

FCC PART 15C TEST REPORT FOR CERTIFICATION
On Behalf of

ION Audio, LLC

bluetooth speaker

Model Number: PATHFINDER™ 320°

Additional Model: iPA159, PATHFINDER*****, iPA159*****
 (* can be 0-9, A-Z or blank)

FCC ID: 2AB3E-IPA159

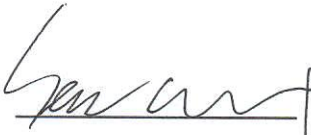
Applicant :	ION Audio, LLC
Address:	200 Scenic View Drive, Cumberland, RI 02864 U.S.A.
Prepared By:	EST Technology Co., Ltd.
	Chilingxiang, Qishantou, Santun, Houjie, Dongguan, Guangdong, China
	Tel: 86-769-83081888-808

Report Number:	ESTE-R2112354-1
Date of Test:	Jan. 24~Feb. 24, 2022
Date of Report:	Feb. 28, 2022

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EST Technology Co., Ltd.

Applicant:	ION Audio, LLC		
Address:	200 Scenic View Drive, Cumberland, RI 02864 U.S.A.		
Manufacturer:	ION Audio, LLC		
Address:	200 Scenic View Drive, Cumberland, RI 02864 U.S.A.		
Factory:	ION Audio, LLC		
Address:	200 Scenic View Drive, Cumberland, RI 02864 U.S.A.		
E.U.T:	bluetooth speaker		
Model Number:	PATHFINDER™ 320°		
Additional Model:	iPA159, PATHFINDER*****, iPA159***** (* can be 0-9, A-Z or blank) Note: ("*" is a variable, it can be 0-9, A-Z or blank), they are identical to each other, only except for model name, appearance in color or decorating parts and silkscreen for marketing purpose.		
Power Supply:	AC 100-240V/60Hz		
Trade Name:		Serial No.:	-----
Date of Receipt:	Jan. 24, 2022	Date of Test:	Jan. 24~Feb. 24, 2022
Test Specification:	FCC Part 15 Subpart C (15.247) ANSI C63.10:2013 FCC KDB 558074 D01 15.247 Meas Guidance v05r02		
Test Result:	The device described above is tested by EST Technology Co., Ltd. The measurement results were contained in this test report and EST Technology Co., Ltd. was assumed full responsibility for the accuracy and completeness of these measurements. Also, this report shows that the EUT to be technically compliance with the FCC Rules and Regulations Part 15 Subpart C requirements. This report applies to above tested sample only and shall not be reproduced in part without written approval of EST Technology Co., Ltd.		
Prepared by:		Reviewed by:	
 Emily Cai / Assistant		 Seven Wang / Engineer	
		Date: Feb. 28, 2022 Approved by:  Iceman Hu / Manager	
Other Aspects: This report base on the previous report with report number: ESTE-R2112354, Change the AMP board, so just re-tested Radiated Emissions (30-1000MHz), other test item needn't re-tested.			
Abbreviations: OK/P=passed fail/F=failed n.a/N=not applicable E.U.T=equipment under tested			
This test report is based on a single evaluation of one sample of above mentioned products ,It is not permitted to be duplicated in extracts without written approval of EST Technology Co., Ltd.			

1. GENERAL INFORMATION

1.1. Description of Device (EUT)

Product Name	:	bluetooth speaker
Model Number	:	PATHFINDER™ 320°
Software Version	:	2.0
Hardware Version	:	V2.2
Operation frequency	:	2402MHz~2480MHz
Number of channel	:	40
Modulation Type	:	GFSK
Sample Type	:	Prototype production

Note:

For a more detailed features description, please refer to the manufacturer's specifications or the user's manual.

1.2. Antenna Information

Ant No.	Brand	Model Name	Antenna Type	Connector	Gain (dBi)
1	-	-	PCB	-	3.38

Note: This information is provided by the applicant.

1.3. Information of RF Cable

Cable Loss(dB)	Provided by
1.0	ION Audio, LLC
Note: 1.The customer declared the loss value of the RF Cable, and the test results of this report only apply to the sample as received. 2. This information is provided by the applicant.	

2. SUMMARY OF TEST

2.1. Summary of test result

Report Section	Description of Test Item	FCC Standard Section	Results
3	Radiated Spurious Emissions and Band Edge	15.205 15.209 15.247(d)	PASS

2.2. Test Facilities

EMC Lab

: Certificated by CNAS, CHINA
Registration No.: L5288
This Certificate is valid until: November 12, 2023

Certificated by FCC, USA
Designation Number: CN1215
This Certificate is valid until: January 31, 2024

Certificated by A2LA, USA
Registration No.: 4366.01
This Certificate is valid until: January 31, 2024

Certificated by Industry Canada
CAB identifier No.: CN0035
This Certificate is valid until: January 31, 2024

Certificated by VCCI, Japan
Registration No.: C-14103; T-20073; R-13663;
R-20103; G-20097
Date of registration: Apr. 20, 2020
This Certificate is valid until: Apr. 19, 2023

Certificated by TUV Rheinland, Germany
Registration No.: UA 50413872 0001
Date of registration: July 31, 2018

Certificated by Intertek
Registration No.: 2011-RTL-L2-64
Date of registration: November 08, 2018

Name of Firm : EST Technology Co., Ltd.

Site Location : Chilingxiang, Qishantou, Santun, Houjie, Dongguan, Guangdong, China

2.3. Measurement uncertainty

Test Item	Uncertainty
Uncertainty for Conduction emission test	$\pm 3.48\text{dB}$
Uncertainty for spurious emissions test (30MHz-1GHz)	$\pm 4.60\text{ dB(Polarize: H)}$
	$\pm 4.68\text{ dB(Polarize: V)}$
Uncertainty for spurious emissions test (1GHz to 25GHz)	$\pm 4.96\text{dB}$
Uncertainty for radio frequency	7×10^{-8}
Uncertainty for conducted RF Power	1.08dB
Uncertainty for Power density test	0.26dB

Note: This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

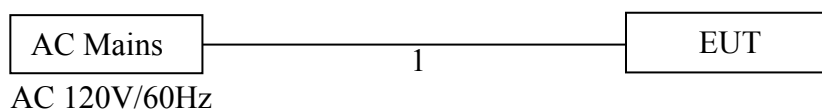
2.4. Assistant equipment used for test

Item	Equipment	Brand	Model Name/Type No.	FCC ID	Series No.
-	-	-	-	-	-

Item	Shielded Type	Ferrite Core	Length	Note
1	NO	NO	1.8m	AC Cable

2.5. Block Diagram

For radiated emissions test: EUT was placed on a turn table, which is 0.8 (or 1.5) meter high above ground. EUT was beset into BLE test mode by software before test.



(EUT: bluetooth speaker)

2.6. Test Mode

The test mode was selected for the final test as listed below.

Test Item	Modulation Type	Test Channel
Radiated Spurious Emissions(Below 1GHz)	GFSK	Low/Middle/High

Note:

1. In radiated measurement,the EUT had been pre-scan on the positioned of each 3 axis(X,Y,Z), the worst case was found when positioned on **X-plane**.

2.7. Channel List

Channel No .	Frequency (MHz)	Channel No .	Frequency (MHz)
0	2402	1	2404
2	2406	3	2408
4	2410	5	2412
6	2414	7	2416
8	2418	9	2420
10	2422	11	2424
12	2426	13	2428
14	2430	15	2432
16	2434	17	2436
18	2438	19	2440
20	2442	21	2444
22	2446	23	2448
24	2450	25	2452
26	2454	27	2456
28	2458	29	2460
30	2462	31	2464
32	2466	33	2468
34	2470	35	2472
36	2474	37	2476
38	2478	39	2480

2.8. Test Equipment List

For radiated emissions test (30-1000MHz)						
Equipment	Manufacturer	Model No.	Serial No.	Calibration Body	Last Cal.	Next Cal.
EMI Test Receiver	Rohde & Schwarz	ESR7	EST-E047	LISAI	June 13,21	1 Year
Bilog Antenna	Teseq	CBL 6111D	EST-E034	LISAI	June 13,21	1 Year
Test Software	Audix	e3-6.111221a	N/A	N/A	N/A	N/A
30-1000MHz Cable	N/A	EST-002	N/A	N/A	N/A	N/A

3. RADIATED SPURIOUS EMISSIONS AND BAND EDGE

3.1. Limit

All the emissions appearing within 15.205 restricted frequency bands shall not exceed the limits shown in 15.209, all the other emissions shall be at least 20dB below the fundamental emissions, or comply with 15.209 limits.

15.205 Restricted frequency band

MHz	MHz	MHz	GHz
0.090 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
¹ 0.495 - 0.505	16.69475 - 16.69525	608 - 614	5.35 - 5.46
2.1735 - 2.1905	16.80425 - 16.80475	960 - 1240	7.25 - 7.75
4.125 - 4.128	25.5 - 25.67	1300 - 1427	8.025 - 8.5
4.17725 - 4.17775	37.5 - 38.25	1435 - 1626.5	9.0 - 9.2
4.20725 - 4.20775	73 - 74.6	1645.5 - 1646.5	9.3 - 9.5
6.215 - 6.218	74.8 - 75.2	1660 - 1710	10.6 - 12.7
6.26775 - 6.26825	108 - 121.94	1718.8 - 1722.2	13.25 - 13.4
6.31175 - 6.31225	123 - 138	2200 - 2300	14.47 - 14.5
8.291 - 8.294	149.9 - 150.05	2310 - 2390	15.35 - 16.2
8.362 - 8.366	156.52475 - 156.52525	2483.5 - 2500	17.7 - 21.4
8.37625 - 8.38675	156.7 - 156.9	2690 - 2900	22.01 - 23.12
8.41425 - 8.41475	162.0125 - 167.17	3260 - 3267	23.6 - 24.0
12.29 - 12.293	167.72 - 173.2	3332 - 3339	31.2 - 31.8
12.51975 - 12.52025	240 - 285	3345.8 - 3358	36.43 - 36.5
12.57675 - 12.57725	322 - 335.4	3600 - 4400	(²)

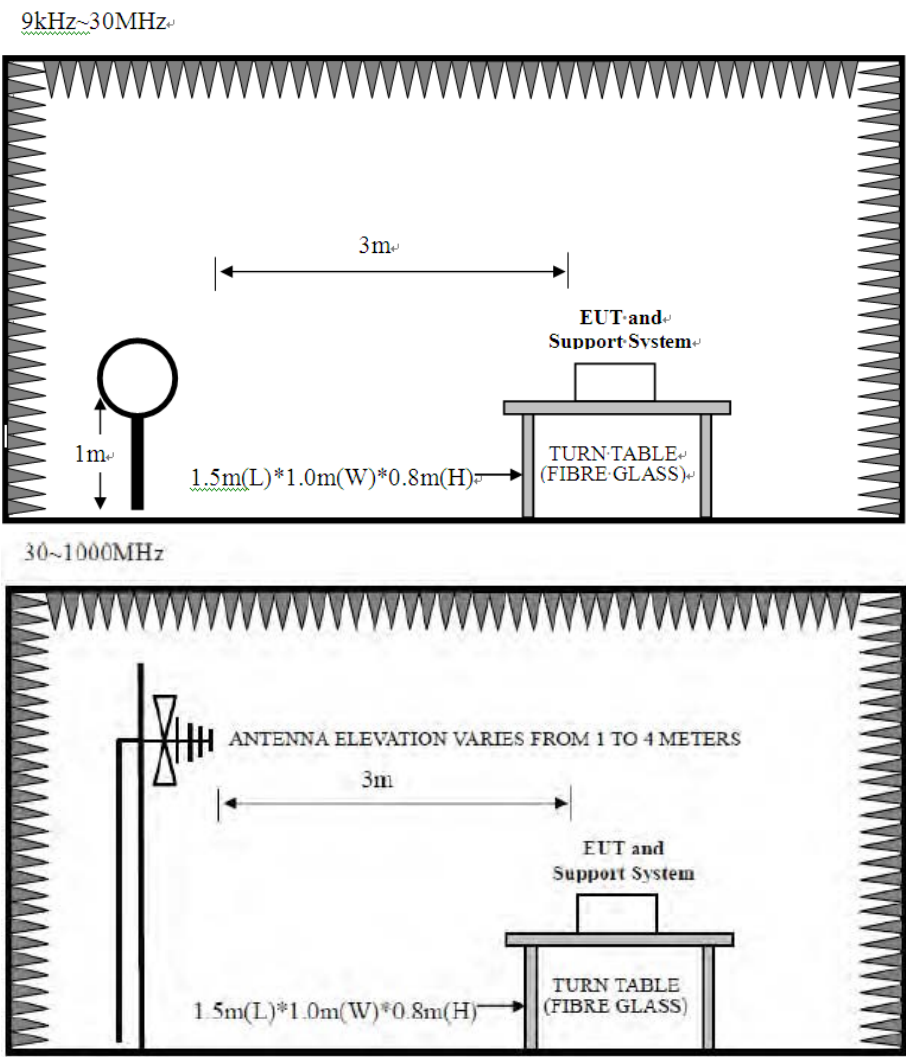
15.209 Limit

Frequency (MHz)	Field Strength(μ V/m)	Distance(m)
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

Note:

- (1) Emission level dB μ V = 20 log Emission level μ V/m.
- (2) The smaller limit shall apply at the cross point between two frequency bands.
- (3) Distance is the distance in meters between the measuring instrument, antenna and the closest point of any part of the device or system.

3.2. Test Setup



3.3. Spectrum Analyzer Setting

For 9KHz-150KHz

Spectrum Parameters	Setting
RBW	300Hz(for Peak&AVG)/CISPR 200Hz(for QP)
VBW	300Hz(for Peak&AVG)/CISPR 200Hz(for QP)
Start frequency	9KHz
Stop frequency	150KHz
Sweep Time	Auto
Detector	PEAK/QP/AVG
Trace Mode	Max Hold

For 150KHz-30MHz

Spectrum Parameters	Setting
RBW	9KHz
VBW	9KHz
Start frequency	150KHz
Stop frequency	30MHz
Sweep Time	Auto
Detector	QP
Trace Mode	Max Hold

For 30MHz-1GHz

Spectrum Parameters	Setting
RBW	120KHz
VBW	300KHz
Start frequency	30MHz
Stop frequency	1GHz
Sweep Time	Auto
Detector	QP
Trace Mode	Max Hold

3.4. Test Procedure

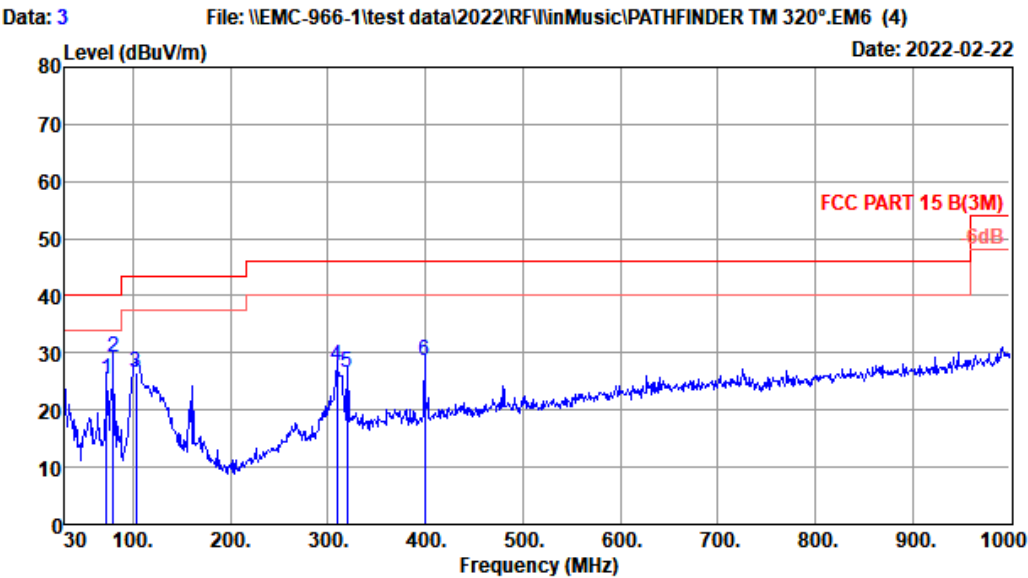
- EUT was placed on a turn table, which is 0.8 meter high above ground for below 1GHz test.
- EUT is set 3 meters away from the receiving antenna, which is mounted on a antenna tower.
- Set the EUT transmit continuously with maximum output power.
- The turn table can rotate 360 degrees to determine the position of the maximum emission level.
- The antenna can be moved up and down between 1 meter and 4 meters to find out the maximum emission level. Both horizontal and vertical polarization of the antenna are set on test.
- Spectrum analyzer setting parameters in accordance with section 3.3.
- Repeat above procedures until all channels were measured.
- Record the results in the test report.

3.5. Test Result

Radiated Emissions Below 1GHz

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Site no. : 1# 966 Chamber Data no. : 3
Dis. / Ant. : 3m 37062 Ant. pol. : VERTICAL
Limit : FCC PART 15 B(3M)
Env. / Ins. : Temp:23.5';Humi:51%;Press:101.51kPa
Engineer : Zzb
EUT : bluetooth speaker
Power : AC 120V/60Hz
M/N : PATHFINDER TM 320°
Test Mode : TX Mode

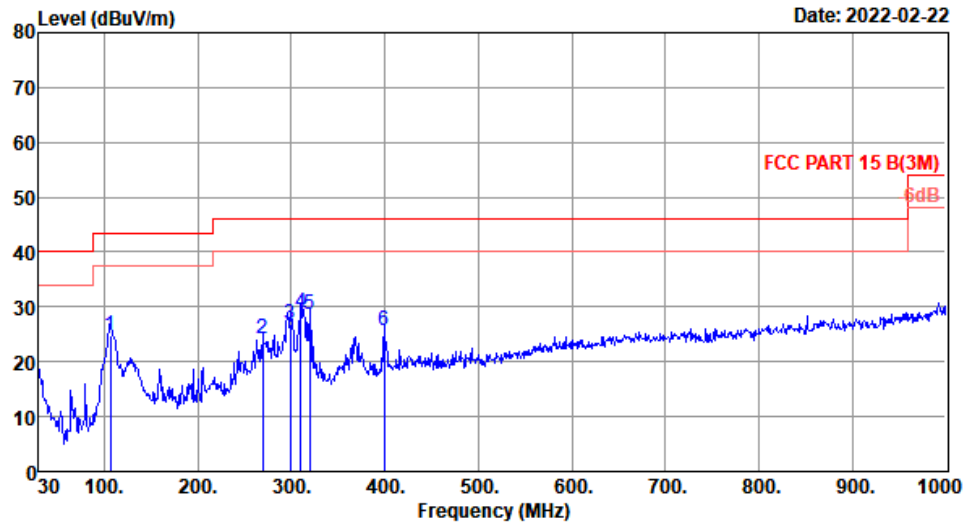
	Freq. (MHz)	ANT Factor (dB/m)	Cable Loss (dB)	Reading (dBUV)	Emission Level (dBUV/m)	Limit (dBUV/m)	Margin (dB)	Remark
1	72.68	6.86	0.88	17.70	25.44	40.00	14.56	QP
2	79.47	7.65	0.94	20.65	29.24	40.00	10.76	QP
3	102.75	10.34	0.99	15.19	26.52	43.50	16.98	QP
4	309.36	13.90	1.68	12.12	27.70	46.00	18.30	QP
5	320.03	14.20	1.66	10.75	26.61	46.00	19.39	QP
6	399.57	16.60	1.79	10.38	28.77	46.00	17.23	QP

Remarks: 1. Emission Level= Antenna Factor + Cable Loss + Reading.
2. Margin= Limit - Emission Level.
3. The emission levels that are 20dB below the official limit are not reported.

EST Technology

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Data: 4 File: \\EMC-966-1\test data\2022\RF\linMusic\PATHFINDER TM 320°.EM6 (4) Date: 2022-02-22



Site no. : 1# 966 Chamber Data no. : 4
Dis. / Ant. : 3m 37062 Ant. pol. : HORIZONTAL
Limit : FCC PART 15 B(3M)
Env. / Ins. : Temp:23.5'; Humi:51%; Press:101.51kPa
Engineer : Zzb
EUT : bluetooth speaker
Power : AC 120V/60Hz
M/N : PATHFINDER TM 320°
Test Mode : TX Mode

	Freq. (MHz)	ANT Factor (dB/m)	Cable Loss (dB)	Reading (dBuV)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	106.63	10.62	1.07	13.19	24.88	43.50	18.62	QP
2	269.59	13.50	1.58	9.11	24.19	46.00	21.81	QP
3	298.69	13.88	1.68	11.39	26.95	46.00	19.05	QP
4	310.33	13.90	1.68	13.21	28.79	46.00	17.21	QP
5	320.03	14.20	1.66	12.81	28.67	46.00	17.33	QP
6	399.57	16.60	1.79	7.40	25.79	46.00	20.21	QP

Remarks: 1. Emission Level= Antenna Factor + Cable Loss + Reading.
2. Margin= Limit - Emission Level.
3. The emission levels that are 20dB below the official limit are not reported.

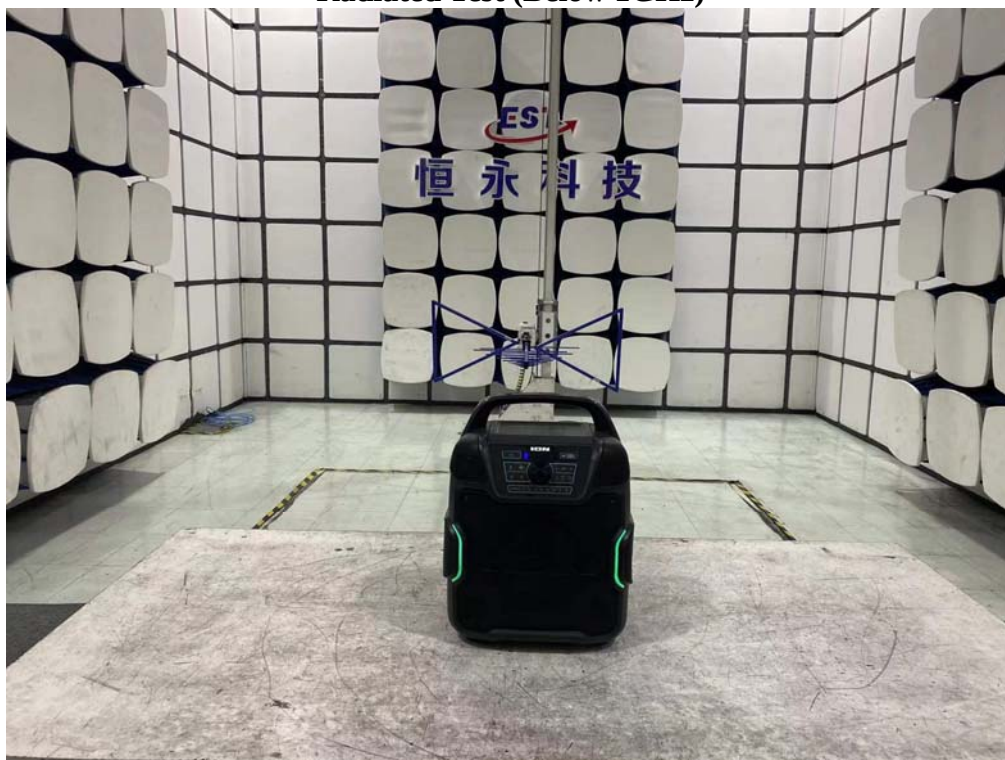
Note:

1. The amplitude of 9KHz to 30MHz spurious emission that is attenuated by more than 20dB below the permissible limit has no need to be reported.
2. All channels had been pre-test, only the worst case was reported.



4. TEST SETUP PHOTO

Radiated Test (Below 1GHz)



5. EUT PHOTO

External Photos
M/N: PATHFINDER™ 320°



External Photos
M/N: PATHFINDER™ 320°



External Photos
M/N: PATHFINDER™ 320°



External Photos
M/N: PATHFINDER™ 320°



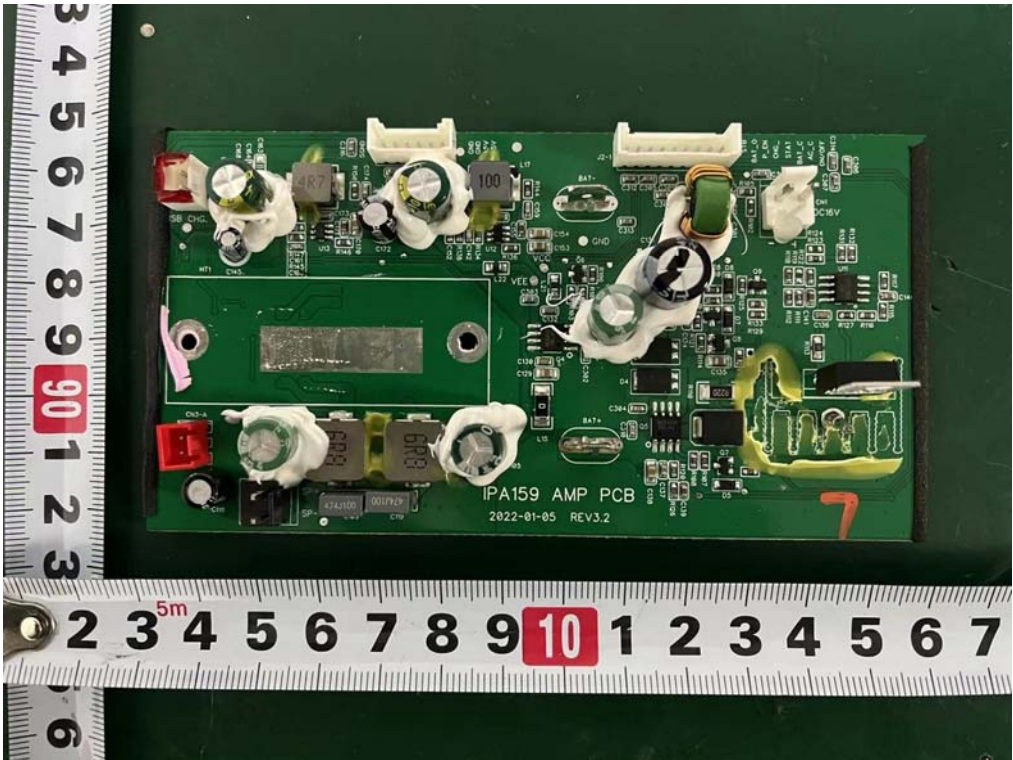
Internal Photos
M/N: PATHFINDER™ 320°



Internal Photos
M/N: PATHFINDER™ 320°

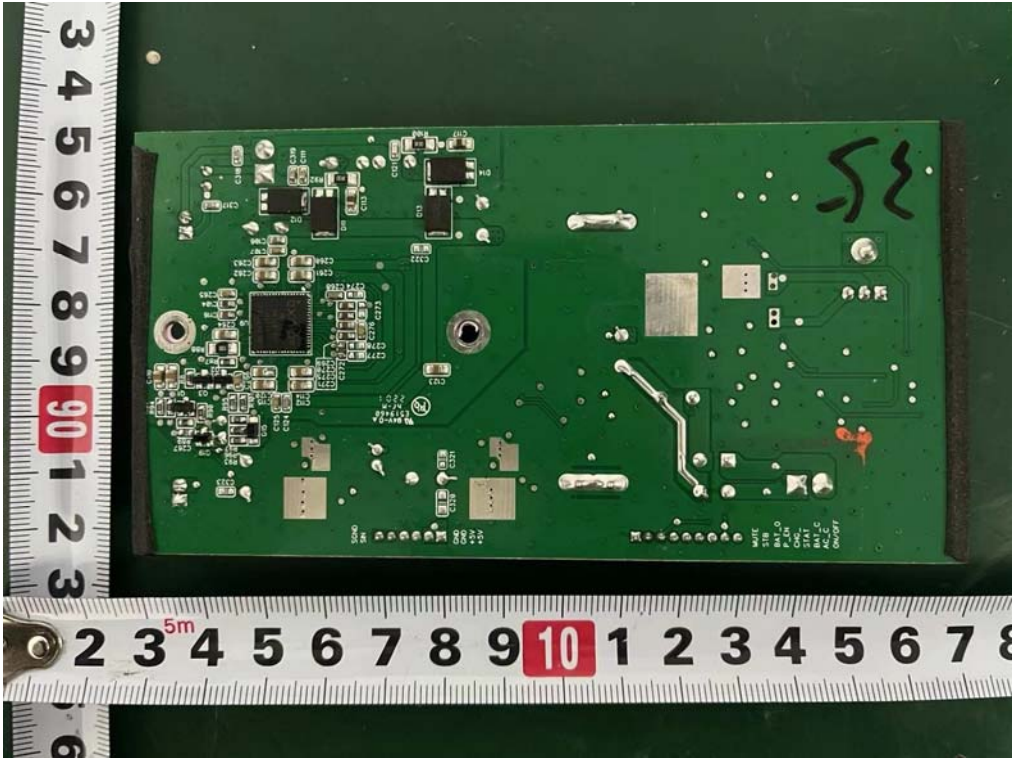


(Model: MA12070)



(Model: MA12070)

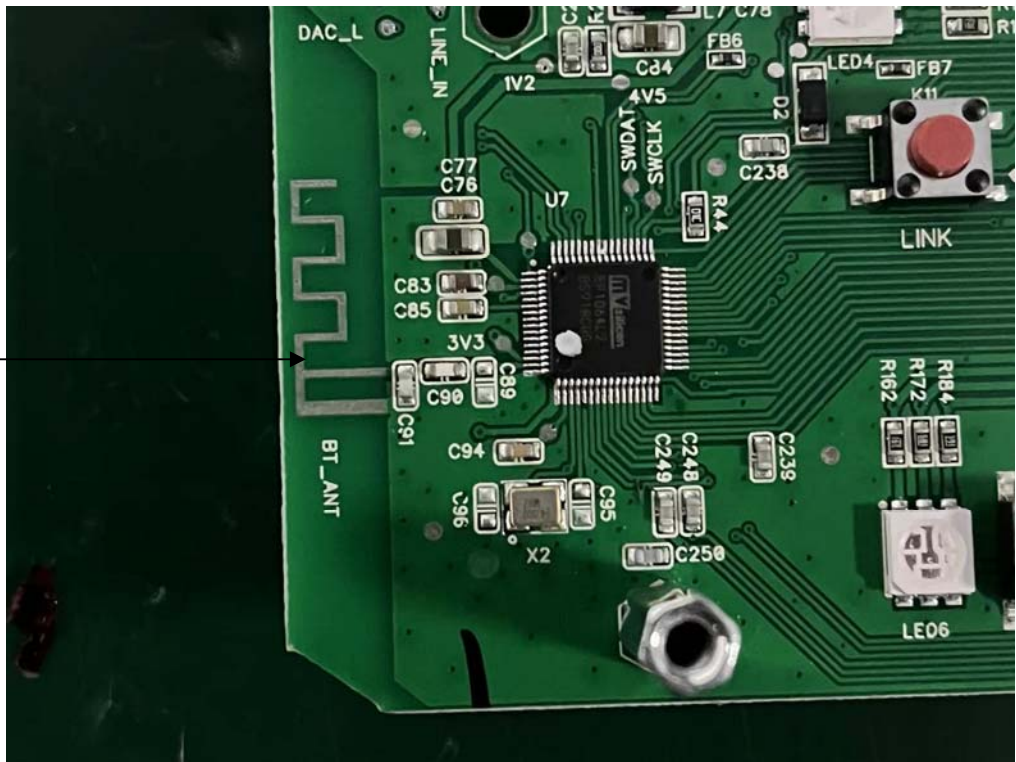
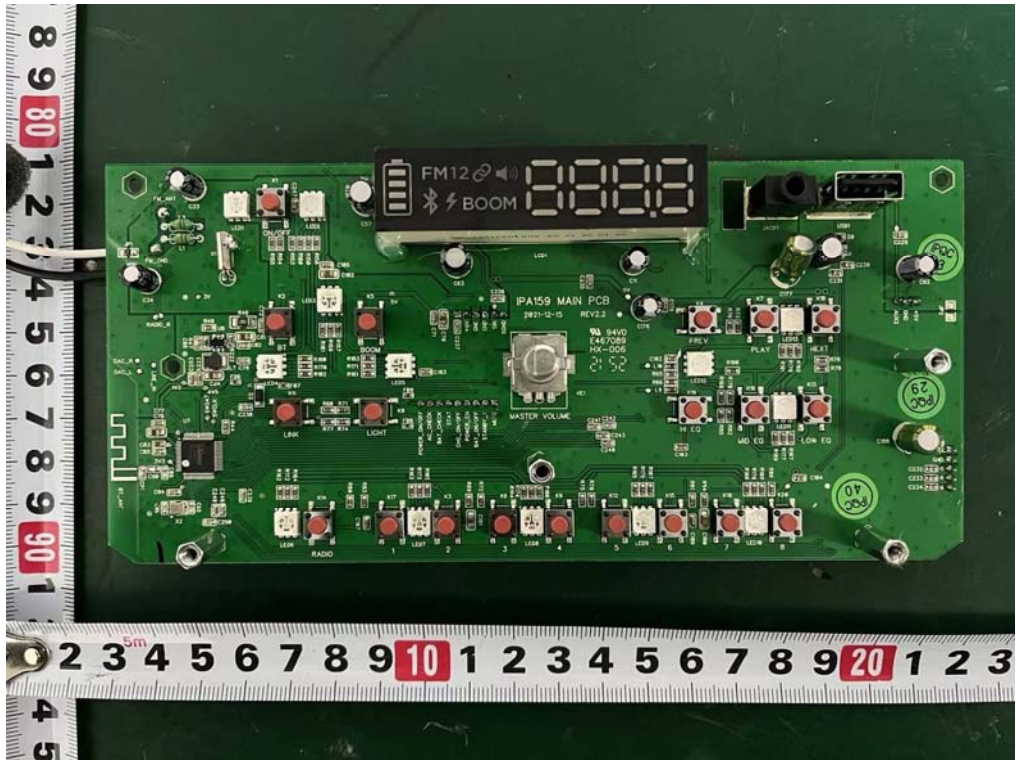
Internal Photos
M/N: PATHFINDER™ 320°



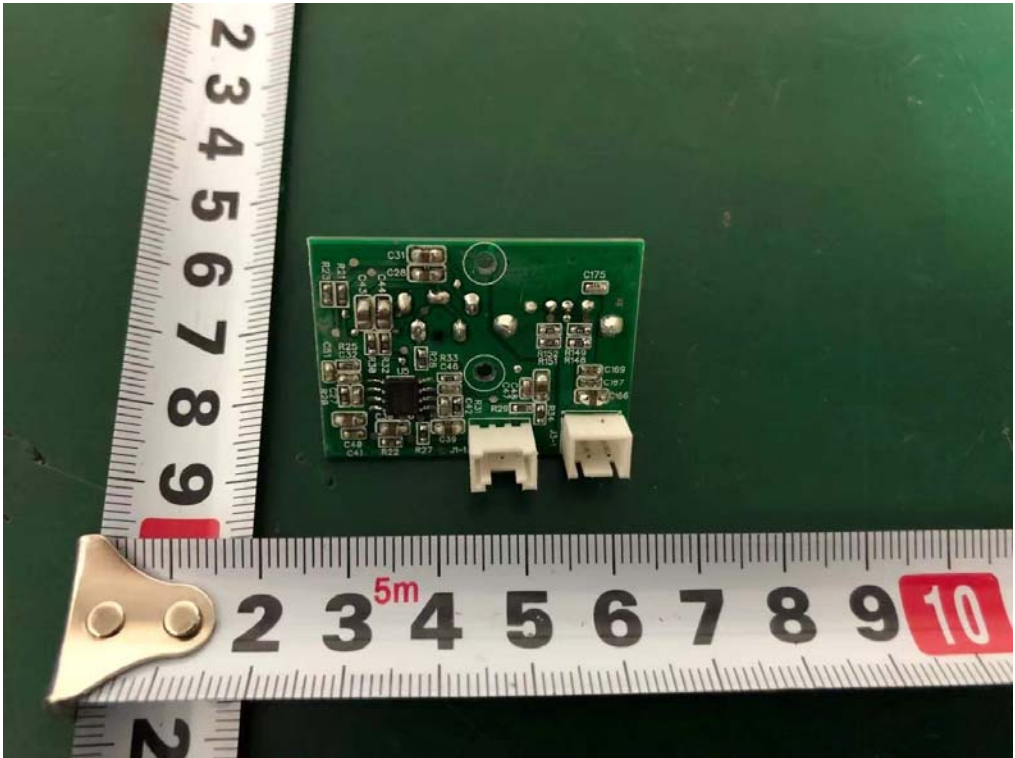
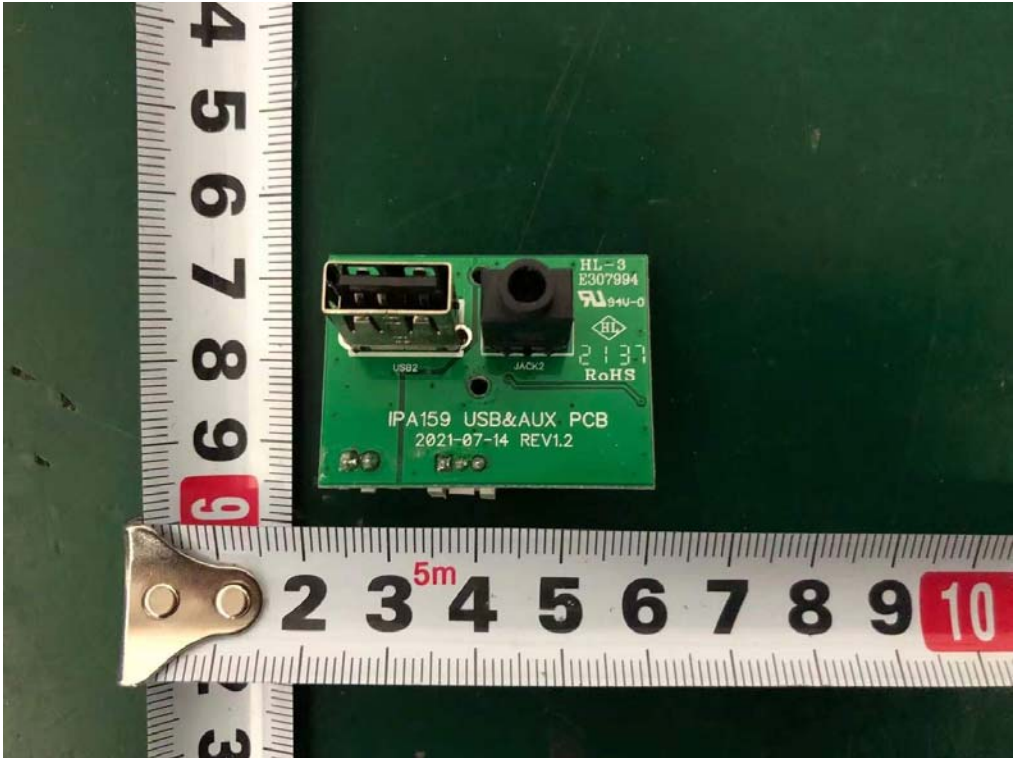
(Model: MA12070)



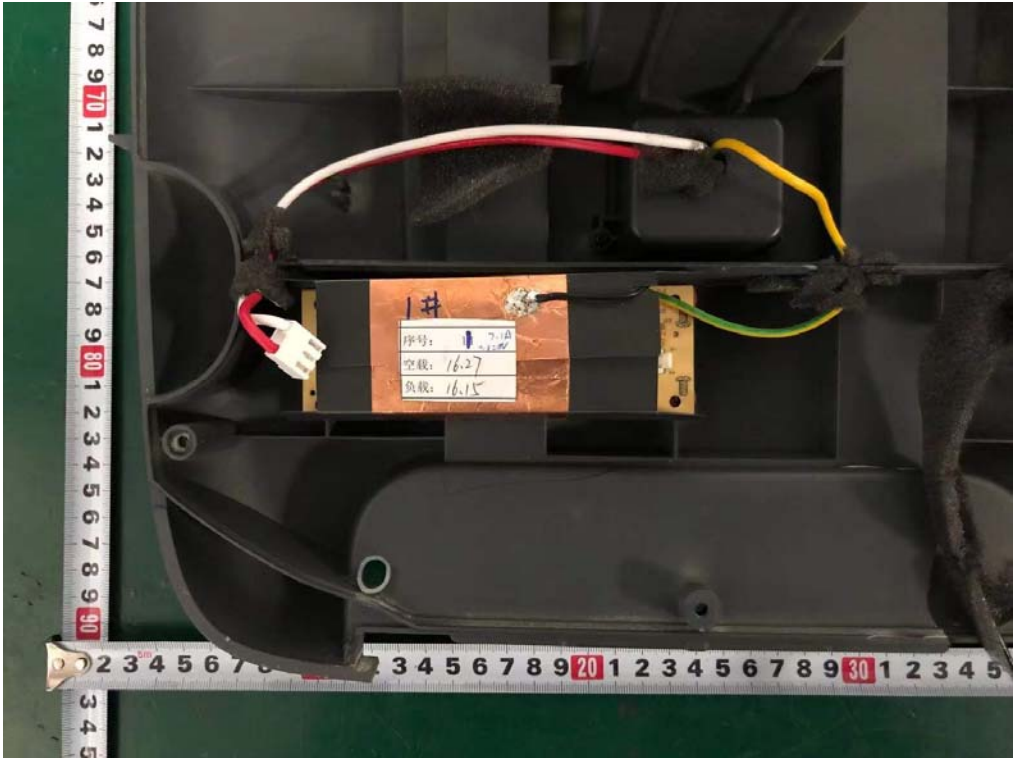
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M/N: PATHFINDER™ 320°



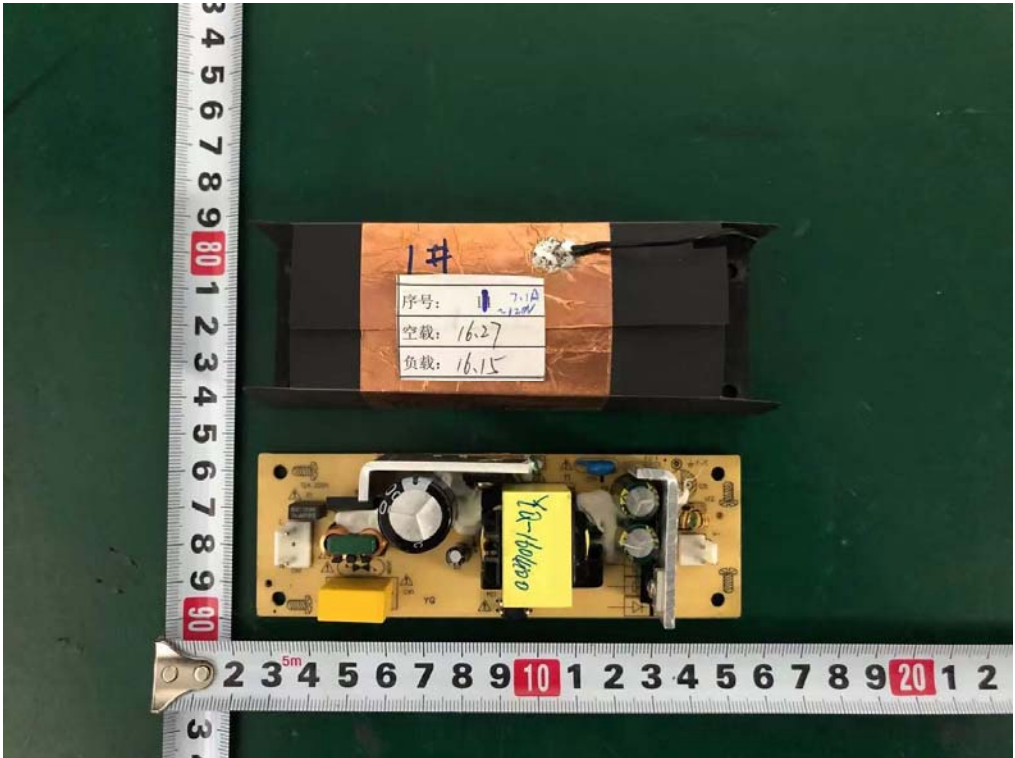
Internal Photos
M/N: PATHFINDER™ 320°



Internal Photos
M/N: PATHFINDER™ 320°



(Model: YQ-1604100; DC 16V)

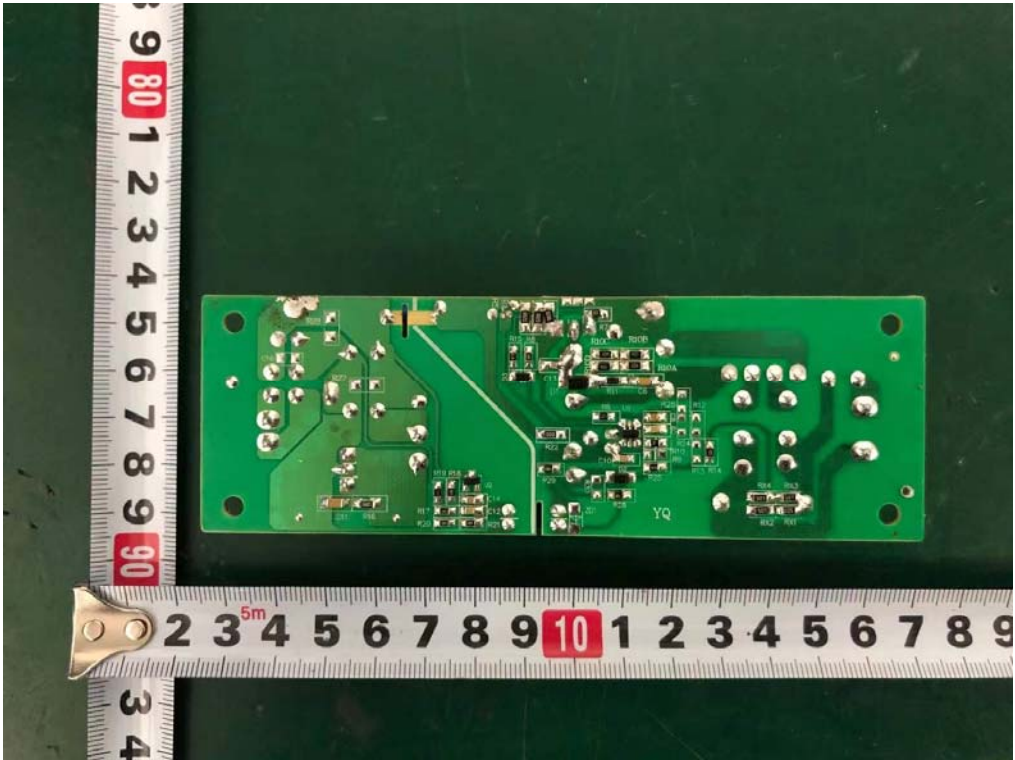


(Model: YQ-1604100; DC 16V)

Internal Photos
M/N: PATHFINDER™ 320°



(Model: YQ-1604100; DC 16V)



(Model: YQ-1604100; DC 16V)

Internal Photos
M/N: PATHFINDER™ 320°



(Model: CB7-12; DC 12V)



(Model: CB7-12; DC 12V)

Internal Photos
M/N: PATHFINDER™ 320°

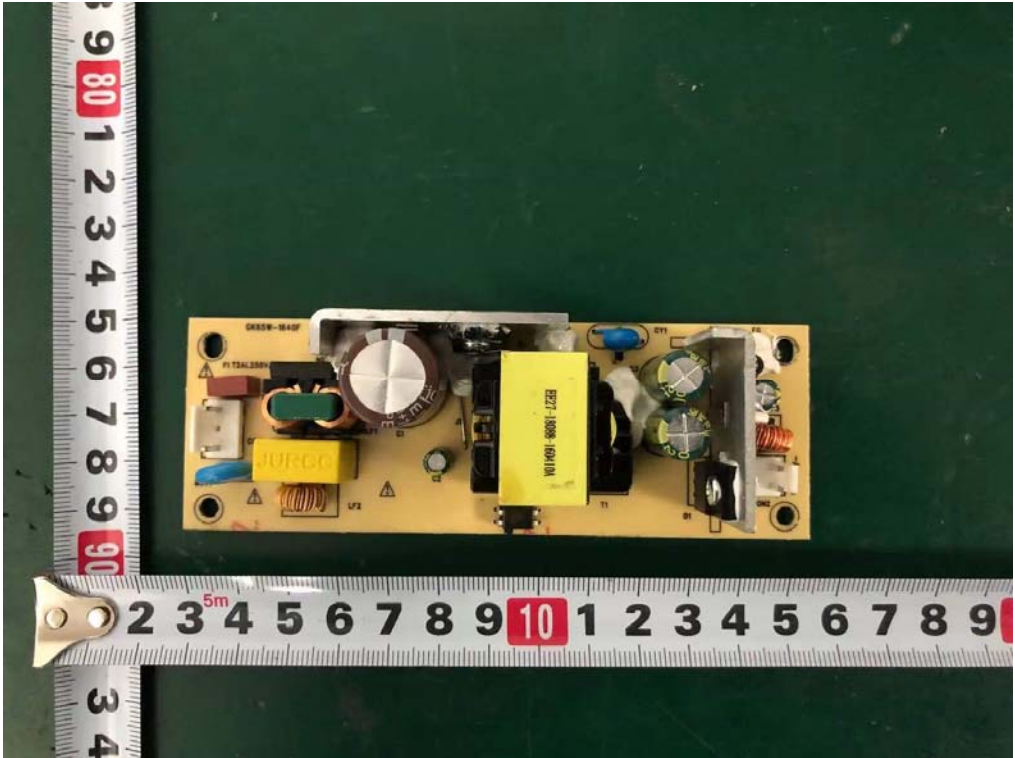


(Model: EE27-18088-160410A; DC 16V)

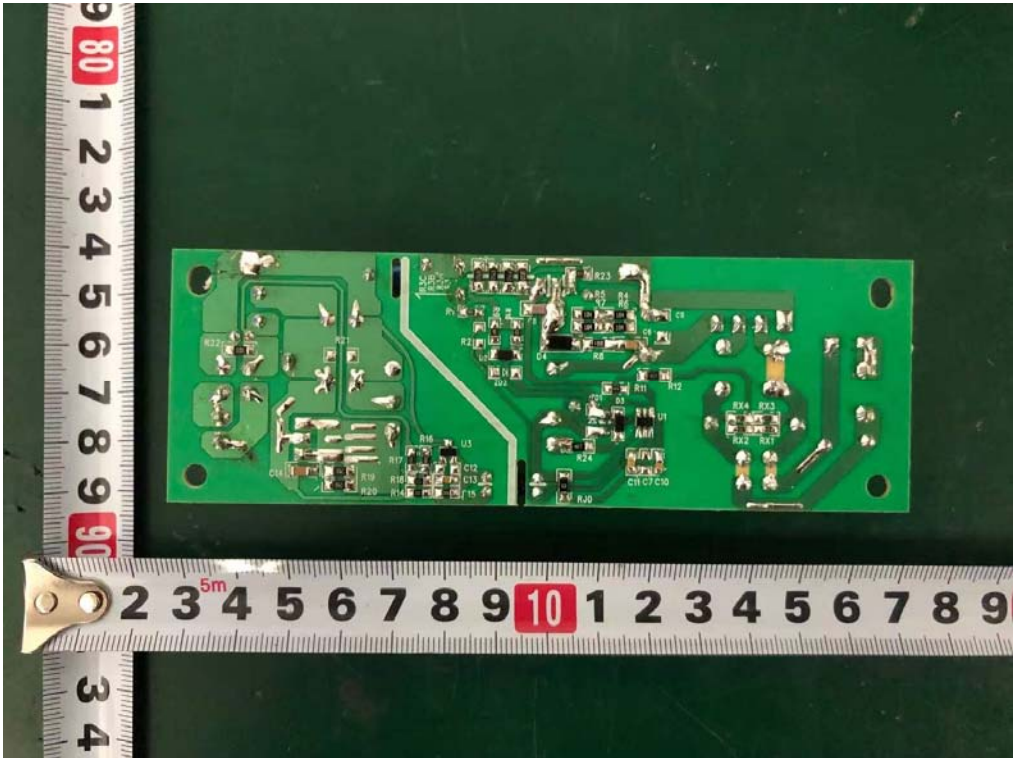


(Model: EE27-18088-160410A; DC 16V)

Internal Photos
M/N: PATHFINDER™ 320°



(Model: EE27-18088-160410A; DC 16V)



(Model: EE27-18088-160410A; DC 16V)

Internal Photos
M/N: PATHFINDER™ 320°



(Model: GS12V7AH; DC 12V)



(Model: GS12V7AH; DC 12V)

End of Test Report