW (YY stands for years, WW stands week)

General product information:

The equipment under test is a:

☒Class A external power supply;
☒Direct operation external power supply;
☐Indirect operation external power supply
☒Single-voltage external AC-DC power supply; and:
☐Single-voltage external AC-AC power supply; and:
☐Multiple-voltage external power supply;
☐Switch-selectable single voltage external power supply;
☐Adaptive external power supply;
☒Basic-voltage external power supply;
☐Low-voltage external power supply;

The equipment under test ☐with ☒without a manual on-off switch.

Model difference:--

Test program and conditions:

1. All tests was carried out in a room with an air speed immediately surrounding the UUT of ≤0.5 m/s.

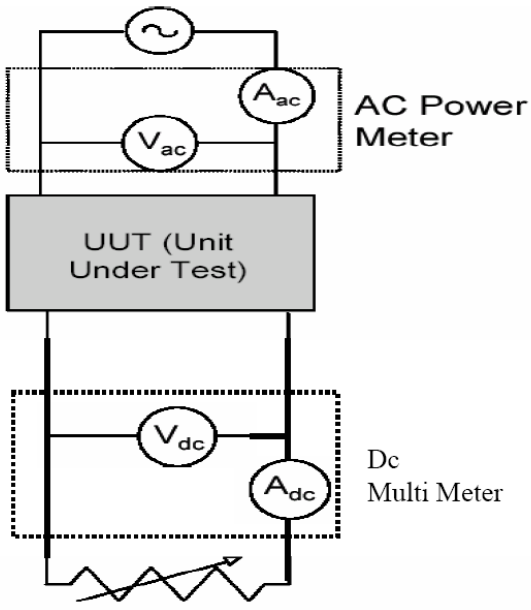
2. The ambient temperature was maintained at 24.6°C throughout the test.

3. Measurements were mode for supply voltage of 115V/60Hz and 230V/50Hz.

4. Test switch-selectable single-voltage external power supplies twice—once at the highest nameplate output voltage and once at the lowest.

5. Test adaptive external power supplies twice—once at the highest achievable output voltage and once at the lowest.

6. In order to load the power supply to produce all four active-mode load conditions, use a set of variable resistive or electronic loads. Although these loads may have different characteristics than the electronic loads power supplies are intended to power, they provide standardized and readily repeatable references for testing and product comparison. Note that resistive loads need not be measured precisely with an ohmmeter; simply adjust a variable resistor to the point where the ammeter confirms that the desired percentage of nameplate output current is flowing. For electronic loads, adjust the desired output current in constant current (CC) mode rather than adjusting the required output power in constant power (CP) mode. The following provides one illustration of how to set up an EPS for test.



7. As noted in IEC 62301 (incorporated by reference; see §430.3), instantaneous measurements are appropriate when power readings are stable in a particular load condition. Operate the UUT at 100% of nameplate current output for at least 30 minutes immediately prior to conducting efficiency measurements. After this warm-up period, monitor AC input power for a period of 5 minutes to assess the stability of the UUT. If the power level does not drift by more than 5% from the maximum value observed, the UUT is considered stable and the measurements should be recorded at the end of the 5-minute period. Measure subsequent load conditions under the same 5-minute stability parameters. Note that only one warm-up period of 30 minutes is required for each UUT at the beginning of the test procedure. If the AC input power is not stable over a 5-minute period, follow the guidelines established by IEC 62301 for measuring average power or accumulated energy over time for both AC input and DC output. Conduct efficiency measurements in sequence from Load Condition 1 to Load Condition 5 as indicated in Table 1. If testing of additional, optional load conditions is desired, that testing should be conducted in accordance with this test procedure and subsequent to completing the

sequence described above.
Note: the method used for measure input power is accumulated energy approach according IEC 62301. The interval is 15min, the average power is calculated by the equation:
Average. Power (W)=[Wh x 60 minutes/hours]/Wh Interval (minutes).

8. Power consumption of the UUT at each Load Condition 1-4 is the difference between the DC output power (W) at that Load Condition and the AC input power (W) at that Load Condition. The power consumption of Load Condition 5 (no load) is equal to the AC input power (W) at that Load Condition.

TABLE 1—LOADING CONDITIONS FOR UNIT UNDER TEST

Loading Condition 1	100% of Derated Nameplate Output Current ±2%.
Loading Condition 2	75% of Derated Nameplate Output Current ±2%.
Loading Condition 3	50% of Derated Nameplate Output Current ±2%.
Loading Condition 4	25% of Derated Nameplate Output Current ±2%.
Loading Condition 5	0%.

9. When test power supplies packaged for consumer use to power a product with the DC output cord supplied by the manufacturer. Cut the cord immediately adjacent to the DC output connector, and report the output cord length is max.15cm, min.18 AWG under test.

10. When test power supplies packaged for consumer use to power a product with the AC power supply cord supplied by the manufacturer. Report the power supply cord length is max.150cm, min.18 AWG under test.

11. All power figures should be in watts and rounded to the second decimal place. For loads greater than or equal to 10 W, three significant figures shall be reported.

THE LIMITS FOR EXTERNAL POWER SUPPLY:

All Class A external power supplies manufactured on or after July 1, 2008, shall meet the following standards: (Level IV)

Active mode	
Nameplate output	**Required efficiency (decimal equivalent of a percentage)**
Less than 1 watt	0.5 times the Nameplate output.
From 1 watt to not more than 51 watts	The sum of 0.09 times the Natural Logarithm of the Nameplate Output and 0.5.
Greater than 51 watts	0.85.
No-load mode	
Nameplate output	**Maximum consumption**
Not more than 250 watts	0.5 watts.

All direct operation external power supplies manufactured on or after February 10, 2016, shall meet the following standards: (Level VI)

Single-Voltage External Power Supply, Basic-Voltage			
Nameplate Output Power (P_{out})	**Minimum Average Efficiency in Active Mode**	**Maximum Power in No-Load Mode [W]**	
		AC-AC	**AC-DC**
$P_{out} \leq 1W$	$\geq 0.5 \times P_{out} + 0.16$	≤0.210	≤0.100
$1W < P_{out} \leq 49W$	$\geq 0.071 \times \ln(P_{out}) - 0.0014 \times P_{out} + 0.67$	≤0.210	≤0.100
$49W < P_{out} \leq 250W$	≥0.880	≤0.210	≤0.210
$P_{out} > 250W$	≥0.875	≤0.500	≤0.500
Single-Voltage External Power Supply, Low-Voltage			
Nameplate Output Power (P_{out})	**Minimum Average Efficiency in Active Mode**	**Maximum Power in No-Load Mode [W]**	
		AC-AC	**AC-DC**
$P_{out} \leq 1W$	$\geq 0.517 \times P_{out} + 0.087$	≤0.210	≤0.100
$1W < P_{out} \leq 49W$	$\geq 0.0834 \times \ln(P_{out}) - 0.0014 \times P_{out} + 0.609$	≤0.210	≤0.100
$49W < P_{out} \leq 250W$	≥0.870	≤0.210	≤0.210
$P_{out} > 250W$	≥0.875	≤0.500	≤0.500

Multiple-Voltage External Power Supply		
Nameplate Output Power (P_{out})	**Minimum Average Efficiency in Active Mode**	**Maximum Power in No-Load Mode [W]**
$P_{out} \leq 1W$	$\geq 0.497 \times P_{out} + 0.067$	≤0.300
$1W < P_{out} \leq 49W$	$\geq 0.075 \times \ln(P_{out}) + 0.561$	≤0.300
$P_{out} > 49W$	≥0.860	≤0.300

Definitions:

External power supply means an external power supply circuit that is used to convert household electric current into DC current or lower-voltage AC current to operate a consumer product.

Class A external power supply—

(1) Means a device that—

(i) Is designed to convert line voltage AC input into lower voltage AC or DC output;

(ii) Is able to convert to only one AC or DC output voltage at a time;

(iii) Is sold with, or intended to be used with, a separate end-use product that constitutes the primary load;

(iv) Is contained in a separate physical enclosure from the end-use product;

(v) Is connected to the end-use product via a removable or hard-wired male/female electrical connection, cable, cord, or other wiring; and

(vi) Has nameplate output power that is less than or equal to 250 watts;

(2) But, does not include any device that—

(i) Requires Federal Food and Drug Administration listing and approval as a medical device in accordance with section 513 of the Federal Food, Drug, and Cosmetic Act (21 U.S.C. 360(c)); or

(ii) Powers the charger of a detachable battery pack or charges the battery of a product that is fully or primarily motor operated.

Single-voltage external AC-DC power supply means an external power supply that is designed to convert line voltage AC into lower-voltage DC output and is able to convert to only one DC output voltage at a time.

Single-voltage external AC-AC power supply means an external power supply that is designed to convert line voltage AC into lower-voltage AC output and is able to convert to only one AC output voltage at a time.

Multiple-voltage external power supply means an external power supply that is designed to convert line voltage AC input into more than one simultaneous lower-voltage output.

Low-voltage external power supply means an external power supply with a nameplate output voltage less than 6 volts and nameplate output current greater than or equal to 550 milliamps.

Basic-voltage external power supply means an external power supply that is not a low-voltage external power supply.

Switch-selectable single voltage external power supply means a single-voltage AC-AC or AC-DC power supply that allows users to choose from more than one output voltage.

Direct operation external power supply means an external power supply that can operate a consumer product that is not a battery charger without the assistance of a battery.

Indirect operation external power supply means an external power supply that cannot operate a consumer product that is not a battery charger without the assistance of a battery.

Adaptive external power supply (EPS) means an external power supply that can alter its output voltage during active-mode based on an established digital communication protocol with the end-use application without any user-generated action.

Active mode means the mode of operation when the external power supply is connected to the main electricity supply and the output is (or “all outputs are” for a multiple-voltage external power supply) connected to a load (or “loads” for a multiple-voltage external power supply).

No-load mode means the mode of operation when an external power supply is connected to the main electricity supply and the output is (or “all outputs are” for a multiple-voltage external power supply) not connected to a load (or “loads” for a multiple-voltage external power supply).

UUT means unit under test.

Average Active-Mode Efficiency means the average of the loading conditions (100 percent, 75 percent, 50 percent, and 25 percent of its nameplate output current) for which it can sustain the output current.

Federally regulated external power supply means an external power supply circuit that is used to convert household electric current into DC current or lower-voltage AC current to operate a consumer product.

Test Data:

Sample No. 1	
Test Model	KP58T-290180

Measured and Calculated Data at 115V, 60Hz							
	No load	**Active Power Values**					**Average**
Percent of nameplate current	0%	10%	25%	50%	75%	100%	
Output Current (mA)		--	450	900	1350	1800	--
Output Voltage (V, r.m.s)	--	--	29.09	29.09	29.06	29.06	
Output Power (W, r.m.s)		--	13.091	26.181	39.231	52.308	
AC Input Voltage (V, r.m.s)	115	--	115	115	115	115	
AC Input Power (W, r.m.s)	0.072	--	14.694	29.666	44.760	59.911	
THD (%)	0.18	--	0.65	1.04	1.35	1.62	--
True Power Factor (W/VA)	0.0474	--	0.493	0.53	0.552	0.575	
AC Input Frequency (Hz)	60	--	60	60	60	60	
Power Consumed (W)	0.072	--	1.604	3.485	5.529	7.603	--
Efficiency (%)	--	--	89.09	88.25	87.65	87.31	88.07

Measured and Calculated Data at 230V, 50Hz							
	No load	**Active Power Values**					**Average**
Percent of nameplate current	0%	10%	25%	50%	75%	100%	
Output Current (mA)		--	450	900	1350	1800	--
Output Voltage (V, r.m.s)	--	--	29.10	29.10	29.07	29.07	
Output Power (W, r.m.s)		--	13.095	26.190	39.245	52.326	
AC Input Voltage (V, r.m.s)	230	--	230	230	230	230	
AC Input Power (W, r.m.s)	0.188	--	14.873	29.634	44.461	59.313	
THD (%)	0.54	--	0.61	0.75	0.90	1.06	--
True Power Factor (W/VA)	0.0358	--	0.446	0.489	0.513	0.529	
AC Input Frequency (Hz)	50	--	50	50	50	50	
Power Consumed (W)	0.188	--	1.778	3.444	5.217	6.987	--
Efficiency (%)	--	--	88.05	88.38	88.27	88.22	88.23

Test Data:

Sample No. 2	
Test Model	KP58T-290180

Measured and Calculated Data at 115V, 60Hz							
	No load	**Active Power Values**					**Average**
Percent of nameplate current	0%	10%	25%	50%	75%	100%	
Output Current (mA)		--	450	900	1350	1800	
Output Voltage (V, r.m.s)	--	--	29.13	29.13	29.11	29.11	--
Output Power (W, r.m.s)		--	13.109	26.217	39.299	52.398	
AC Input Voltage (V, r.m.s)	115	--	115	115	115	115	
AC Input Power (W, r.m.s)	0.074	--	14.828	29.686	44.586	59.723	
THD (%)	0.18	--	0.54	0.85	1.13	1.41	--
True Power Factor (W/VA)	0.0476	--	0.481	0.52	0.542	0.561	
AC Input Frequency (Hz)	60	--	60	60	60	60	
Power Consumed (W)	0.074	--	1.720	3.469	5.288	7.325	--
Efficiency (%)	--	--	88.40	88.31	88.14	87.74	88.15

Measured and Calculated Data at 230V, 50Hz							
	No load	**Active Power Values**					**Average**
Percent of nameplate current	0%	10%	25%	50%	75%	100%	
Output Current (mA)		--	450	900	1350	1800	
Output Voltage (V, r.m.s)	--	--	29.13	29.13	29.10	29.10	--
Output Power (W, r.m.s)		--	13.109	26.217	39.285	52.380	
AC Input Voltage (V, r.m.s)	230	--	230	230	230	230	
AC Input Power (W, r.m.s)	0.190	--	14.904	29.714	44.580	59.374	
THD (%)	0.55	--	0.6	0.75	0.90	1.05	--
True Power Factor (W/VA)	0.036	--	0.448	0.491	0.515	0.53	
AC Input Frequency (Hz)	50	--	50	50	50	50	
Power Consumed (W)	0.190	--	1.796	3.497	5.295	6.994	--
Efficiency (%)	--	--	87.95	88.23	88.12	88.22	88.13

TEST RESULTS:

Test item	Test at 115V, 60Hz	Test at 230V, 50Hz	Efficiency requirements
No load power (W)	Max.0.074	Max.0.190	≤0.210
Average efficiency (%)	Min.88.07	Min.88.13	≥88.00
Complies with performance mark	Level **VI**		

Note: According Subpart B of 10 CFR Part 429, the report value is:

1. Any represented value of the estimated energy consumption (No load power) of a basic model for which consumers would favor lower values shall be greater than or equal to the higher of The mean of the sample and The upper 97.5 percent confidence limit (UCL) of the true mean divided by 1.05.
2. Any represented value of the estimated energy consumption (Average efficiency) of a basic model for which consumers would favor higher values shall be less than or equal to the lower of The mean of the sample and The lower 97.5 percent confidence limit (LCL) of the true mean divided by 0.95.

	Active Efficiency Average (%)		No Load Power (W)	
Test Voltage	115Vac, 60Hz	230Vac, 50Hz	115Vac, 60Hz	230Vac, 50Hz
No. 1	88.07	88.23	0.072	0.188
No. 2	88.15	88.13	0.074	0.190
No. 3	--	--	--	--
Average (X)	88.11	88.18	0.073	0.189
UCL/1.05	--	--	0.074	0.184
LCL/0.95	92.56	92.56	--	--

Note:

The equation for the lower confidence limit (LCL; used for reporting average efficiency) is:

$$LCL = X - \frac{t \cdot s}{\sqrt{n}}$$

while that for the upper confidence limit (UCL; used for reporting no-load power) is:

$$UCL = X + \frac{t \cdot s}{\sqrt{n}}$$

The mean of the sample, X, is calculated as follows:

$$X = \frac{1}{n}\sum_{i=0}^{n} x_i$$

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;

t is the value for 97.5% confidence from Table 2;

s is the sample standard deviation;

n is the number of units tested;

x_i is the i^{th} test result;

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

Table 2. *t*-values for 97.5% confidence.

n	$\sqrt{n}$	*t* for 97.5% confidence
2	1.41	12.706
3	1.73	4.303
4	2.00	3.182
5	2.24	2.776
6	2.45	2.571
7	2.65	2.447
8	2.83	2.365
9	3.00	2.306
10	3.16	2.262


Power Adapter
Class 2 Power Supply
CAUTION
ATTENTION

Equipment	Manufacturer	Type	Series No	Cal. date	Due. date
Electronic Load	Maynuo	M9711	091000960150829363	2019-10-26	2020-10-25
Measuring tape	THD	5m	--	2019-11-01	2020-10-31
Temp. & Humi. Recorder	ISUZU	TH-27R	ABG400443-2	2019-10-30	2020-10-29
Power Meter	YOKOKAWA	WT210	91N405508	2020-03-28	2021-03-27
Anemometer	TES	TES1340	120708172	2020-04-16	2021-04-15