TEST REPORT

Product Name	:	**FlinInfini Turbo On-Grid inverter with Energy Storage**
Model Number	:	**FlinInfini Turbo MPPT 5.6kW-48V**

Prepared for	:	Flin Technologies Private Limited
Address	:	1601 Montreal Tower, Shastri Nagar, Andheri West, Mumbai - 400 053, India
Prepared by	:	EMTEK (SHENZHEN) CO., LTD.
Address	:	Bldg 69, Majialong Industry Zone, Nanshan District, Shenzhen, Guangdong, China Tel: (0755) 26954280 Fax: (0755) 26954282
Report Number	:	ENS2109280153S00101R

TEST REPORT
IEC 61727
Photovoltaic (PV) systems – Characteristics of the utility interface

Report Number. .....:	ENS2109280153S00101R
Date of issue .....:	2021-09-29
Total number of pages.....	22
Name of Testing Laboratory preparing the Report.....:	EMTEK (Shenzhen) Co., Ltd.
Applicant's name.....:	Flin Technologies Private Limited
Address .....:	1601 Montreal Tower, Shastri Nagar, Andheri West, Mumbai - 400 053 India
Test specification:	
Standard.....:	IEC 61727:2004
Test procedure .....:	IEC report
Non-standard test method .....:	N/A
Test Report Form No.....:	IEC61727B
Test Report Form(s) Originator ....:	TÜV SÜD Product Service GmbH
Master TRF.....:	Dated 2017-11-03

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This report is not valid as a CB Test Report unless signed by an approved CB Testing Laboratory and appended to a CB Test Certificate issued by an NCB in accordance with IECEE 02.

General disclaimer:

The test results presented in this report relate only to the object tested.
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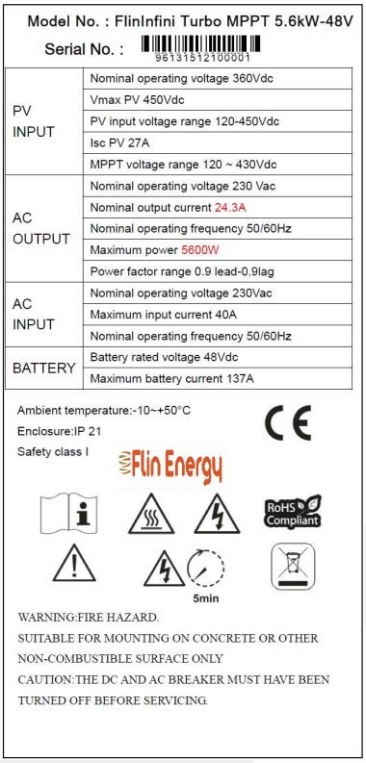
Test item description ..... :	FlinInfini Turbo On-Grid inverter with Energy Storage
Trade Mark ..... :	Flin Energy
Manufacturer ..... :	Flin Technologies Private Limited 1601 Montreal Tower, Shastri Nagar, Andheri West, Mumbai - 400 053 India
Model/Type reference ..... :	FlinInfini Turbo MPPT 5.6kW-48V
Ratings ..... :	See rating label

Responsible Testing Laboratory (as applicable), testing procedure and testing location(s):			
☒	**CB Testing Laboratory:**	EMTEK (SHENZHEN) CO., LTD.	
Testing location/ address.....:		Bldg 69, Majialong Industry Zone, Nanshan District, Shenzhen, Guangdong, China	
Tested by (name, function, signature).....:		Lucien Tan / Engineer	
Approved by (name, function, signature)...:		William Guo / Manager	
☐	**Testing procedure: CTF Stage 1:**		
Testing location/ address.....:			
Tested by (name, function, signature).....:			
Approved by (name, function, signature)...:			
☐	**Testing procedure: CTF Stage 2:**		
Testing location/ address.....:			
Tested by (name + signature).....:			
Witnessed by (name, function, signature) .:			
Approved by (name, function, signature)...:			
☐	**Testing procedure: CTF Stage 3:**		
☐	**Testing procedure: CTF Stage 4:**		
Testing location/ address.....:			
Tested by (name, function, signature).....:			
Witnessed by (name, function, signature) .:			
Approved by (name, function, signature)...:			
Supervised by (name, function, signature) :			

List of Attachments (including a total number of pages in each attachment): **- Page 2 to 12 for TRF;** **- Page 13 to 21 for Product photos.**	
Summary of testing:	
Tests performed (name of test and test clause): 4.4 DC injection 4.6 Harmonic and waveform distortion 4.7 Power factor 5.2.1 Over/under voltage 5.2.2 Over/under frequency	**Testing location:** EMTEK (Shenzhen) Co., Ltd. Bldg. 69, Majialong Industry Zone, Nanshan District, Shenzhen, Guangdong, China.
Summary of compliance with National Differences (List of countries addressed): List of countries addressed: ☒ The product fulfils the requirements of IEC 61727:2004	

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.



Test item particulars.....:	
Classification of installation and use.....:	Fix installation and indoor use
Supply Connection.....:	Permanent connection
.....:	
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 .....:	N/A
Date (s) of performance of tests.....:	N/A

General remarks:
"(See Enclosure #)" refers to additional information appended to the report. "(See appended table)" refers to a table appended to the report. **Throughout this report a ☐ comma / ☒ point is used as the decimal separator.**

Manufacturer's Declaration per sub-clause 4.2.5 of IECEE 02:	
The application for obtaining a CB Test Certificate includes more than one factory location and a declaration from the Manufacturer stating that the sample(s) submitted for evaluation is (are) representative of the products from each factory has been provided ..... :	☐ **Yes** ☒ **Not applicable**

When differences exist; they shall be identified in the General product information section.

Name and address of factory (ies) .....:	Same as manufacturer

General product information:

This report is amended from previous report no. ES210129050S-001, issued date February 27, 2021, due to below amendments:
-Change of Name and address of Applicant, See page 2 of the report for details.
-Change of Name and address of Manufacturer, See page 2 of the report for details.
- Added additional Trade Mark: Flin Energy, See page 3 of the report for details.
- Changed of Model from InfiniSolar V IV 5.6KW to FlinInfini Turbo MPPT 5.6kW-48V, See page 2 of the report for details.
- Changed of Product Name FlinInfini Lite On-grid Inverter with Energy storage to FlinInfini Turbo On-Grid inverter with Energy Storage, See page 3 of the report for details.
-Change the label, See page 5 of the report for details.
No test requirement.

1) The unit is non-isolated PV grid-interactive inverter and Stand-alone inverter, for indoor use.

2) The enclosure assembly was secured by screws.

4) Dusty conditions on the unit may impair the performance of this inverter.

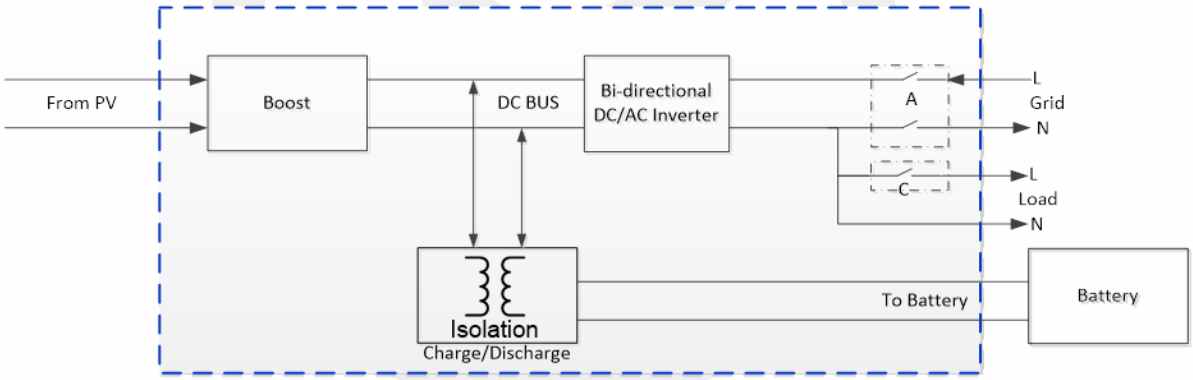
5) The ambient temperature should be between -10°C and 50°C to ensure optimal operation.

6) It is manufactured to be mounted on a wall and its degree of protection is IP21.

7) Software version: 2 17.05

8) The actual block diagram see below.

- The battery circuit is considered DVC A levels.
- The battery circuit is separated by means of reinforced insulation from DVC C circuits.
- The battery circuit is transformer isolated from the AC output.



IEC 61727			
Clause	Requirement + Test	Result - Remark	Verdict

4	**UTILITY COMPATIBILITY**		**P**
	The quality of power provided by the PV system for the on-site AC loads and for power delivered to the utility is governed by practices and standards on voltage, flicker, frequency, harmonics and power factor.		P
	Deviation from these standards represents out-of-bounds conditions and may require the PV system to sense the deviation and properly disconnect from the utility system.		P
4.1	**Voltage, current and frequency**		**P**
	The PV system AC voltage, current and frequency are compatible with the utility system.	See rating label	P
4.2	**Normal voltage operating range**		**P**
	Utility-interconnected PV systems do not normally regulate voltage, they inject current into the utility. Therefore, the voltage operating range for PV inverters is selected as a protection function that responds to abnormal utility conditions, not as a voltage regulation function.		P
4.3	**Flicker**		**P**
	The operation of the PV system is not cause voltage flicker in excess of limits stated in the relevant sections of IEC 61000-3-3 for systems less than 16 A or IEC 61000-3-5 for systems with current of 16 A and above.	See table 4.3	P
4.4	**DC injection**		**P**
	The PV system is not inject DC current greater than 1 % of the rated inverter output current, into the utility AC interface under any operating condition.	See table 4.4	P
4.5	**Normal frequency operating range**		**P**
	The PV system operates in synchronism with the utility system, and within the frequency trip limits defined in 5.2.2.	See 5.2.2	P
4.6	**Harmonics and waveform distortion**		**P**
	Total harmonic current distortion is less than 5 % at rated inverter output. Each individual harmonic is limited to the percentages listed in Table 1.		P
	Even harmonics in these ranges is less than 25 % of the lower odd harmonic limits listed.		P

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Clause	Requirement + Test	Result - Remark	Verdict
	Table 1 – Current distortion limits **Odd harmonics** / **Distortion limit** 3rd through 9th / Less than 4,0 % 11th through 15th / Less than 2,0 % 17th through 21st / Less than 1,5 % 23rd through 33rd / Less than 0,6 % **Even harmonics** / **Distortion limit** 2nd through 8th / Less than 1,0 % 10th through 32nd / Less than 0,5 %		P
4.7	The PV system has a lagging power factor greater than 0,9 when the output is greater than 50 % of the rated inverter output power.	See table 4.7	P
5	**PERSONNEL SAFETY AND EQUIPMENT PROTECTION**		**P**
	This Clause provides information and considerations for the safe and proper operation of the utility-connected PV systems.		P
5.1	**Loss of utility voltage**		**P**
	To prevent islanding, a utility connected PV system ceases to energize the utility system from a de-energized distribution line irrespective of connected loads or other generators within specified time limits.	Considered in IEC 62116	P
	A utility distribution line can become de-energized for several reasons. For example, a substation breaker opening due to fault conditions or the distribution line switched out during maintenance.		P
5.2	**Over/under voltage and frequency**		**P**
	The abnormal utility conditions of concern are voltage and frequency excursions above or below the values stated in this Clause, and the complete disconnection of the utility, presenting the potential for a distributed resource island.		P
5.2.1	**Over/under voltage**		**P**
	When the interface voltage deviates outside the conditions specified in Table 2, the photovoltaic system ceases to energize the utility distribution system. This applies to any phase of a multiphase system.	See table 5.2.1	P
	Table 2 – Response to abnormal voltages **Voltage (at point of utility connection)** / **Maximum trip time*** V < 0,5 × Vnominal / 0,1 s 50 % ≤ V < 85 % / 2,0 s 85 % ≤ V ≤ 110 % / Continuous operation 110 % < V < 135 % / 2,0 s 135 % ≤ V / 0,05 s * Trip time refers to the time between the abnormal condition occurring and the inverter ceasing to energize the utility line. The PV system control circuits shall actually remain connected to the utility to allow sensing of utility electrical conditions for use by the "reconnect" feature.		P
5.2.2	**Over/under frequency**		**P**

IEC 61727			
Clause	Requirement + Test	Result - Remark	Verdict
	When the utility frequency deviates outside the specified conditions the photovoltaic system ceases to energize the utility line. The unit does not have to cease to energize if the frequency returns to the normal utility continuous operation condition within the specified trip time.	See table 5.2.2	P
	When the utility frequency is outside the range of ±1 Hz, the system ceases to energize the utility line within 0,2 s. The purpose of the allowed range and time delay is to allow continued operation for short-term disturbances and to avoid excessive nuisance tripping in weak-utility system conditions.		P
5.3	**Islanding protection**		**P**
	The PV system must cease to energize the utility line within 2 s of loss of utility.	Considered in IEC 62116	P
5.4	**Response to utility recovery**		**P**
	Following an out-of-range utility condition that has caused the photovoltaic system to cease energizing, the photovoltaic system is not energize the utility line for 20 s to 5 min after the utility service voltage and frequency have recovered to within the specified ranges.		P
5.5	**Earthing**		**P**
	The utility interface equipment is earthed/grounded in accordance with IEC 60364-7-712.		P
5.6	**Short circuit protection**		**N/A**
	The photovoltaic system has short-circuit protection in accordance with IEC 60364-7-712.	This short-circuit protection will be considered at the connection to the AC mains	N/A
5.7	**Isolation and switching**		**P**
	A method of isolation and switching is provided in accordance with IEC 60364-7-712.	There are switch disconnector on the DC input side and MCB on the AC output side	P

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4.3	TABLE: Flicker			P
	Starting	**Stopping**	**Running**	
Limit	**4%**	**4%**	**Pst = 1.0**	**Plt = 0.65**
Test value	3.2	3.3	0.795	0.375
	3.3	3.3	0.809	0.375
	3.4	3.3	0.781	0.375
	3.4	3.3	0.591	0.375
	3.1	3.1	0.771	0.375
	3.4	3.5	0.778	0.375
	3.5	3.3	0.829	0.375
	3.4	3.2	0.517	0.375
	3.6	3.6	0.558	0.375
	3.3	3.3	0.592	0.375
Supplementary information:				

4.4	TABLE: Direct current injection								P
Rated output current (A)	**Ratio of rated output power (VA)**	**Measured DC output current between terminals (mA)**						**Isolated transformer (Yes/No)**	**Limit (mA)**
		L1-L2	**L1-L3**	**L2-L3**	**L1-N**	**L2-N**	**L3-N**		
6.075	25%	--	--	--	124	--	--	No	243
12.15	50%	--	--	--	125	--	--	No	243
24.3	100%	--	--	--	127	--	--	No	243
Supplementary information:									

4.6	TABLE: Harmonics and waveform distortion				P
Harmonic	**% of fundamental**	**Limits (% of fundamental)**	**Harmonic**	**% of fundamental**	**Limits (% of fundamental)**
02	0.556	1.0%	03	0.491	4.0%
04	0.173	1.0%	05	0.267	4.0%
06	0.124	1.0%	07	0.54	4.0%
08	0.129	1.0%	09	1.262	4.0%
10	0.171	0.5%	11	0.334	2.0%
12	0.142	0.5%	13	0.496	2.0%
14	0.149	0.5%	15	0.718	2.0%

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Clause	Requirement + Test	Result - Remark	Verdict

16	0.196	0.5%	17	0.23	1.5%
18	0.137	0.5%	19	0.363	1.5%
20	0.111	0.5%	21	0.741	1.5%
22	0.123	0.5%	23	0.237	0.6%
24	0.207	0.5%	25	0.442	0.6%
26	0.237	0.5%	27	0.492	0.6%
28	0.187	0.5%	29	0.331	0.6%
30	0.161	0.5%	31	0.285	0.6%
32	0.188	0.5%	33	0.531	0.6%
THD	0.634	5%	--	--	--
Supplementary information:					

4.7	TABLE: Power factor							P
	Input			Output				
No	Voltage (V d.c.)	Current (A d.c.)	Power (W)	Voltage (V a.c.)	Current (A a.c.)	Power (W)	Power factor (+/-)	Rated output (V.A)
1	430	14.47	6222	230.1	24.34	5600	0.9	5600
2	430	14.47	6222	230.2	24.33	5600	0.9	5600
3	430	14.47	6222	230.2	24.33	5600	0.9	5600
4	430	14.47	6222	230.3	24.32	5600	0.9	5600
5	430	14.47	6222	230.0	24.35	5600	0.9	5600
6	430	14.47	6222	230.1	24.34	5600	0.9	5600
Supplementary information: Power factor with “+” indicating leading and “-“ indicating lagging.								

5.2.1 & 5.4	TABLE: Under-and over-voltage trip settings and reconnection test						P
(1) Under voltage disconnection procedure							
Rated output voltage (V)	Output power (VA)	Required min. voltage (V)	Value of PCE trip settings (V)	Ratio of decreased (V / s)	Interval time (s)	Measured tripped voltage (V)	Measured disconnection time (s)
230	5600	V < 0.5 x Vnominal	<115	0.1	0.1	116.4	63.7ms
230	5.6	50% ⩽ V < 85%	195	0.1	2	194.8	276.6ms
230	5.6	85% ⩽ V < 110%	198	--	--	--	--

IEC 61727			
Clause	Requirement + Test	Result - Remark	Verdict

(2) Under voltage reconnection procedure		
Ratio of voltage rapidly decreased (V / s)	**Reconnection voltage (V)**	**Reconnection time (s)**
0.1	180.5	146.3ms

(3) Over voltage disconnection procedure							
Rated output voltage (V)	**Output power (VA)**	**Required max. voltage (V)**	**Value of PCE trip settings (V)**	**Ratio of increased (V / s)**	**Interval time (s)**	**Measured tripped voltage (V)**	**Measured disconnection time (s)**
230	5600	110% ⩽ V < 135%	256.2	0.1	2	27.8	282.0ms
230	5.6	135% ⩽ V	313.4	0.2	3	314.3	278.5ms
(4) Over voltage reconnection procedure							
Ratio of voltage rapidly decreased (V / s)			**Reconnection voltage (V)**			**Reconnection time (s)**	
0.1			268.8			148.5ms	
Supplementary information:							

5.2.2 & 5.4	TABLE: Over/under frequency trip settings and reconnection test	P

(1) Under frequency disconnection procedure							
Rated output frequency (Hz)	**Output power (VA)**	**Required min. frequency (Hz)**	**Value of PCE trip settings (Hz)**	**Ratio of decreased (Hz / s)**	**Interval time (s)**	**Measured tripped frequency (Hz)**	**Measured disconnection time (s)**
50	5600	49	49	0.1	200	49.0	56ms
(2) Under frequency reconnection procedure							
Ratio of frequency rapidly decreased (Hz / s)			**Reconnection frequency (Hz)**			**Reconnection time (s)**	
0.1			40.8			46.5ms	
(3) Over frequency disconnection procedure							
Rated output frequency (Hz)	**Output power (VA)**	**Required max. frequency (Hz)**	**Value of PCE trip settings (Hz)**	**Ratio of increased (Hz / s)**	**Interval time (s)**	**Measured tripped frequency (Hz)**	**Measured disconnection time (s)**
50	5600	51	51	0.1	200	51	38.2ms
(4) Over frequency reconnection procedure							
Ratio of frequency rapidly decreased (V / s)			**Reconnection frequency (Hz)**			**Reconnection time (s)**	
0.1			54.12			38.9ms	
Supplementary information:							

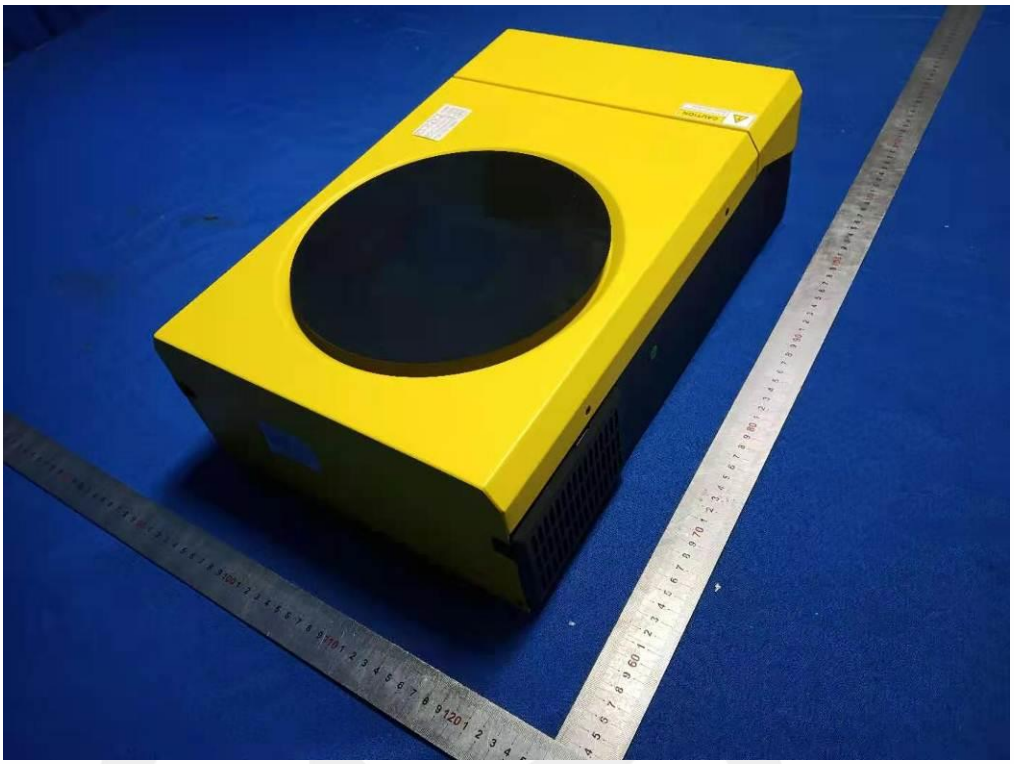

Fig. 1 -- Over view 1

Fig. 2 -- Over view 2

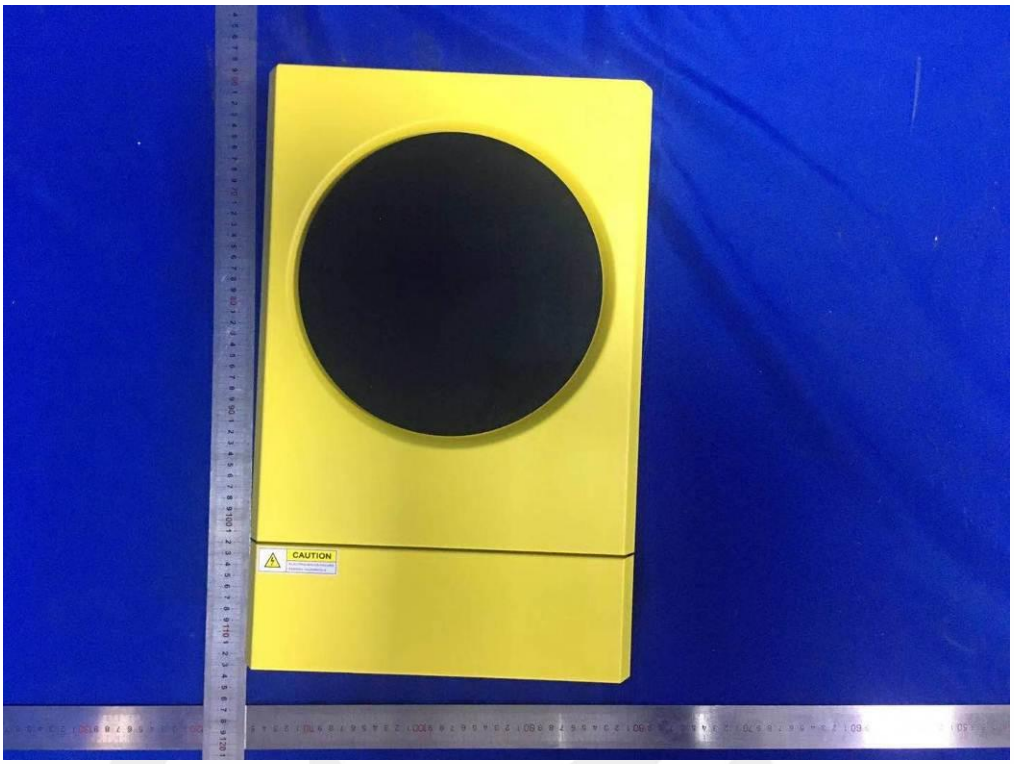

Fig. 3 -- Over view 3

Fig. 4 -- Over view 4

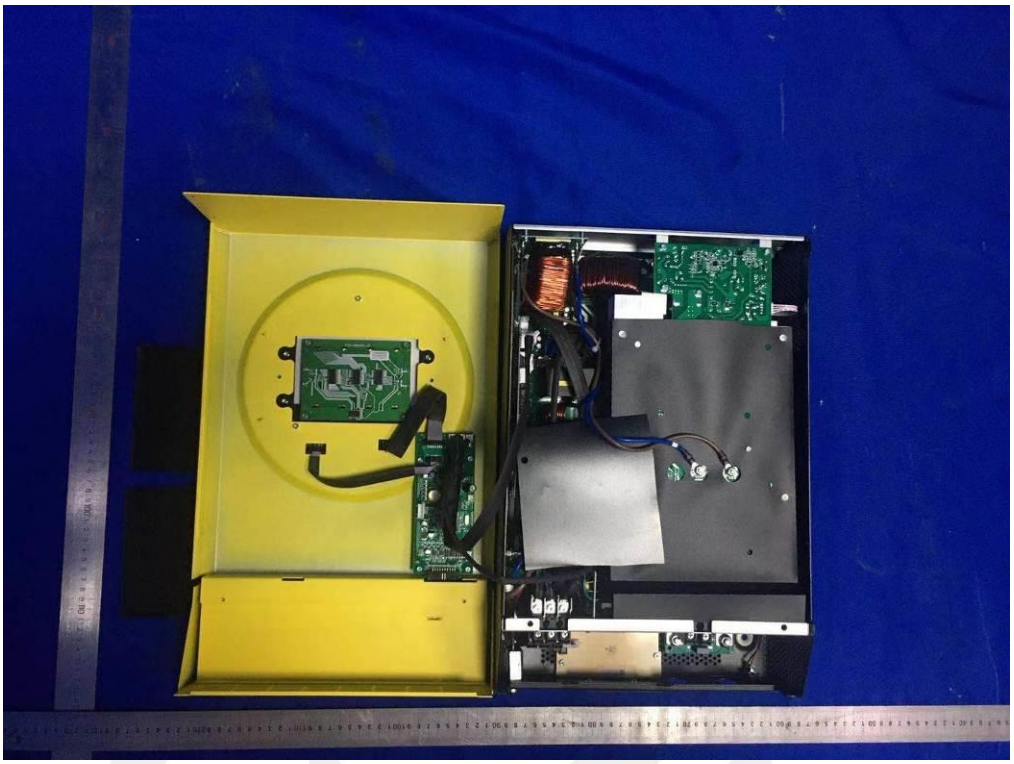

Fig. 5 -- Internal view

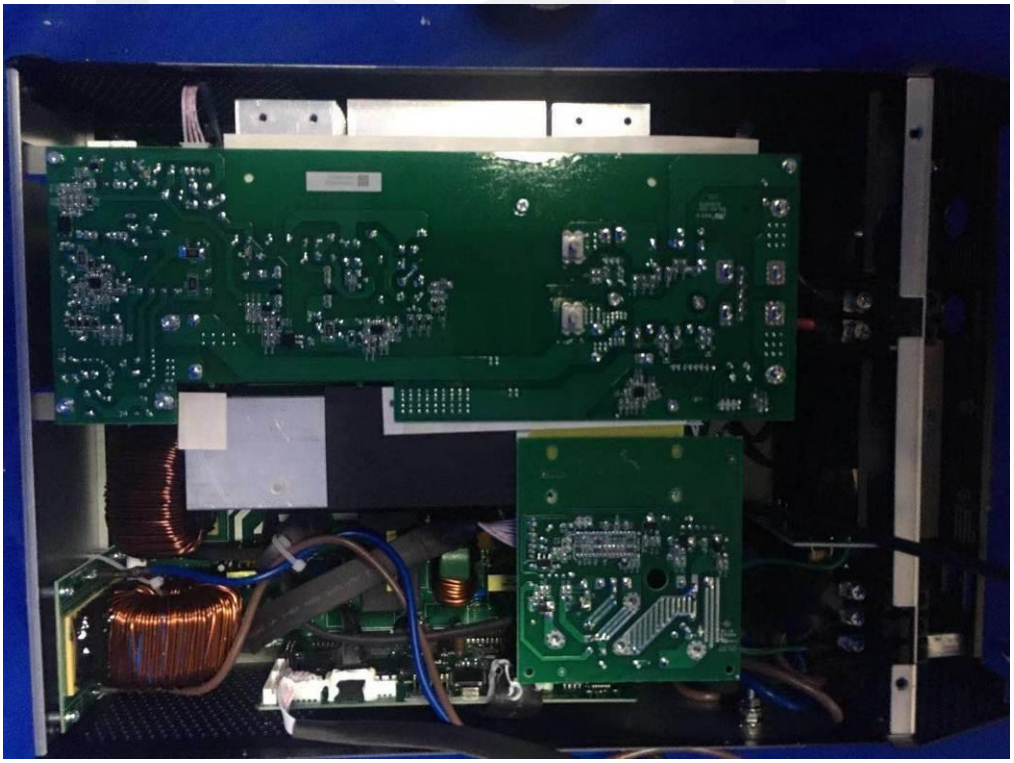

Fig. 6 -- Internal view

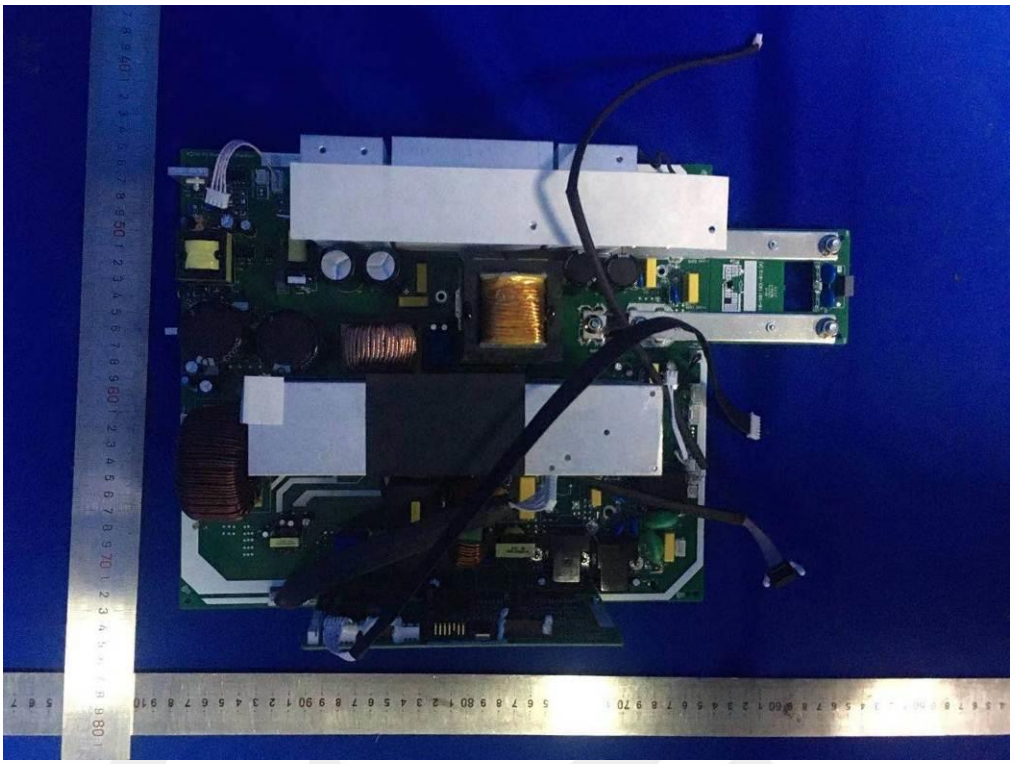

Fig. 7 -- Component side view

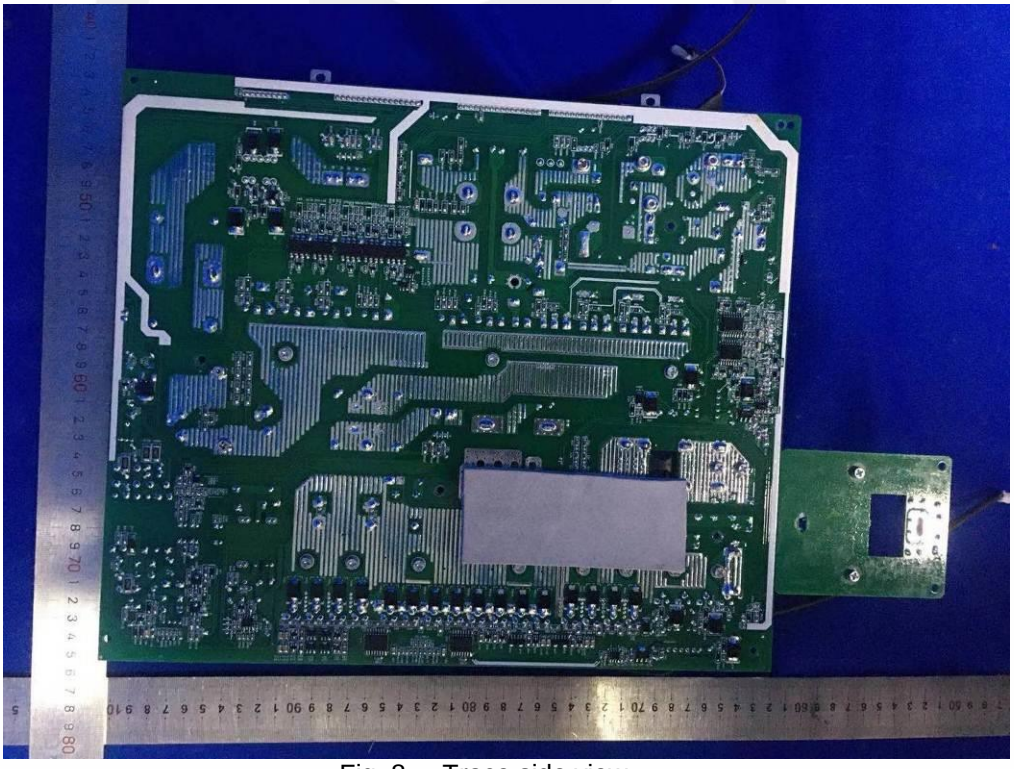

Fig. 8 -- Trace side view

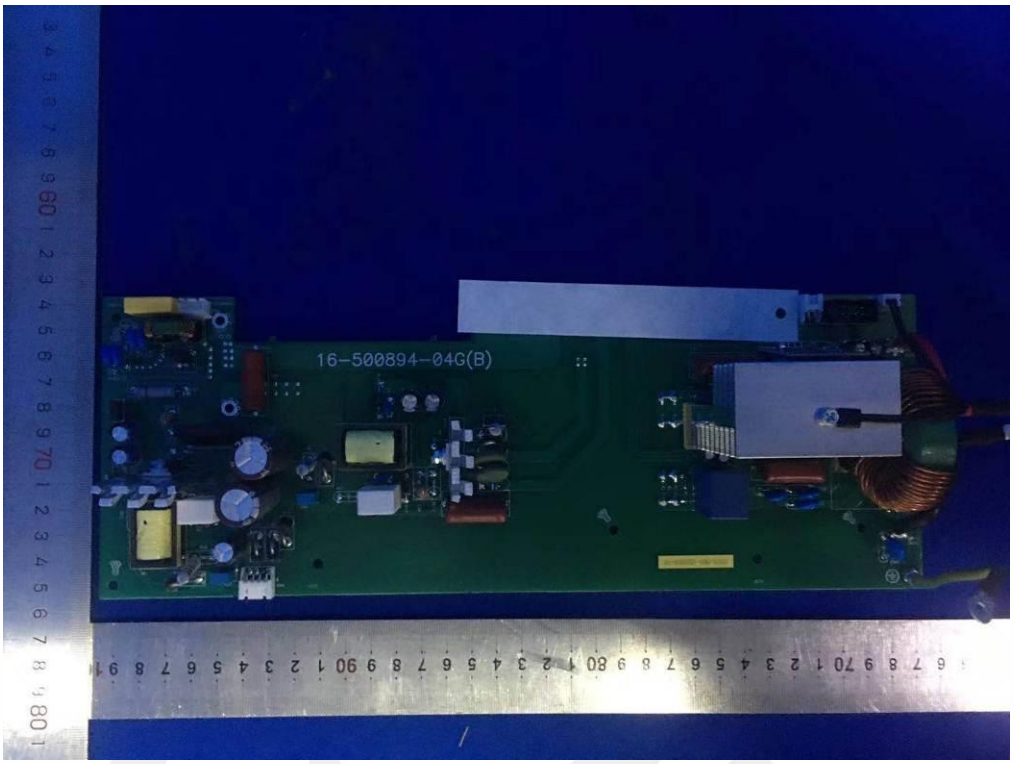

Fig. 9 -- Component side view

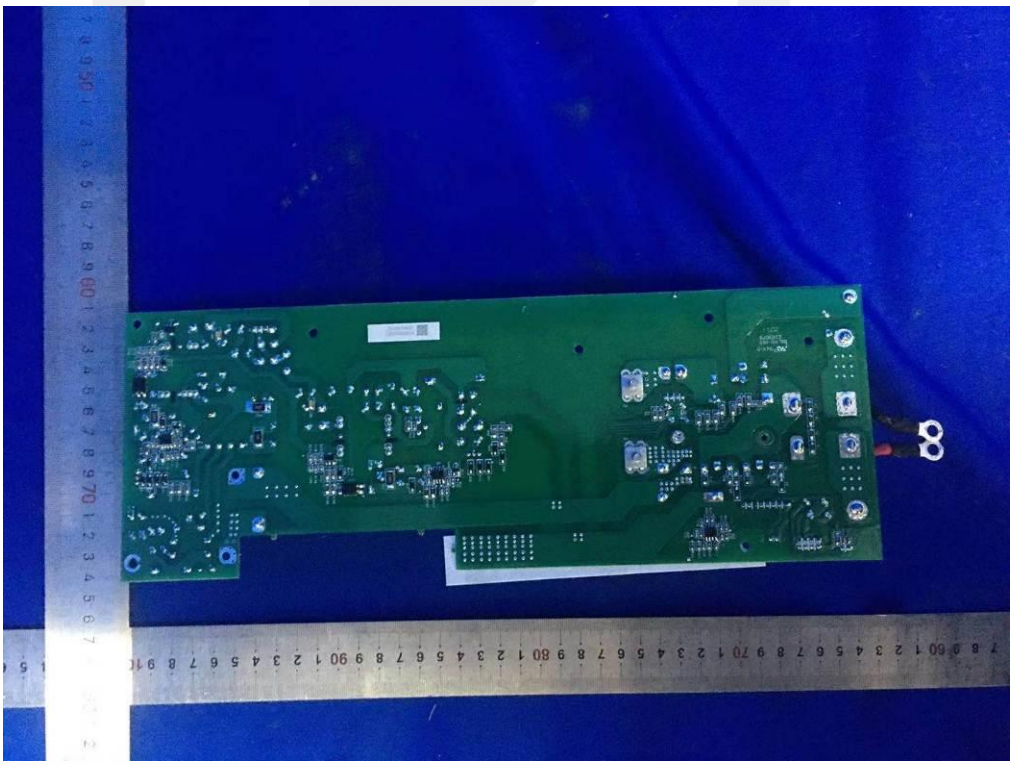

Fig. 10 -- Trace side view

Fig. 11 -- Component side view

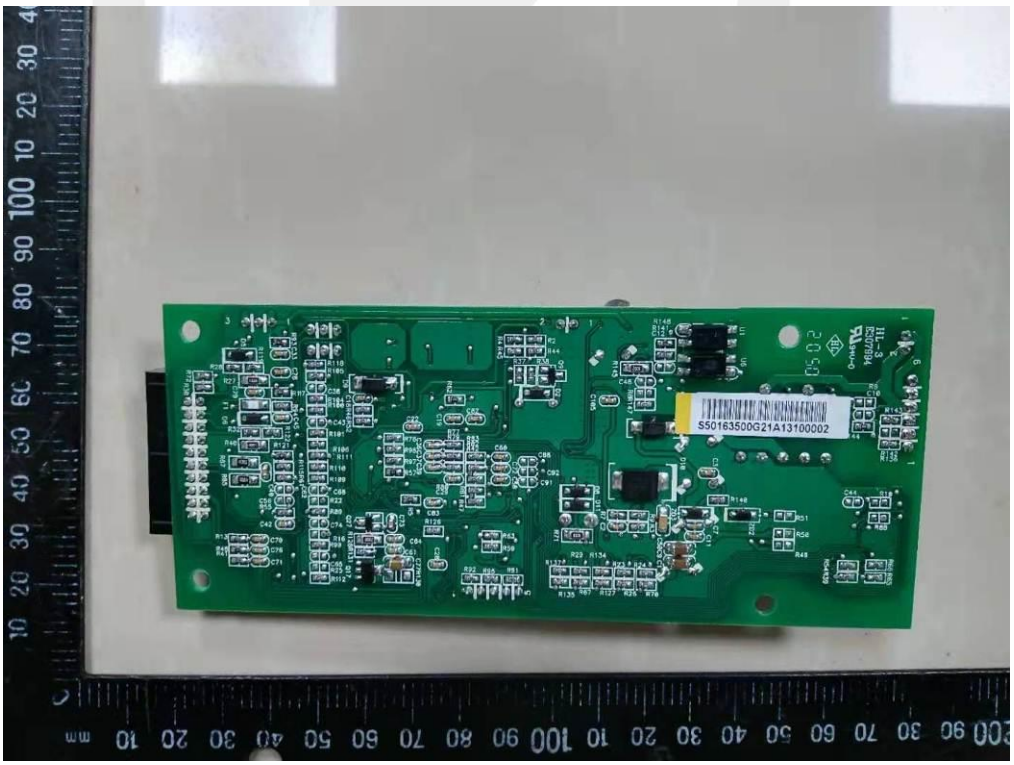

Fig. 12 -- Trace side view

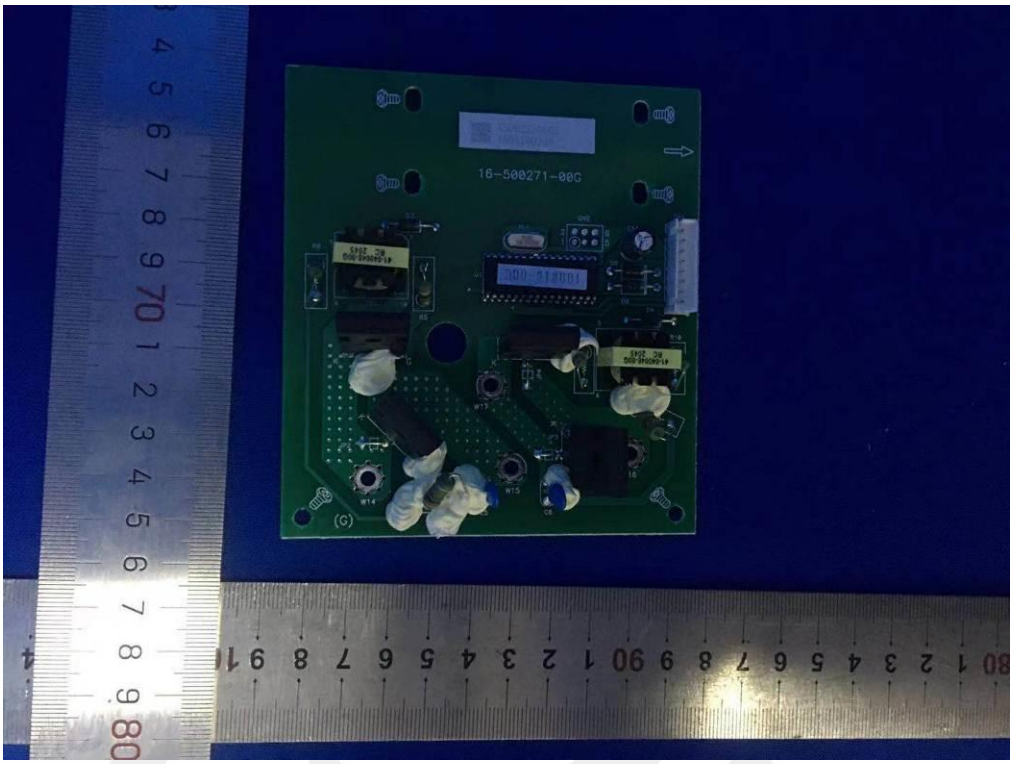

Fig. 13 -- Component side view

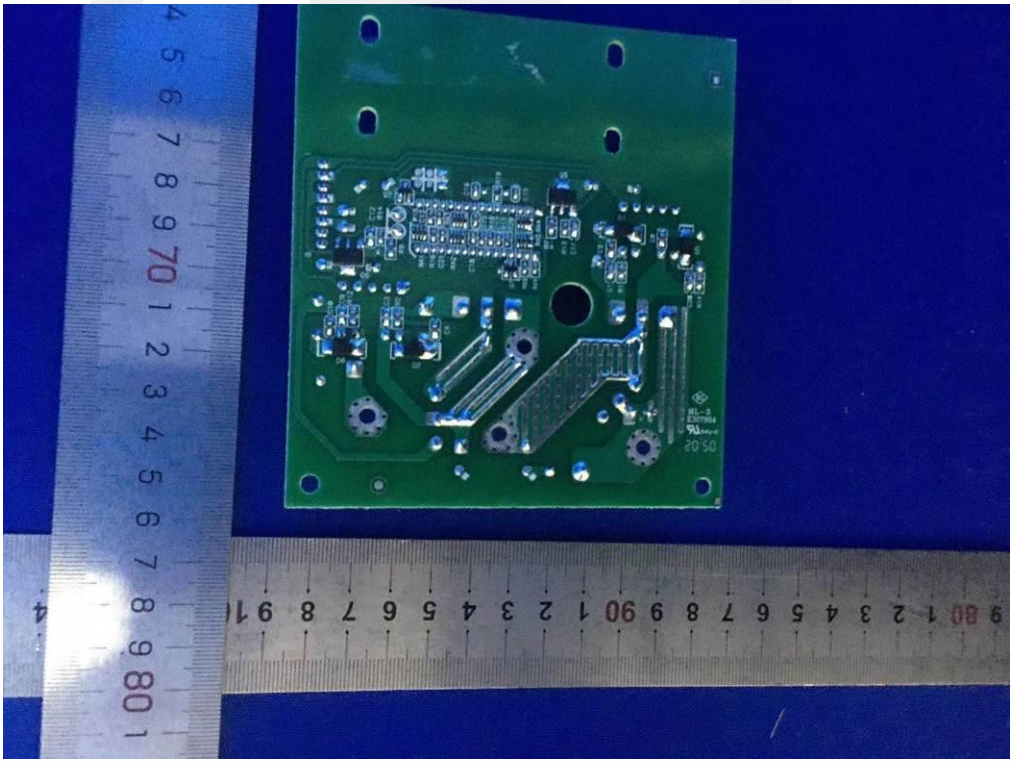

Fig. 14 -- Trace side view

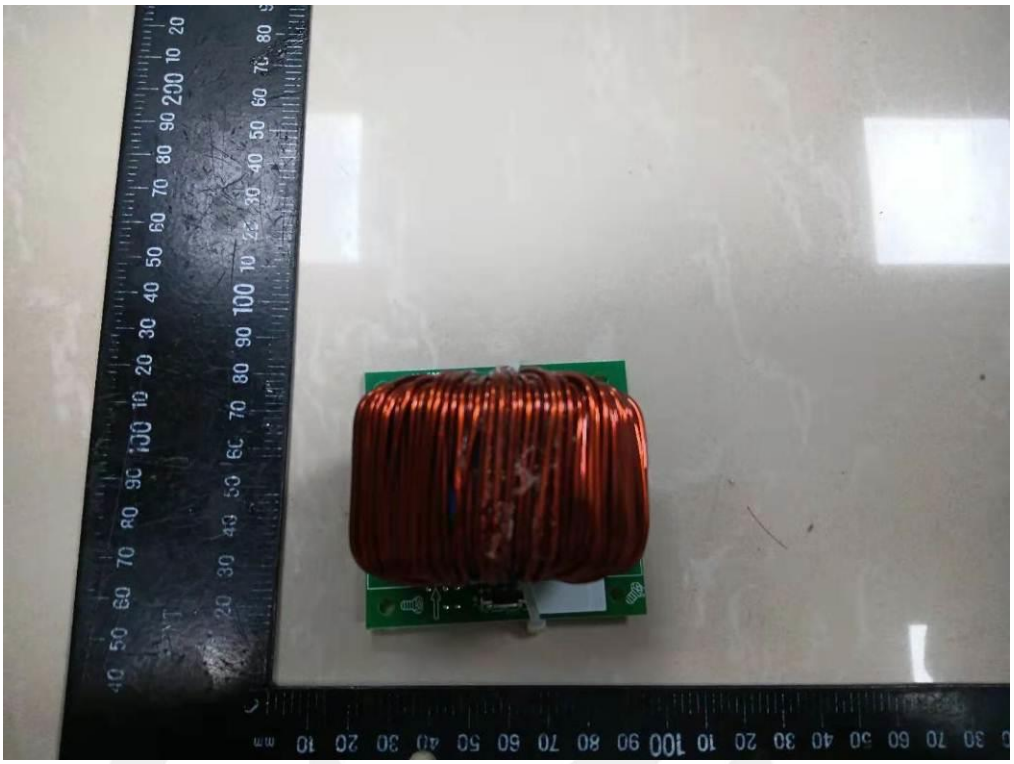

Fig. 15 -- Component side view

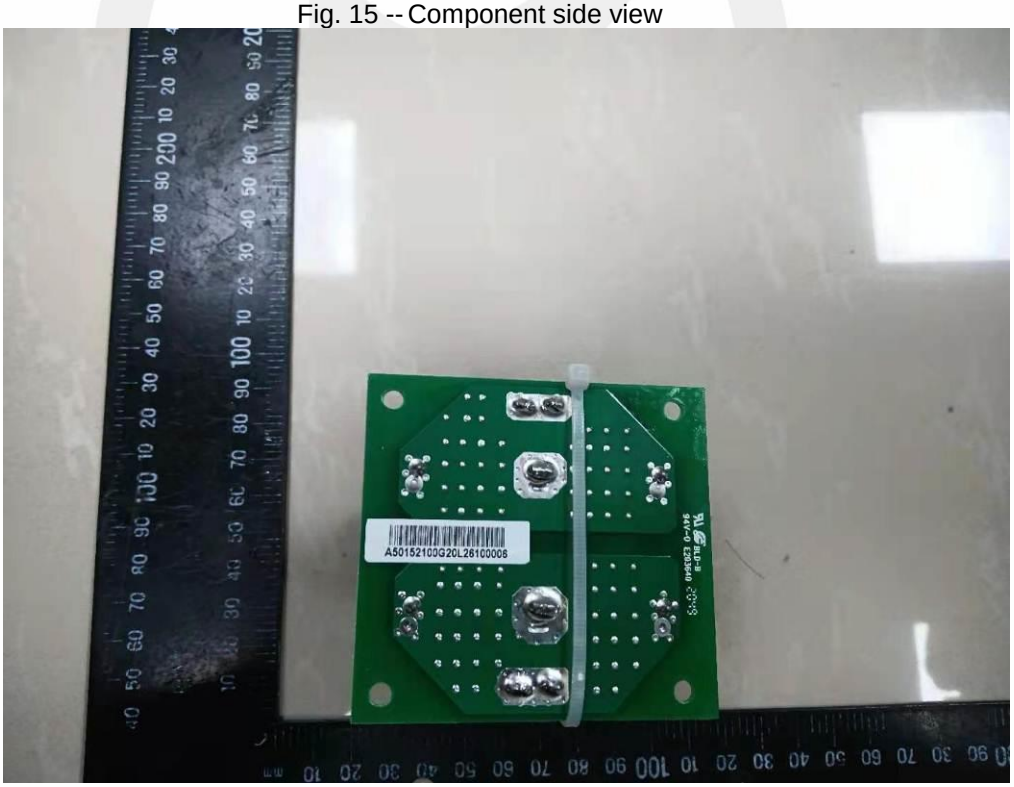

Fig. 16 -- Trace side view

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The test results or observations are provided in accordance with measured value, without taking risks caused by uncertainty into account. Without explicit stipulation in special agreements, standards or regulations, EMTEK shall not assume any responsibility.

6．对本检验报告若有异议，请于收到报告之日起 20 日内提出；

Objections shall be raised within 20 days from the date receiving the report.