

TEST REPORT

UL 2089

Standard for Vehicle Battery Adapters

Job Number. : XK2110012031S

Test by (print+signature)..... : Collin Zhou

Checked by (print+signature) : Jean Shu

Approved by (print+signature) : Andy Wang

Date of issue..... : October 08, 2021

Total number of pages : 21 pages

Name of Testing Laboratory preparing the Report : **Shenzhen SiCT Technology Co., Ltd.**
Room 402, 4/F., Building A, Yidehang Industrial Factory, Fukang Community, Longhua Street, Longhua District, Shenzhen, Guangdong, China

Applicant's name : **Shenzhen Rongerle E-commerce Co., Ltd.**
Address..... : 205, 2nd Floor, No. 1, Longquan Technology Industrial Park, Tongsheng Community, Dalang Street, Longhua District, Shenzhen, China

Manufacturer's name..... : **Huizhou Yimai Electronics Technology Co., Ltd.**
Address..... : 3rd Floor, Building B, Huakai High-tech Industrial Park, Electronic City Road, Longxi Street, Boluo Country

Test specification:

Standard : UL 2089, 3rd Ed., Dated Nov. 22, 2011, Rev. May 07, 2018

Test procedure : Type test

Non-standard test method : N/A

Test Report Form No. : UL2089_2018

Test Report Form(s) Originator : SiCT

Master TRF : Dated 2018-10

Test item description..... : Ainope invisible car charger

Trade Mark..... : AINOPE

Model/Type reference : H78

Ratings : Input: 12V-24V --- 4A
USB OUTPUT: 5V --- 3A, 9V --- 2A, 12V --- 1.5A MAX
TYPE-C PD: 5V --- 3A, 9V --- 3A, 12V --- 2.5A, 15V --- 2A, 20V --- 1.5A
PPS: 3.3-11V --- 3A 3.3-16V --- 2A
Total Output: 48W



Possible test case verdicts:	
- test case does not apply to the test object	N/A
- test object does meet the requirement	P (Pass)
- test object does not meet the requirement	F (Fail)
Testing	
Date of receipt of test item.....	September 28, 2021
Date (s) of performance of tests	September 28, 2021 to October 08, 2021

General product information:

The product covered in this report is a Ainope invisible car charger, which is supplied from a vehicle cigarette lighter receptacle, and provides USB output port.

Relevant Technical consideration:

-Mass of equipment (kg): 25g Max.

-Maximum ambient temperature: 25°C.

All the test was carried on the model H78 and complied with the requirement.

Name and address of factory (ies): **Name:** Shenzhen Junkaida Intelligent Technology Co.,Ltd.
Address: 3F Block A, Junda Industrial park, Fuyuan 2nd road, Fuyong Street, Baoan district, Shenzhen, China

Copy of marking plate:

AINOPE

MODEL : H78 INPUT : 12V $\equiv$ 24V
 USB OUTPUT : 5V $\equiv$ 3A 9V $\equiv$ 2A 12V $\equiv$ 1.5A
 TYPE-C PD : 5V $\equiv$ 3A 9V $\equiv$ 3A 12V $\equiv$ 2.5A
 15V $\equiv$ 2A 20V $\equiv$ 1.5A
 PPS : 3.3-11V $\equiv$ 3A 3.3-16V $\equiv$ 2A
 TOTAL OUTPUT : 48W



CCBJXXC5

MADE IN CHINA

Marking label for model H78

UL 2089			
Clause	Requirement + Test	Result - Remark	Verdict
INTRODUCTION			P
1	Scope	Rated 24Vdc or less, supplied from vehicle cigarette lighter	P
2	Components	Certified Component with suitable rating.	P
3	Units of Measurement	Considered	P
4	Undated References	Considered	P
5	Glossary	Considered	P
CONSTRUCTION			P
6	Mechanical Assembly	-All parts reliably secured in place, no sharp to constitute a risk of injury to person, not necessary to open or remove the enclosure when to use. -Overall mass of the cigarette lighter connector is not exceed 250g	P
7	Enclosure	-Enclosure house all current-carrying parts without a risk of electric shock. -No openings. -Polymer enclosure used. -Plastic enclosure with flammability class: V-0, -HA1: 2 -HWI: 0 - No conductive coating applied to inside surface. - Snap joint assemblies for fixing, no adhesive used. - The plastic enclosure complies with UL746C, See test data	P
8	Protection Against Corrosion	- Plated steel and stainless were used for all metal part.	P
9	Switches	No such switches	N/A

UL 2089			
Clause	Requirement + Test	Result - Remark	Verdict
10	Protective Devices	-Built in fuse considered as protective device. -Fuse is located in the positive side of the supply within the cigarette lighter connector. -Not greater than ampacity of the interconnecting cord and not greater than 20A. -Fuse has suitable rating of voltage and current comparing with those of circuit in which it is connected.	P
11	Components	All components have efficient permanence and stability.	P
12	Coil Insulation	All coil insulation is film-coated magnet wire which is moisture resistant.	P
13	Flexible Cords	No flexible cord used	N/A
14	Input Contacts	-The diameter of the center (positive) contact is 5.75mm (limit $\geq 3.57\text{mm}$)	P
15	Output Connections	USB output terminal used.	P
15.1	General	USB output terminal is considered as a) terminates in a connector for connection to a low voltage appliance.	P
15.2	Low voltage limited energy circuits	-No circuit exceeded 42.4V _{peak} or 60V _{dc} with energy available to the circuit limited 8A which is measured after 1minute of operation by fixed impedance or reliable regulating network.	P
15.3	Output connectors	-Secure connection. -DC female contact does not received the blades of a standard attachment plug.	P
15.4	Bushings		N/A
16	Accessibility of Live Parts		P
16.1	General	No live part can be accessible	P
16.2	Live parts other than expose wiring terminals	Force 4.4N, No live parts with voltage greater than 16.2.2 can be accessible.	P

UL 2089			
Clause	Requirement + Test	Result - Remark	Verdict
16.3	Exposed wiring terminal	Force 25N, No live parts with voltage greater than 16.2.2 can be accessible.	P
17	Live Parts	Current-carrying part is plated steel or stainless steel.	P
18	Strain Relief	See clause 29	P
19	Internal Wiring		N/A
20	Insulating Materials	Approved polymer material used.	P
21	Printed-Wiring Boards	PCB used V-1 at least	P
PERFORMANCE			P
22	General		P
23	Maximum Output Voltage Test		P
24	Power Input Test		P
25	Temperature Test		P
26	Dielectric Voltage – Withstand Test		P
27	Abnormal Test		P
27.1	General		P
27.2	Reverse polarity test		N/A
27.3	Component breakdown test		P
27.4	Battery-supply cord short circuit test		N/A
27.5	Abnormal temperature test		P
28	Resistance to Crushing Test		P
29	Strain Relief Test		N/A
30	Push-Back Relief Test		N/A
MARKINGS			P
31	General		P
32	Cautionary Markings	Markings is legibly and permanently marked where it is readily visible.	P
INSTRUCTIONS			P
33	General	See below	P
34	Assembly Instructions	Instructions is provided with explicit important safety, operation and maintenance instructins for users.	P
35	Operating Instructions	See clause 34	P
36	Maintenance Instructions	See clause 34	P
37	Moving and Storage Instructions	See clause 34	P

UL 2089			
Clause	Requirement + Test	Result - Remark	Verdict

APPENDIX A			P
--	Standards for Compnents	--	--

Clause 11: Critical components information

Component Name	Manufacturer/ trademark	Type / model	Technical data	Standard	Mark(s) of conformity
PCB material	LOMBER CIRCUITS (HUIZHOU) LTD	08V0	130 °C, V-0	UL 796 UL 94	UL E314348
Alt.	Various	Various	130 °C, V-1 or better	UL 796 UL 94	UL
Line filter L1	Shenzhen kwong Electronics Co., Ltd.	040-125-33UH	33μH	UL 2089	Test with appliance
-Magnet wire in Line filter	SIHUI HENGHUI ELECTRICAL APPLIANCES CO LTD	UEW	155 °C	UL 1446	UL

Remark:

Clause 15.2 Low voltage limited energy circuits

15.2.1 A low-voltage limited-energy (LVLE) circuit is defined as a circuit with an open-circuit potential of not more than 42.4 V peak ac, or 60 V dc, with the energy available to the circuit limited:

- a) So that the current under any condition of load including short circuit is not more than 8 A for potentials up to 42.4 V peak, and $150/V_{\max}$ for potentials from 30 to 60 V dc, measured after 1 minute of operation by:
- 1) An isolating transformer; or
 - 2) A fixed impedance or reliable regulating network; or
- b) By a fuse or nonadjustable manually reset circuit protective device that is rated or set at not more than the value specified in Table 15.1.

Table 15.1
Rating for fuse or circuit protector

Open-circuit potential, V	Current rating, A
0 – 21.2 (peak)	5
21.3 – 42.4 (peak)	3.2
Over 30 to 60 dc only	$150/V_{\max}^a$

^a $V_{\max}$ is defined as the maximum voltage obtained under any condition of load or no load in volts rms.

Measurement			P
Condition:	Output Voltage (Vmax)	Output current (Imax)	Limited
USB output	5.022	5.23A	42.4V peak, <8A; 30~60Vdc, <150V/Vmax
USB output	9.041	3.18A	42.4V peak, <8A; 30~60Vdc, <150V/Vmax
USB output	12.033	3.06A	42.4V peak, <8A; 30~60Vdc, <150V/Vmax
TYPE-C PD Output	5.112V	4.13A	42.4V peak, <8A; 30~60Vdc, <150V/Vmax
TYPE-C PD Output	9.086V	3.23A	42.4V peak, <8A; 30~60Vdc, <150V/Vmax
TYPE-C PD Output	12.124V	1.98A	42.4V peak, <8A; 30~60Vdc, <150V/Vmax
TYPE-C PD Output	15.029	3.22A	42.4V peak, <8A; 30~60Vdc, <150V/Vmax
TYPE-C PD Output	20.041	2.65A	42.4V peak, <8A; 30~60Vdc, <150V/Vmax

Clause 23 Maximum output voltage test

23.1 The maximum output voltage under any load condition (including no load) between any two output terminations of a unit shall not be more than the peak voltages specified in 16.2.2.

23.2 If a unit has more than one pair of output terminations, the output voltage mentioned in 23.1 is to be measured with any combination of interconnections of the output terminations.

23.3 The maximum voltage between output terminations of a multiple output unit may exceed the values specified in 23.1 when the output terminations are interconnected, if the following conditions are met:

a) The maximum output voltage between any two terminations is not more than the values indicated in 16.2.2 when no connections are made between the output terminations; and

b) The unit is marked in accordance with 32.6.

Measurement		P
Condition:	Measured Voltage	Limit
Lighter connector using rated input voltage, with any loading, include no loading.	1. 12V supplied: Normal load: 19.887V No load: 20.034V 2. 24V supplied: Normal load: 19.976V No load: 20.046V	$\leq 42,4 \text{ Vpeak a.c., or}$ $\leq 60 \text{ Vdc, or}$ $\leq 24,8 \text{ Vpeak d.c., @ 200 Hz, < 50\% duty cycle, or}$ In the range of below table for AC+DC Figure 15.3 Maximum acceptable voltage

Clause 24 Power input test

The current or watts input to a vehicle battery adapter, shall not be more than 110 percent of the rated value.

24	TABLE: Electrical data					P
U (V)	I (A)	I _{rated} (A)	P (W)	Fuse #	I _{fuse} (A)	Condition/status
12 Vdc	4.02	4.0	48.24	F1	2.52	Output: USB: 12V/1.5A PD: 12V/2.5A
24Vdc	2.033	4.0	48.28	F1	1.262	Output: USB: 12V/1.5A PD: 12V/2.5A
Remark:						

Clause 25. Temperature test (including Cl 27.5 Abnormal temperature test)

25&27.5		Thermal requirements				P
Supply voltage (V): Normal: Input: 12 Vdc.		normal	—	abnormal		—
Maximum measured temperature T of part/at::		dT (K)	Allowed dT (°C) Normal	dT (K)		Allowed dT (°C) Abnormal
	Supply voltage	12Vdc	--	10.5Vdc	14.5Vdc	--
1	C4	42.3.	80(105-25)	36.8	44.6	100(80+20)
2	PCB near U1	45.6	105(130-25)	40.5	48.3	125(105+20)
3	C10	38.5	80(105-25)	31.7	39.5	100(80+20)
4	C18	39.2	80(105-25)	36.2	44	125(105+20)
5	L1 inductor	53.6	105(130-25)	49.2	57	125(105+20)
6	L2 inductor	41.2	105(130-25)	40.8	48.6	125(105+20)
7	PCB near USB port	35.7	105(130-25)	27.9	35.7	125(105+20)
8	PCB near U2	32.8	105(130-25)	26.8	34.6	125(105+20)
9	Enclosure outside near Lighter connector	34.6	50	31.5	36.8	70(50+20)
10	Enclosure outside near L1	21.8	50	20.3	22.5	70(50+20)
11	Ambient	25.1	--	25.0	25.2	--
Remark:						

Clause 25. Temperature test (including CI 27.5 Abnormal temperature test) (Cont'd)

25&27.5		Thermal requirements				P
Supply voltage (V): Normal: Input: 24 Vdc.		normal	—	abnormal		—
Maximum measured temperature T of part/at::		dT (K)	Allowed dT (°C) Normal	dT (K)		Allowed dT (°C) Abnormal
	Supply voltage	24Vdc	--	21Vdc	29Vdc	--
1	C4	41.6	80(105-25)	41.1	46.7	100(80+20)
2	PCB near U1	45.3	105(130-25)	44.8	50.4	125(105+20)
3	C10	36.5	80(105-25)	34.2	41.6	100(80+20)
4	C18	38.9	80(105-25)	36.3	43.7	100(80+20)
5	L1 inductor	42.7	105(130-25)	41.8	45.1	100(80+20)
6	L2 inductor	41.3	105(130-25)	40.5	46.1	100(80+20)
7	PCB near USB port	51.8	105(130-25)	53.5	59.1	125(105+20)
8	PCB near U2	42.3	105(130-25)	45.1	50.7	125(105+20)
9	Enclosure outside near Lighter connector	32.5	50	32.2	37.8	70(50+20)
10	Enclosure outside near L1	21.6	50	21.1	26.7	70(50+20)
11	Ambient	25.0	--	25.1	25.2	--
Remark:						

Clause 26-Dielectric Voltage-Withstand Test

While still in a heated condition, a unit shall withstand for 1 min without breakdown the application of a 60-Hz essentially sinusoidal potential of:

- a) 500 V between a circuit operating at 60 V dc or less or 50 V ac rms (70 V peak) or less and dead metal parts; and
- b) 1000 V plus twice the maximum circuit voltage between a circuit operating at more than 60 V dc or more than 50 V ac rms (70 V peak) and dead metal parts.

26 Electric strength		P
Test voltage applied between:	Test voltage (V)	Breakdown
Positive and negative polarity	500	Yes / No
Output and accessible enclosure with foil	500	Yes / No
Withstanding Voltage Tester		

Clause 27-Abnormal tests Abnormal operation

27.1.1 A unit shall not emit flame or molten metal or become a risk of fire or electric shock when subjected to the reverse polarity, component breakdown and battery-supply cord short circuit tests. 26.1.2 A risk of fire or electric shock is considered to exist if any of the following occurs:

- a) Charring of cheesecloth;
- b) Emission of flame or molten material from the unit enclosure and output cord, if provided; or,
- c) Any condition that exposes live parts which present a risk of electric shock as specified in Section 15.

27.1.2 A risk of fire or electric shock is considered to exist if any of the following occurs:

- a) Charring of cheesecloth;
- b) Emission of flame or molten material from the unit enclosure and output cord, if provided; or,
- c) Any condition that exposes live parts which present a risk of electric shock as specified in Section 16, Accessibility of Live Parts.

27.1.3 Each test is to be conducted on a separate sample unless the manufacturer requests that more than one test be conducted on the same sample.

27.1.4 A polarity-protection circuit provided to prevent output-current flow until a battery is connected as intended to the output is to be made inoperative so that the required output current will flow.

27.1.5 During all abnormal tests the unit is to be draped with a double layer of cheesecloth conforming to the outline of the unit.

Clause 27.3-Component breakdown test

27.3.1 A unit having components – such as diodes, resistors, transistors, capacitors, and the like – with a single component fault of short or open, shall not result in the output exceeding the levels specified in 16.3.2, or any condition as specified in 27.1.2. The unit is to be connected to the maximum test voltage and operated until ultimate conditions are observed, or for 4 hours if cycling of an automatically reset protector occurs.

Ambient temperature						25.0 °C
No.	component	fault	test voltage (V)	test time	Input current (A)	result
1	C4	S	24V	30minutes	0	The fuse F1 opened immediately, no hazards
2	C10	S	24V	30minutes	0.05	The unit shutdown immediately, no damage, no hazards.
3	C18	S	24V	30minutes	0.05	The unit shutdown immediately, no damage, no hazards.
4	C3	S	24V	30minutes	0.05	The unit shutdown immediately, no damage, no hazards.
5	U2 Pin 1-4	S	24V	30minutes	0.05	The unit shutdown immediately, no damage, no hazards.
6	U2 Pin 1-8	S	24V	30minutes	0.05	The unit shutdown immediately, no damage, no hazards.
7	R2	S	24V	30minutes	2.033	The unit normal operation, no damage, no hazards.
8	C1	S	24V	30minutes	0.05	The unit shutdown immediately, no damage, no hazards.
Note: S: Short-circuited; O: Open-circuited; O/L: Overloaded; B: Blocked; L: Locked. Observation: The observations during and after fault condition tests. Damaged: Which component (components) damaged during the fault condition test. Max. Voltage: The maximum accessible voltage of DC output terminal during the fault condition test.						

Clause 28 Resistance to Crushing Test

Test Method:

28.1 One sample of the cigarette lighter connector shall withstand for 1 min a steady crushing force of 75 lbf (334 N). The cigarette lighter connector is to be tested between two parallel, flat, maple blocks, each not less than 1/2 in (12.7 mm) thick. The crushing force is to be applied gradually in a direction normal to the mounting surface.

Results:

These results (☒did / ☐did not) comply with the requirements.

UL 746C, cl 29: Mold Stress-Relief Distortion Test for enclosure N/A

Test Method:

The sample of the completed equipment or the part under consideration shall be placed in a circulating air oven for 7 hours at a temperature 10 °C above the maximum attained on the enclosure during the Normal Temperature test or 70 °C, whichever is higher .

The temperature of the test was ____ °C.

Result:

Following the conditioning, there (☐was / ☒was no) softening of the material as determined by handling immediately.

There (☐was / ☐was no) reduction of spacing below those required by the standard.

There (☐was / ☐was no) exposure of live parts or internal wiring or defeating the integrity of the enclosure so that acceptable mechanical protection is not afforded to internal parts of the equipment.

There (☐was / ☐was no) conditions that causing interference with the intended operation or servicing of the equipment.

Results:

These results (☐did / ☐did not) comply with the requirements.

UL 746C, cl 31: Strain Relief Test After Mold Stress-Relief Distortion N/A

Test Method:

a) The sample of the completed equipment or the part under consideration shall be placed in a circulating air oven for 7 hours at a temperature 10 °C above the maximum attained on the enclosure during the Normal Temperature test or 70 °C, whichever is higher.

The temperature of the test was _____ °C.

After the test sample has cooled to room temperature following the oven conditioning, the strain relief test was performed.

b) A pull of 20 / 35 pounds force was applied to the attached flexible cord for 1 minute. The connections of the cord inside of the appliance were disconnected.

Record:

The strain relief means provided (☐ could / ☐ could not) withstand the pull applied on the flexible cord.

Results:

These results (☐ did / ☐ did not) comply with the requirements.

Pictures

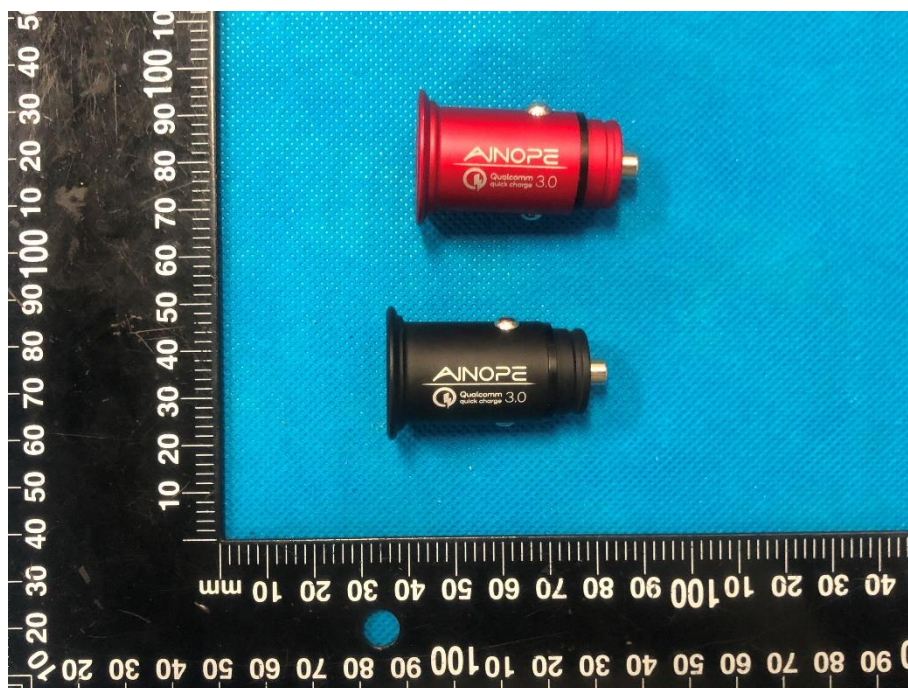


Figure 1(For model: H78)

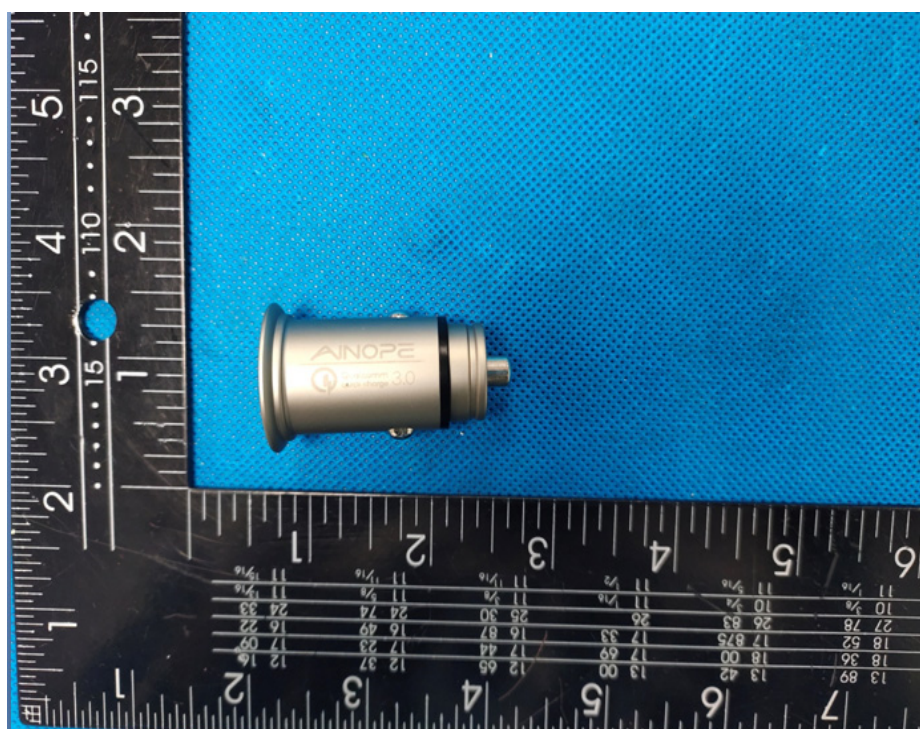


Figure 2 (For model: H78)

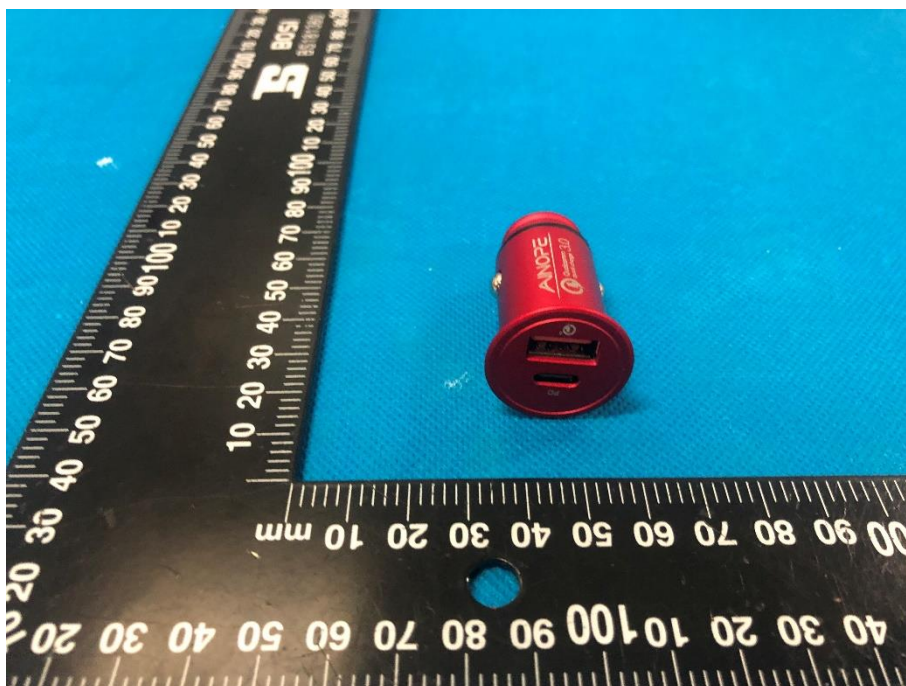
Pictures

Figure 3 (For model: H78)

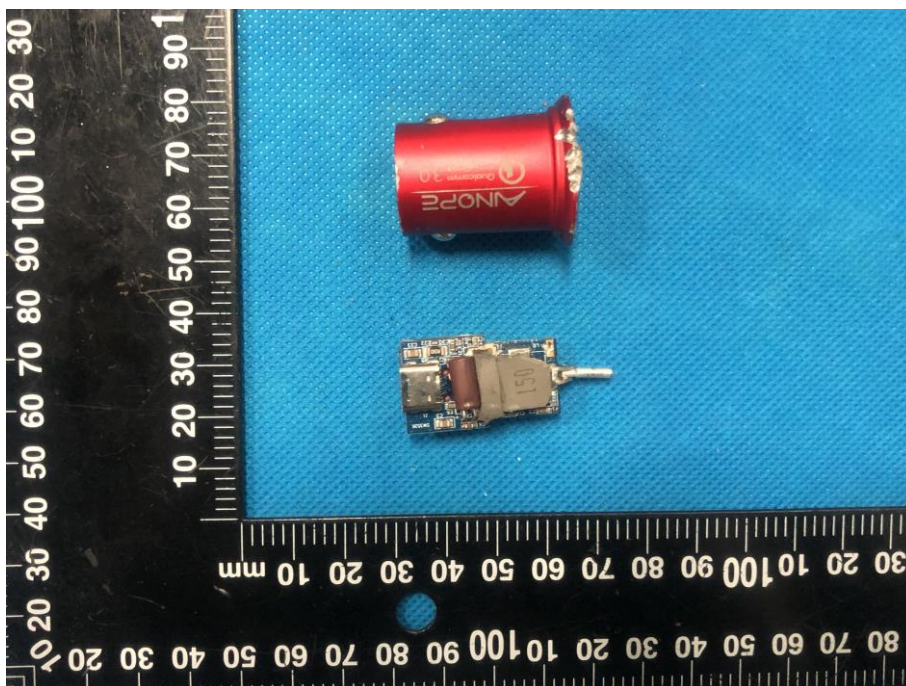


Figure 4 (For model: H78)

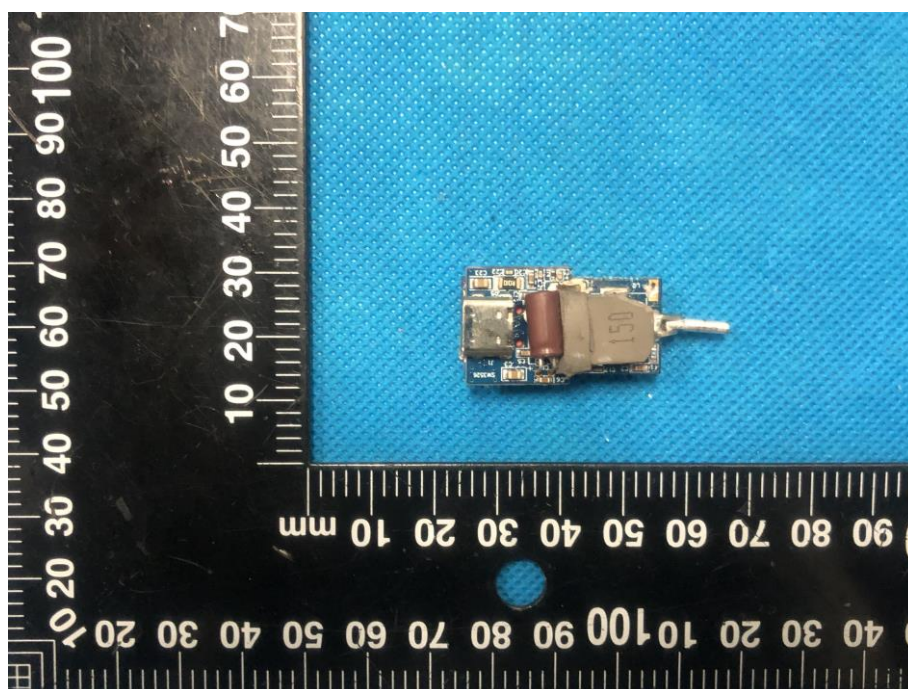
Pictures

Figure 5 (For model: H78)

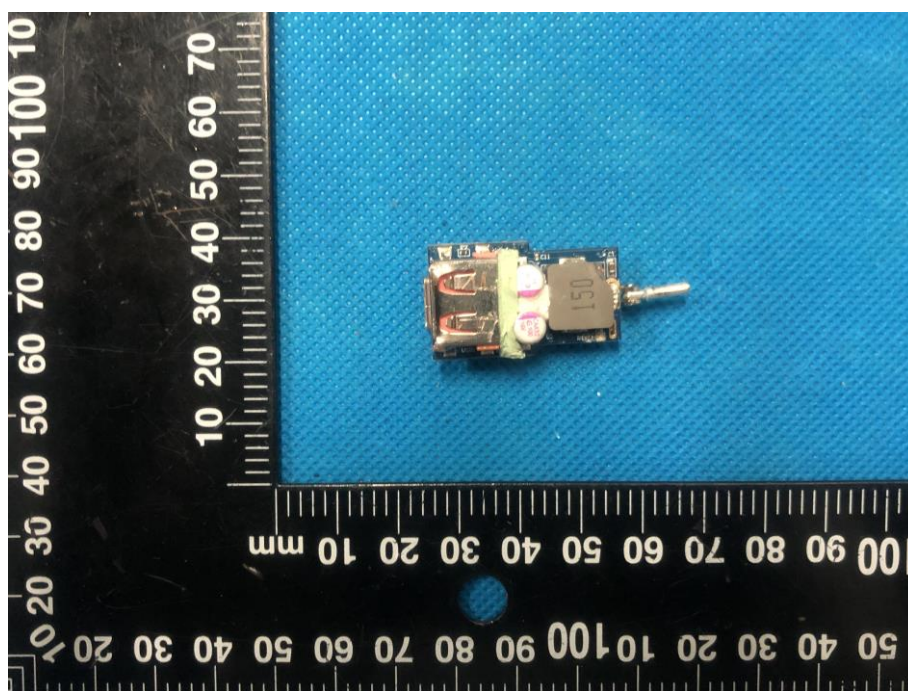


Figure 6 (For model: H78)

***** End of report *****