
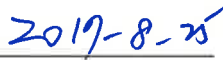







<b>Test Report No.:</b> PV170217E03B	
<b>Client</b>	
Name :	Ablerex Electronics Co., Ltd.
Address :	1F, No. 3, Lane 7, Paokao Rd., Hsintien, New Taipei City, Taiwan
<b>Test Item :</b>	Grid-tied photovoltaic inverter
<b>Identification :</b>	ES 3000H, ES 3680H, ES 4000H, ES 4600H, ES 5000H, ES 5500H, ES 3000HC, ES 3680HC, ES 4000HC, ES 4600HC, ES 5000HC, ES 3000T, ES 3680T, ES 4000T, ES 4600T, ES 5000T, ES 5500T, ES 3330W, ES 3990W, ES 4990W, ES 5500W
<b>Testing laboratory</b>	
Name :	Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch
Address :	No. 47-2, 14th Ling, Chia Pau Vil., Lin Kou Dist., New Taipei City, Taiwan
<b>Test specification</b>	
<b>Standard :</b>	IEEE 519:2014
<b>Test Result :</b>	The test item passed.
<b>Prepared By :</b>	
	
Signature	Date
Dino Kao	
Senior Engineer	
<b>Approved By:</b>	
	
Signature	Date
Edward Chiueh	
Technical Manager	
<b>Other Aspects:</b>	
The completed test report includes the following documents: IEEE 519:2014 report (36 pages)	
<p>This report is for your exclusive use. Any copying or replication of this report to or for any other person or entity, or use of our name or trademark, is permitted only with our prior written permission. This report sets forth our findings solely with respect to the test samples identified herein. The results set forth in this report are not indicative or representative of the quality or characteristics of the lot from which a test sample was taken or any similar or identical product unless specifically and expressly noted. Our report includes all of the tests requested by you and the results thereof based upon the information that you provided to us. You have 60 days from date of issuance of this report to notify us of any material error or omission caused by our negligence, provided, however, that such notice shall be in writing and shall specifically address the issue you wish to raise. A failure to raise such issue within the prescribed time shall constitute your unqualified acceptance of the completeness of this report, the tests conducted and the correctness of the report contents. Unless specific mention, the uncertainty of measurement has been explicitly taken into account to declare the compliance or non-compliance to the specification</p>	



<b>TEST REPORT</b>	
<b>IEEE 519:2014</b>	
IEEE Recommended Practice and Requirements for Harmonic Control in Electric Power Systems	
<b>Report reference No.</b> .....	PV170217E03B
Prepared by (printed name and signature) .....	See cover sheet
Approved by (printed name and signature) .....	See cover sheet
Date of issue .....	See cover sheet
<b>Testing Laboratory Name</b> .....	Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch
Address.....	No. 47-2, 14th Ling, Chia Pau Vil., Lin Kou Dist., New Taipei City, Taiwan
Testing location.....	Bureau Veritas Consumer Product Services Limited, Taoyuan Branch
Address.....	No. 19, Hwa Ya 2nd Rd., Wen Hwa Tsuen, Kwei Shan Hsiang, Taoyuan Hsien 333, Taiwan
<b>Applicant's Name</b> .....	Ablerex Electronics Co., Ltd.
Address .....	1F, No. 3, Lane 7, Paokao Rd., Hsintien, New Taipei City, Taiwan
<b>Test specification</b>	
Standard .....	IEEE 519:2014
Non-standard test method .....	None
<b>Test Report Form No.</b> .....	IEEE 519:2014_A
Master TRF .....	Bureau Veritas Consumer Product Services GmbH
Copyright © Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch	
<b>Test item description</b> .....	Grid-tied photovoltaic inverter
Trademark .....	
Model / Type .....	ES 3000H, ES 3680H, ES 4000H, ES 4600H, ES 5000H, ES 5500H, ES 3000HC, ES 3680HC, ES 4000HC, ES 4600HC, ES 5000HC, ES 3000T, ES 3680T, ES 4000T, ES 4600T, ES 5000T, ES 5500T, ES 3330W, ES 3990W, ES 4990W, ES 5500W

<b>Ratings..... :</b>	ES 3000H ES 3000HC ES 3000T	ES 3680H ES 3680HC ES 3680T ES 3330W	ES 4000H ES 4000HC ES 4000T ES 3990W	ES 4600H ES 4600HC ES 4600T
PV Array MPP DC voltage range [V]:	200-450Vdc			
PV Array Input DC voltage range [V]:	120-500Vdc			
PV Array Input AC current [A].....:	7,9A x 2	9,7A x 2	10,5A x 2	12,1A x 2
Output AC voltage [V].....:	230Vac, 50/60Hz			
Output AC current [A] .....	13A	16A	17,4A	20A
Output power [VA] .....	3000VA	3680VA	4000VA	4600VA
<b>Ratings..... :</b>	ES 5000H ES 5000HC ES 5000T ES 4990W		ES 5500H ES 5500T ES 5500W	
PV Array MPP DC voltage range [V]:	200-450Vdc		230-450Vdc	
PV Array Input DC voltage range [V]:	120-500Vdc			
PV Array Input AC current [A].....:	13,2A x 2			
Output AC voltage [V].....:	230Vac, 50/60Hz			
Output AC current [A] .....	21,7A		23,9A	
Output power [VA] .....	5000VA		5500VA	

### Copy of marking plate



<p>MODEL NO.: ES 3000H DC-Input Max.input voltage (Voc): 500 d.c. V Max.short circuit current (Isc): 2 x 7.9 d.c. A AC-Output Rated output voltage: 230 a.c. V Rated output frequency: 50/60Hz Rated output apparent power: 3000VA Rated output current: 13 a.c. A PF range: cos <math>\phi</math> 0.9 - 1.0 Enclosure: IP 65 Complying with VDE 0126-1, VDE-AR-N 4105 Protective class I ABLEREX ELECTRONICS CO., LTD.</p> <div></div> <p>MA3C0130001</p>	<p>MODEL NO.: ES 3680H DC-Input Max.input voltage (Voc): 500 d.c. V Max.short circuit current (Isc): 2 x 9.7 d.c. A AC-Output Rated output voltage: 230 a.c. V Rated output frequency: 50/60Hz Rated output apparent power: 3680VA Rated output current: 16 a.c. A PF range: cos <math>\phi</math> 0.9 - 1.0 Enclosure: IP 65 Complying with VDE 0126-1, VDE-AR-N 4105 Protective class I ABLEREX ELECTRONICS CO., LTD.</p> <div></div> <p>MA3C0130001</p>	<p>MODEL NO.: ES 4000H DC-Input Max.input voltage (Voc): 500 d.c. V Max.short circuit current (Isc): 2 x 10.5 d.c. A AC-Output Rated output voltage: 230 a.c. V Rated output frequency: 50/60Hz Rated output apparent power: 4000VA Rated output current: 17.4 a.c. A PF range: cos <math>\phi</math> 0.9 - 1.0 Enclosure: IP 65 Complying with VDE 0126-1, VDE-AR-N 4105 Protective class I ABLEREX ELECTRONICS CO., LTD.</p> <div></div> <p>MA3C0130001</p>
<p>MODEL NO.: ES 4600H DC-Input Max.input voltage (Voc): 500 d.c. V Max.short circuit current (Isc): 2 x 12.1 d.c. A AC-Output Rated output voltage: 230 a.c. V Rated output frequency: 50/60Hz Rated output apparent power: 4600VA Rated output current: 20 a.c. A PF range: cos <math>\phi</math> 0.9 - 1.0 Enclosure: IP 65 Complying with VDE 0126-1, VDE-AR-N 4105 Protective class I ABLEREX ELECTRONICS CO., LTD.</p> <div></div> <p>MA3C0130001</p>	<p>MODEL NO.: ES 5000H DC-Input Max.input voltage (Voc): 500 d.c. V Max.short circuit current (Isc): 2 x 13.2 d.c. A AC-Output Rated output voltage: 230 a.c. V Rated output frequency: 50/60Hz Rated output apparent power: 5000VA Rated output current: 21.7 a.c. A PF range: cos <math>\phi</math> 0.9 - 1.0 Enclosure: IP 65 Complying with VDE 0126-1 VDE-AR-N 4105(De-rating to 4600VA for Germany) Protective class I ABLEREX ELECTRONICS CO., LTD.</p> <div></div> <p>MA3C0130001</p>	<p>MODEL NO.: ES 5500H DC-Input Max.input voltage (Voc): 500 d.c. V Max.short circuit current (Isc): 2 x 13.2 d.c. A AC-Output Rated output voltage: 230 a.c. V Rated output frequency: 50/60Hz Rated output apparent power: 5500VA Rated output current: 23.9 a.c. A PF range: cos <math>\phi</math> 0.9 - 1.0 Enclosure: IP 65 Complying with VDE 0126-1 VDE-AR-N 4105(De-rating to 4600VA for Germany) Protective class I ABLEREX ELECTRONICS CO., LTD.</p> <div></div> <p>MA3C0130001</p>
<p>MODEL NO.: ES 3000HC DC-Input Max.input voltage (Voc): 500 d.c. V Max.short circuit current (Isc): 2 x 7.9 d.c. A AC-Output Rated output voltage: 230 a.c. V Rated output frequency: 50/60Hz Rated output apparent power: 3000VA Rated output current: 13 a.c. A PF range: cos <math>\phi</math> 0.9 - 1.0 Enclosure: IP 65 Complying with VDE 0126-1, VDE-AR-N 4105 Protective class I ABLEREX ELECTRONICS CO., LTD.</p> <div></div> <p>MA3C0130001</p>	<p>MODEL NO.: ES 3680HC DC-Input Max.input voltage (Voc): 500 d.c. V Max.short circuit current (Isc): 2 x 9.7 d.c. A AC-Output Rated output voltage: 230 a.c. V Rated output frequency: 50/60Hz Rated output apparent power: 3680VA Rated output current: 16 a.c. A PF range: cos <math>\phi</math> 0.9 - 1.0 Enclosure: IP 65 Complying with VDE 0126-1, VDE-AR-N 4105 Protective class I ABLEREX ELECTRONICS CO., LTD.</p> <div></div> <p>MA3C0130001</p>	<p>MODEL NO.: ES 4000HC DC-Input Max.input voltage (Voc): 500 d.c. V Max.short circuit current (Isc): 2 x 10.5 d.c. A AC-Output Rated output voltage: 230 a.c. V Rated output frequency: 50/60Hz Rated output apparent power: 4000VA Rated output current: 17.4 a.c. A PF range: cos <math>\phi</math> 0.9 - 1.0 Enclosure: IP 65 Complying with VDE 0126-1, VDE-AR-N 4105 Protective class I ABLEREX ELECTRONICS CO., LTD.</p> <div></div> <p>MA3C0130001</p>
<p>MODEL NO.: ES 4600HC DC-Input Max.input voltage (Voc): 500 d.c. V Max.short circuit current (Isc): 2 x 12.1 d.c. A AC-Output Rated output voltage: 230 a.c. V Rated output frequency: 50/60Hz Rated output apparent power: 4600VA Rated output current: 20 a.c. A PF range: cos <math>\phi</math> 0.9 - 1.0 Enclosure: IP 65 Complying with VDE 0126-1, VDE-AR-N 4105 Protective class I ABLEREX ELECTRONICS CO., LTD.</p> <div></div> <p>MA3C0130001</p>	<p>MODEL NO.: ES 5000HC DC-Input Max.input voltage (Voc): 500 d.c. V Max.short circuit current (Isc): 2 x 13.2 d.c. A AC-Output Rated output voltage: 230 a.c. V Rated output frequency: 50/60Hz Rated output apparent power: 5000VA Rated output current: 21.7 a.c. A PF range: cos <math>\phi</math> 0.9 - 1.0 Enclosure: IP 65 Complying with VDE 0126-1 VDE-AR-N 4105(De-rating to 4600VA for Germany) Protective class I ABLEREX ELECTRONICS CO., LTD.</p> <div></div> <p>MA3C0130001</p>	

MODEL NO.: ES 3000T  
DC-Input  
Max.input voltage (Voc): 500 d.c. V  
Max.short circuit current (Isc): 2 x 7.9 d.c. A  
AC-Output  
Rated output voltage: 230 a.c. V  
Rated output frequency: 50/60Hz  
Rated output apparent power: 3000VA  
Rated output current: 13 a.c. A  
PF range: cos  $\phi$  0.9 - 1.0  
Enclosure: IP 65  
Complying with VDE 0126-1, VDE-AR-N 4105  
Protective class I  
ABLEREX ELECTRONICS CO., LTD.



MA3C0130001

MODEL NO.: ES 3680T  
DC-Input  
Max.input voltage (Voc): 500 d.c. V  
Max.short circuit current (Isc): 2 x 9.7 d.c. A  
AC-Output  
Rated output voltage: 230 a.c. V  
Rated output frequency: 50/60Hz  
Rated output apparent power: 3680VA  
Rated output current: 16 a.c. A  
PF range: cos  $\phi$  0.9 - 1.0  
Enclosure: IP 65  
Complying with VDE 0126-1, VDE-AR-N 4105  
Protective class I  
ABLEREX ELECTRONICS CO., LTD.



MA3C0130001

MODEL NO.: ES 4000T  
DC-Input  
Max.input voltage (Voc): 500 d.c. V  
Max.short circuit current (Isc): 2 x 10.5 d.c. A  
AC-Output  
Rated output voltage: 230 a.c. V  
Rated output frequency: 50/60Hz  
Rated output apparent power: 4000VA  
Rated output current: 17.4 a.c. A  
PF range: cos  $\phi$  0.9 - 1.0  
Enclosure: IP 65  
Complying with VDE 0126-1, VDE-AR-N 4105  
Protective class I  
ABLEREX ELECTRONICS CO., LTD.



MA3C0130001

MODEL NO.: ES 4600T  
DC-Input  
Max.input voltage (Voc): 500 d.c. V  
Max.short circuit current (Isc): 2 x 12.1 d.c. A  
AC-Output  
Rated output voltage: 230 a.c. V  
Rated output frequency: 50/60Hz  
Rated output apparent power: 4600VA  
Rated output current: 20 a.c. A  
PF range: cos  $\phi$  0.9 - 1.0  
Enclosure: IP 65  
Complying with VDE 0126-1, VDE-AR-N 4105  
Protective class I  
ABLEREX ELECTRONICS CO., LTD.



MA3C0130001

MODEL NO.: ES 5000T  
DC-Input  
Max.input voltage (Voc): 500 d.c. V  
Max.short circuit current (Isc): 2 x 13.2 d.c. A  
AC-Output  
Rated output voltage: 230 a.c. V  
Rated output frequency: 50/60Hz  
Rated output apparent power: 5000VA  
Rated output current: 21.7 a.c. A  
PF range: cos  $\phi$  0.9 - 1.0  
Enclosure: IP 65  
Complying with VDE 0126-1  
VDE-AR-N 4105(De-rating to 4600VA for Germany)  
Protective class I  
ABLEREX ELECTRONICS CO., LTD.



MA3C0130001

MODEL NO.: ES 5500T  
DC-Input  
Max.input voltage (Voc): 500 d.c. V  
Max.short circuit current (Isc): 2 x 13.2 d.c. A  
AC-Output  
Rated output voltage: 230 a.c. V  
Rated output frequency: 50/60Hz  
Rated output apparent power: 5500VA  
Rated output current: 23.9 a.c. A  
PF range: cos  $\phi$  0.9 - 1.0  
Enclosure: IP 65  
Complying with VDE 0126-1  
VDE-AR-N 4105(De-rating to 4600VA for Germany)  
Protective class I  
ABLEREX ELECTRONICS CO., LTD.



MA3C0130001

MODEL NO.: ES 3330W  
DC-Input  
Max.input voltage (Voc): 500 d.c. V  
Max.short circuit current (Isc): 2 x 9.7 d.c. A  
AC-Output  
Rated output voltage: 230 a.c. V  
Rated output frequency: 50/60Hz  
Rated output apparent power: 3680VA  
Rated output current: 16 a.c. A  
PF range: cos  $\phi$  0.9 - 1.0  
Enclosure: IP 65  
Complying with VDE 0126-1, VDE-AR-N 4105  
Protective class I  
ABLEREX ELECTRONICS CO., LTD.



MA3C0130001

MODEL NO.: ES 3990W  
DC-Input  
Max.input voltage (Voc): 500 d.c. V  
Max.short circuit current (Isc): 2 x 10.5 d.c. A  
AC-Output  
Rated output voltage: 230 a.c. V  
Rated output frequency: 50/60Hz  
Rated output apparent power: 4000VA  
Rated output current: 17.4 a.c. A  
PF range: cos  $\phi$  0.9 - 1.0  
Enclosure: IP 65  
Complying with VDE 0126-1, VDE-AR-N 4105  
Protective class I  
ABLEREX ELECTRONICS CO., LTD.



MA3C0130001

MODEL NO.: ES 4990W  
DC-Input  
Max.input voltage (Voc): 500 d.c. V  
Max.short circuit current (Isc): 2 x 13.2 d.c. A  
AC-Output  
Rated output voltage: 230 a.c. V  
Rated output frequency: 50/60Hz  
Rated output apparent power: 5000VA  
Rated output current: 21.7 a.c. A  
PF range: cos  $\phi$  0.9 - 1.0  
Enclosure: IP 65  
Complying with VDE 0126-1  
VDE-AR-N 4105(De-rating to 4600VA for Germany)  
Protective class I  
ABLEREX ELECTRONICS CO., LTD.

MA3C0130001

MODEL NO.: ES 5500W  
DC-Input  
Max.input voltage (Voc): 500 d.c. V  
Max.short circuit current (Isc): 2 x 13.2 d.c. A  
AC-Output  
Rated output voltage: 230 a.c. V  
Rated output frequency: 50/60Hz  
Rated output apparent power: 5500VA  
Rated output current: 23.9 a.c. A  
PF range: cos  $\phi$  0.9 - 1.0  
Enclosure: IP 65  
Complying with VDE 0126-1  
VDE-AR-N 4105(De-rating to 4600VA for Germany)  
Protective class I  
ABLEREX ELECTRONICS CO., LTD.

MA3C0130001

The artwork above may be only a draft.

<b>History Sheet:</b>			
Name	Date	Comment	Revision
Dino Kao	2017-03-28	Initial report was written	--
Dino Kao	2017-05-11	Add Models ES 3000T, ES 3680T, ES 4000T, ES 4600T, ES 5000T, and ES 5500T. Add Test for Model ES 5500T.	A
Dino Kao	2017-08-25	Correct typo for heatsink. (ES xxxxT: 300 x 284,5 x 39 mm) Add model name "ES 5500H, ES 3330W, ES 3990W, ES 4990W, ES 5500W" for marketing purpose. Alternate construction and photos for models ES 3000T, ES 3680T, ES 4000T, ES 4600T, ES 5000T, ES 5500T. No any additional test needed.	B

<b>Address of the manufacturer sites:</b>
<p><b>1) Ablerex Electronics (SUZHOU) Co., Ltd.</b> No. 36 Wang Wu Road, Wu Zhong District Suzhou, 215128, P.R. China</p> <p><b>2) Ablerex Electronics Co., Ltd.</b> No. 1-1, Gongye Rd., Pingtung City, Pingtung Country 90049, Taiwan</p>

<b>Particulars:</b>	
Equipment mobility .....	Permanent connection
Operating condition .....	Continuous
Class of equipment .....	Class I
<b>Test case verdicts:</b>	
Test case does not apply to the test object .....	<b>N/A</b>
Test item does meet the requirement .....	<b>P(ass)</b>
Test item does not meet the requirement .....	<b>F(ail)</b>
<b>Testing:</b>	
Date of receipt of test item .....	1) 2013-04-16 2) 2017-03-30
Date(s) of performance of test .....	1) 2013-06-10 to 2013-06-28 2) 2017-04-10 to 2017-04-14
<b>General remarks:</b> <p>The test result presented in this report relate only to the object(s) tested.  This report shall not be reproduced, except in full, without the written approval of the applicant.  Throughout this report a comma is used as the decimal separator.  Some test results are reference report number: " PV170217E03A " due to the same circuits design.  Remark 1: The previous report " PV170217E03A " is replaced by this report.</p>	
<b>Model Differences:</b> <p>The models ES 3000H, ES 3680H, ES 4000H, and ES 4600H are identical in hardware and software with ES 5000H except for electrical ratings (Software setting).</p> <p>The models ES 3000HC, ES 3680HC, ES 4000HC, ES 4600HC, and ES 5000HC are identical in hardware and software with ES 3000H, ES 3680H, ES 4000H, ES 4600H, and ES 5000H except for model type.</p> <p>The models ES 3330W, ES 3990W, ES 4990W, and ES 5500W are identical in hardware and software with ES 3680T, ES 4000T, ES 5000T, and ES 5500T except for model type.</p> <p>The models ES 3000T, ES 3680T, ES 4000T, ES 4600T, ES 5000T, and ES 5500H are identical in hardware and software with ES 5500T except for electrical ratings (Software setting).</p> <p>The models ES 3000T, ES 3680T, ES 4000T, ES 4600T, ES 5000T, ES 5500T, and ES 5500H are identical in hardware and software with ES 3000H. ES 3680H, ES 4000H, ES 4600H, and ES 5000H except for size of heatsink. (ES xxxxH: 425 x 300 x 39 mm; ES xxxT, ES 5500H: 300 x 284,5 x 39 mm)</p> <p>All tests were performed on EUTs of ES 3000H. ES 3680H, ES 4000H, ES 4600H, ES 5000H, and ES 5500T. Test of the EUTs of ES 3000H. ES 3680H, ES 4000H, ES 4600H, ES 5000H, and ES 5500T applicable for the models ES 3000HC, ES 3680HC, ES 4000HC, ES 4600HC, ES 5000HC, ES 3000T, ES 3680T, ES 4000T, ES 4600T, ES 5000T, ES 5500H, ES 3330W, ES 3990W, ES 4990W, and ES 5500W were performed on the concerned models and a statement is given at the relevant test.</p>	
<b>This Test Report consists of the following documents:</b> <ol style="list-style-type: none"> <li>1. Test Results</li> <li>2. Annex 1: Pictures of the unit</li> <li>3. Annex 2: Test equipment list</li> </ol>	



4.5 (B1) Harmonic Current Limit Test				P
Test Sample: ES 3000H				
Watts [kW]		2,976		
VA [kVA]		2,978		
Vrms [V]		230,14		
Arms [A]		12,941		
Power Factor		0,999		
THD [%]		3,337		
Harmonics	Current Magnitude (A)	% of Fundamental	Phase	Harmonic Current Limits (%)
1st	12,934	99,162	Single Phase	--
2nd	0,080	0,613	Single Phase	1
3rd	0,298	2,290	Single Phase	4
4th	0,028	0,218	Single Phase	1
5th	0,130	0,996	Single Phase	4
6th	0,039	0,301	Single Phase	1
7th	0,147	1,132	Single Phase	4
8th	0,021	0,159	Single Phase	1
9th	0,136	1,046	Single Phase	4
10th	0,013	0,100	Single Phase	1
11th	0,093	0,718	Single Phase	2
12th	0,024	0,187	Single Phase	0,5
13th	0,079	0,611	Single Phase	2
14th	0,029	0,220	Single Phase	0,5
15th	0,064	0,489	Single Phase	2
16th	0,036	0,280	Single Phase	0,5
17th	0,047	0,364	Single Phase	1,5
18th	0,018	0,137	Single Phase	0,375
19th	0,040	0,309	Single Phase	1,5
20th	0,012	0,092	Single Phase	0,375
21th	0,038	0,291	Single Phase	1,5
22th	0,015	0,112	Single Phase	0,375
23th	0,032	0,248	Single Phase	0,6
24th	0,014	0,107	Single Phase	0,15
25th	0,027	0,206	Single Phase	0,6
26th	0,014	0,111	Single Phase	0,15
27th	0,025	0,189	Single Phase	0,6
28th	0,013	0,098	Single Phase	0,15
29th	0,024	0,188	Single Phase	0,6
30th	0,011	0,086	Single Phase	0,15
31th	0,020	0,157	Single Phase	0,6
32th	0,011	0,083	Single Phase	0,15
33th	0,014	0,110	Single Phase	0,6
34th	0,009	0,071	Single Phase	0,15
35th	0,014	0,107	Single Phase	0,3
36th	0,008	0,064	Single Phase	0,075
37th	0,008	0,064	Single Phase	0,3
38th	0,008	0,065	Single Phase	0,075
39th	0,009	0,073	Single Phase	0,3
40th	0,008	0,061	Single Phase	0,075



Test Sample: ES 3680H				
Watts [kW]		3,612		
VA [kVA]		3,614		
Vrms [V]		230,26		
Arms [A]		15,696		
Power Factor		0,999		
THD [%]		3,156		
Harmonics	Current Magnitude (A)	% of Fundamental	Phase	Harmonic Current Limits (%)
1st	15,688	98,050	Single Phase	--
2nd	0,096	0,598	Single Phase	1
3rd	0,323	2,020	Single Phase	4
4th	0,027	0,168	Single Phase	1
5th	0,141	0,883	Single Phase	4
6th	0,052	0,325	Single Phase	1
7th	0,170	1,063	Single Phase	4
8th	0,042	0,264	Single Phase	1
9th	0,173	1,080	Single Phase	4
10th	0,031	0,192	Single Phase	1
11th	0,143	0,891	Single Phase	2
12th	0,021	0,130	Single Phase	0,5
13th	0,136	0,852	Single Phase	2
14th	0,021	0,130	Single Phase	0,5
15th	0,092	0,572	Single Phase	2
16th	0,027	0,169	Single Phase	0,5
17th	0,040	0,249	Single Phase	1,5
18th	0,022	0,134	Single Phase	0,375
19th	0,022	0,139	Single Phase	1,5
20th	0,018	0,114	Single Phase	0,375
21th	0,019	0,120	Single Phase	1,5
22th	0,017	0,104	Single Phase	0,375
23th	0,015	0,093	Single Phase	0,6
24th	0,011	0,069	Single Phase	0,15
25th	0,015	0,096	Single Phase	0,6
26th	0,012	0,078	Single Phase	0,15
27th	0,014	0,089	Single Phase	0,6
28th	0,012	0,077	Single Phase	0,15
29th	0,016	0,101	Single Phase	0,6
30th	0,015	0,092	Single Phase	0,15
31th	0,016	0,101	Single Phase	0,6
32th	0,013	0,080	Single Phase	0,15
33th	0,017	0,103	Single Phase	0,6
34th	0,010	0,064	Single Phase	0,15
35th	0,017	0,107	Single Phase	0,3
36th	0,011	0,067	Single Phase	0,075
37th	0,012	0,078	Single Phase	0,3
38th	0,008	0,049	Single Phase	0,075
39th	0,013	0,080	Single Phase	0,3
40th	0,007	0,043	Single Phase	0,075

Test Sample: ES 4000H				
Watts [kW]		3,895		
VA [kVA]		3,897		
Vrms [V]		230,25		
Arms [A]		16,927		
Power Factor		0,999		
THD [%]		2,993		
Harmonics	Current Magnitude (A)	% of Fundamental	Phase	Harmonic Current Limits (%)
1st	16,918	97,280	Single Phase	--
2nd	0,116	0,667	Single Phase	1
3rd	0,322	1,848	Single Phase	4
4th	0,031	0,180	Single Phase	1
5th	0,145	0,835	Single Phase	4
6th	0,041	0,235	Single Phase	1
7th	0,172	0,987	Single Phase	4
8th	0,036	0,206	Single Phase	1
9th	0,176	1,014	Single Phase	4
10th	0,026	0,147	Single Phase	1
11th	0,154	0,885	Single Phase	2
12th	0,015	0,088	Single Phase	0,5
13th	0,150	0,865	Single Phase	2
14th	0,018	0,104	Single Phase	0,5
15th	0,112	0,644	Single Phase	2
16th	0,026	0,147	Single Phase	0,5
17th	0,048	0,278	Single Phase	1,5
18th	0,022	0,125	Single Phase	0,375
19th	0,027	0,157	Single Phase	1,5
20th	0,021	0,122	Single Phase	0,375
21th	0,022	0,126	Single Phase	1,5
22th	0,015	0,084	Single Phase	0,375
23th	0,014	0,083	Single Phase	0,6
24th	0,011	0,062	Single Phase	0,15
25th	0,011	0,063	Single Phase	0,6
26th	0,012	0,069	Single Phase	0,15
27th	0,011	0,063	Single Phase	0,6
28th	0,010	0,055	Single Phase	0,15
29th	0,013	0,077	Single Phase	0,6
30th	0,013	0,072	Single Phase	0,15
31th	0,013	0,072	Single Phase	0,6
32th	0,009	0,051	Single Phase	0,15
33th	0,014	0,079	Single Phase	0,6
34th	0,009	0,051	Single Phase	0,15
35th	0,015	0,088	Single Phase	0,3
36th	0,009	0,052	Single Phase	0,075
37th	0,012	0,069	Single Phase	0,3
38th	0,006	0,032	Single Phase	0,075
39th	0,013	0,076	Single Phase	0,3
40th	0,008	0,044	Single Phase	0,075

Test Sample: ES 4600H				
Watts [kW]		4,558		
VA [kVA]		4,560		
Vrms [V]		230,34		
Arms [A]		19,797		
Power Factor		0,999		
THD [%]		2,991		
Harmonics	Current Magnitude (A)	% of Fundamental	Phase	Harmonic Current Limits (%)
1st	19,804	99,020	Single Phase	--
2nd	0,128	0,640	Single Phase	1
3rd	0,361	1,807	Single Phase	4
4th	0,037	0,186	Single Phase	1
5th	0,158	0,791	Single Phase	4
6th	0,046	0,229	Single Phase	1
7th	0,184	0,919	Single Phase	4
8th	0,046	0,228	Single Phase	1
9th	0,193	0,963	Single Phase	4
10th	0,037	0,183	Single Phase	1
11th	0,177	0,885	Single Phase	2
12th	0,021	0,106	Single Phase	0,5
13th	0,183	0,916	Single Phase	2
14th	0,036	0,179	Single Phase	0,5
15th	0,160	0,801	Single Phase	2
16th	0,026	0,131	Single Phase	0,5
17th	0,080	0,401	Single Phase	1,5
18th	0,024	0,119	Single Phase	0,375
19th	0,047	0,233	Single Phase	1,5
20th	0,019	0,094	Single Phase	0,375
21th	0,041	0,203	Single Phase	1,5
22th	0,013	0,066	Single Phase	0,375
23th	0,027	0,133	Single Phase	0,6
24th	0,013	0,063	Single Phase	0,15
25th	0,020	0,099	Single Phase	0,6
26th	0,010	0,050	Single Phase	0,15
27th	0,015	0,076	Single Phase	0,6
28th	0,008	0,041	Single Phase	0,15
29th	0,020	0,100	Single Phase	0,6
30th	0,008	0,039	Single Phase	0,15
31th	0,015	0,077	Single Phase	0,6
32th	0,008	0,038	Single Phase	0,15
33th	0,009	0,043	Single Phase	0,6
34th	0,007	0,037	Single Phase	0,15
35th	0,013	0,063	Single Phase	0,3
36th	0,009	0,043	Single Phase	0,075
37th	0,006	0,032	Single Phase	0,3
38th	0,008	0,038	Single Phase	0,075
39th	0,009	0,045	Single Phase	0,3
40th	0,009	0,047	Single Phase	0,075

Test Sample: ES 5000H				
Watts [kW]		5,002		
VA [kVA]		5,004		
Vrms [V]		230,42		
Arms [A]		21,717		
Power Factor		0,999		
THD [%]		3,008		
Harmonics	Current Magnitude (A)	% of Fundamental	Phase	Harmonic Current Limits (%)
1st	21,707	99,850	Single Phase	--
2nd	0,141	0,648	Single Phase	1
3rd	0,402	1,851	Single Phase	4
4th	0,055	0,255	Single Phase	1
5th	0,170	0,783	Single Phase	4
6th	0,039	0,182	Single Phase	1
7th	0,190	0,876	Single Phase	4
8th	0,041	0,191	Single Phase	1
9th	0,203	0,935	Single Phase	4
10th	0,028	0,128	Single Phase	1
11th	0,187	0,863	Single Phase	2
12th	0,023	0,105	Single Phase	0,5
13th	0,196	0,902	Single Phase	2
14th	0,029	0,136	Single Phase	0,5
15th	0,181	0,835	Single Phase	2
16th	0,033	0,151	Single Phase	0,5
17th	0,098	0,454	Single Phase	1,5
18th	0,026	0,121	Single Phase	0,375
19th	0,050	0,232	Single Phase	1,5
20th	0,025	0,117	Single Phase	0,375
21th	0,052	0,239	Single Phase	1,5
22th	0,021	0,095	Single Phase	0,375
23th	0,036	0,166	Single Phase	0,6
24th	0,018	0,082	Single Phase	0,15
25th	0,025	0,116	Single Phase	0,6
26th	0,013	0,061	Single Phase	0,15
27th	0,022	0,103	Single Phase	0,6
28th	0,011	0,052	Single Phase	0,15
29th	0,025	0,115	Single Phase	0,6
30th	0,010	0,046	Single Phase	0,15
31th	0,022	0,102	Single Phase	0,6
32th	0,010	0,044	Single Phase	0,15
33th	0,012	0,056	Single Phase	0,6
34th	0,008	0,038	Single Phase	0,15
35th	0,016	0,075	Single Phase	0,3
36th	0,009	0,039	Single Phase	0,075
37th	0,009	0,040	Single Phase	0,3
38th	0,008	0,039	Single Phase	0,075
39th	0,010	0,046	Single Phase	0,3
40th	0,008	0,036	Single Phase	0,075

Test Sample: ES 5500T				
Watts [kW]		5,555		
VA [kVA]		5,558		
Vrms [V]		230,50		
Arms [A]		24,113		
Power Factor		0,999		
THD [%]		3,280		
Harmonics	Current Magnitude (A)	% of Fundamental	Phase	Harmonic Current Limits (%)
1st	24,100	100,781	Single Phase	--
2nd	0,216	0,902	Single Phase	1
3rd	0,455	1,901	Single Phase	4
4th	0,170	0,712	Single Phase	1
5th	0,235	0,981	Single Phase	4
6th	0,039	0,164	Single Phase	1
7th	0,225	0,939	Single Phase	4
8th	0,068	0,286	Single Phase	1
9th	0,222	0,928	Single Phase	4
10th	0,046	0,192	Single Phase	1
11th	0,195	0,816	Single Phase	2
12th	0,037	0,154	Single Phase	0,5
13th	0,209	0,872	Single Phase	2
14th	0,054	0,226	Single Phase	0,5
15th	0,204	0,853	Single Phase	2
16th	0,048	0,202	Single Phase	0,5
17th	0,093	0,387	Single Phase	1,5
18th	0,058	0,241	Single Phase	0,375
19th	0,076	0,317	Single Phase	1,5
20th	0,085	0,357	Single Phase	0,375
21th	0,103	0,429	Single Phase	1,5
22th	0,049	0,206	Single Phase	0,375
23th	0,055	0,231	Single Phase	0,6
24th	0,032	0,135	Single Phase	0,15
25th	0,043	0,181	Single Phase	0,6
26th	0,025	0,105	Single Phase	0,15
27th	0,037	0,156	Single Phase	0,6
28th	0,022	0,090	Single Phase	0,15
29th	0,033	0,138	Single Phase	0,6
30th	0,017	0,072	Single Phase	0,15
31th	0,024	0,100	Single Phase	0,6
32th	0,015	0,063	Single Phase	0,15
33th	0,024	0,098	Single Phase	0,6
34th	0,013	0,053	Single Phase	0,15
35th	0,021	0,086	Single Phase	0,3
36th	0,011	0,046	Single Phase	0,075
37th	0,018	0,074	Single Phase	0,3
38th	0,010	0,041	Single Phase	0,075
39th	0,014	0,058	Single Phase	0,3
40th	0,009	0,036	Single Phase	0,075
<b>Note:</b> ISC/IL = 20 Ref. to Table 2 of the IEEE 519:2014 Some test results are reference report number: "PV130409E08-2 " due to the same circuits design.				

5.1 Harmonic Voltage Limit Test				P
Test conditions:				
THD50 [%]			0,053	
Harmonics	Voltage Magnitude (V)	% of Fundamental	Phase	Harmonic Limits of Test Voltage (%)
1st	230,33	100,000	Single Phase	--
2nd	0,011	0,005	Single Phase	5
3rd	0,054	0,024	Single Phase	5
4th	0,009	0,004	Single Phase	5
5th	0,054	0,023	Single Phase	5
6th	0,002	0,001	Single Phase	5
7th	0,022	0,009	Single Phase	5
8th	0,017	0,007	Single Phase	5
9th	0,028	0,012	Single Phase	5
10th	0,006	0,003	Single Phase	5
11th	0,044	0,019	Single Phase	5
12th	0,008	0,003	Single Phase	5
13th	0,046	0,020	Single Phase	5
14th	0,009	0,004	Single Phase	5
15th	0,023	0,010	Single Phase	5
16th	0,004	0,002	Single Phase	5
17th	0,020	0,009	Single Phase	5
18th	0,014	0,006	Single Phase	5
19th	0,020	0,009	Single Phase	5
20th	0,005	0,002	Single Phase	5
21th	0,017	0,007	Single Phase	5
22th	0,003	0,001	Single Phase	5
23th	0,013	0,006	Single Phase	5
24th	0,009	0,004	Single Phase	5
25th	0,013	0,005	Single Phase	5
26th	0,004	0,002	Single Phase	5
27th	0,009	0,004	Single Phase	5
28th	0,003	0,001	Single Phase	5
29th	0,013	0,006	Single Phase	5
30th	0,003	0,002	Single Phase	5
31th	0,011	0,005	Single Phase	5
32th	0,004	0,002	Single Phase	5
33th	0,006	0,003	Single Phase	5
34th	0,004	0,002	Single Phase	5
35th	0,011	0,005	Single Phase	5
36th	0,005	0,002	Single Phase	5
37th	0,005	0,002	Single Phase	5
38th	0,006	0,002	Single Phase	5
39th	0,007	0,003	Single Phase	5
40th	0,006	0,003	Single Phase	5
41th	0,006	0,003	Single Phase	5
42th	0,004	0,002	Single Phase	5
43th	0,006	0,003	Single Phase	5
44th	0,006	0,003	Single Phase	5
45th	0,006	0,003	Single Phase	5



Harmonics	Voltage Magnitude (V)	% of Fundamental	Phase	Harmonic Limits of Test Voltage (%)
46th	0,006	0,003	Single Phase	5
47th	0,006	0,003	Single Phase	5
48th	0,006	0,003	Single Phase	5
49th	0,008	0,003	Single Phase	5

**Note:**

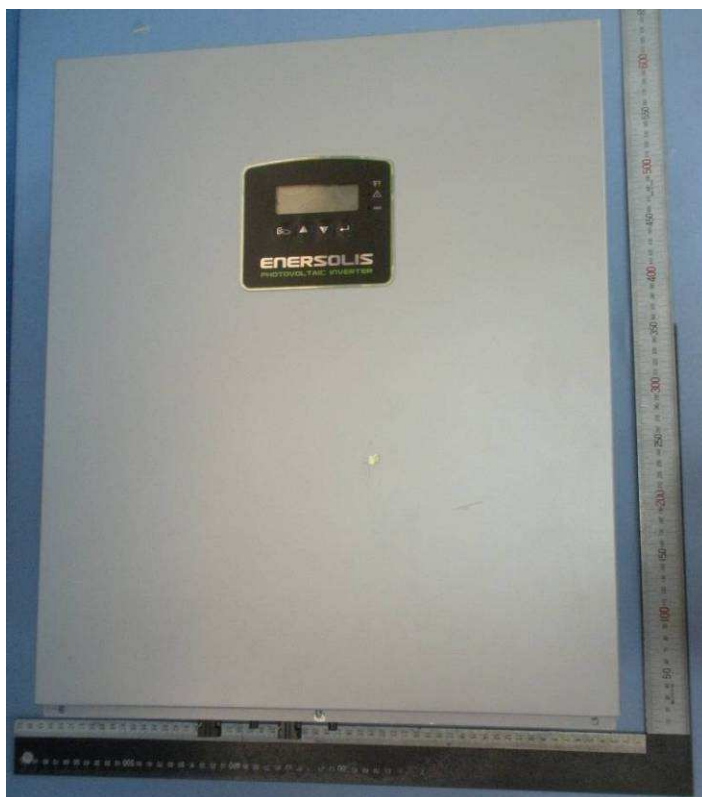
Some test results are reference report number: "PV130409E08-2 " due to the same circuits design.



# **Annex 1**

## **Pictures of the unit**

**Inverter (ES 5000H)  
Enclosure front**



**Inverter (ES 5000H)  
AC-DC section**



**Enclosure back side (ES 5000H)**



**Enclosure top (ES 5000H)**



**Enclosure left side (ES 5000H)**

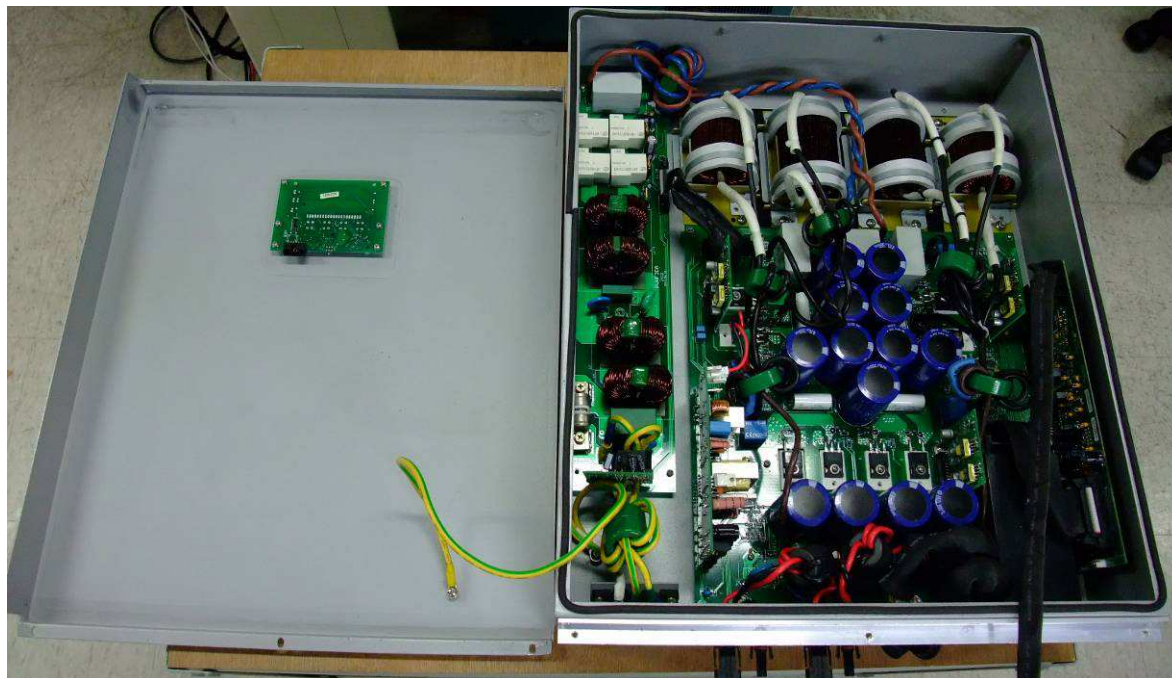


**Enclosure right side (ES 5000H)**





**Inverter (ES 5000H)**  
**Interior view**



**Inverter (ES 5500T)  
Enclosure front**



**Inverter (ES 5500T)  
AC-DC section**



**Enclosure back side (ES 5500T)**



**Enclosure top (ES 5500T)**

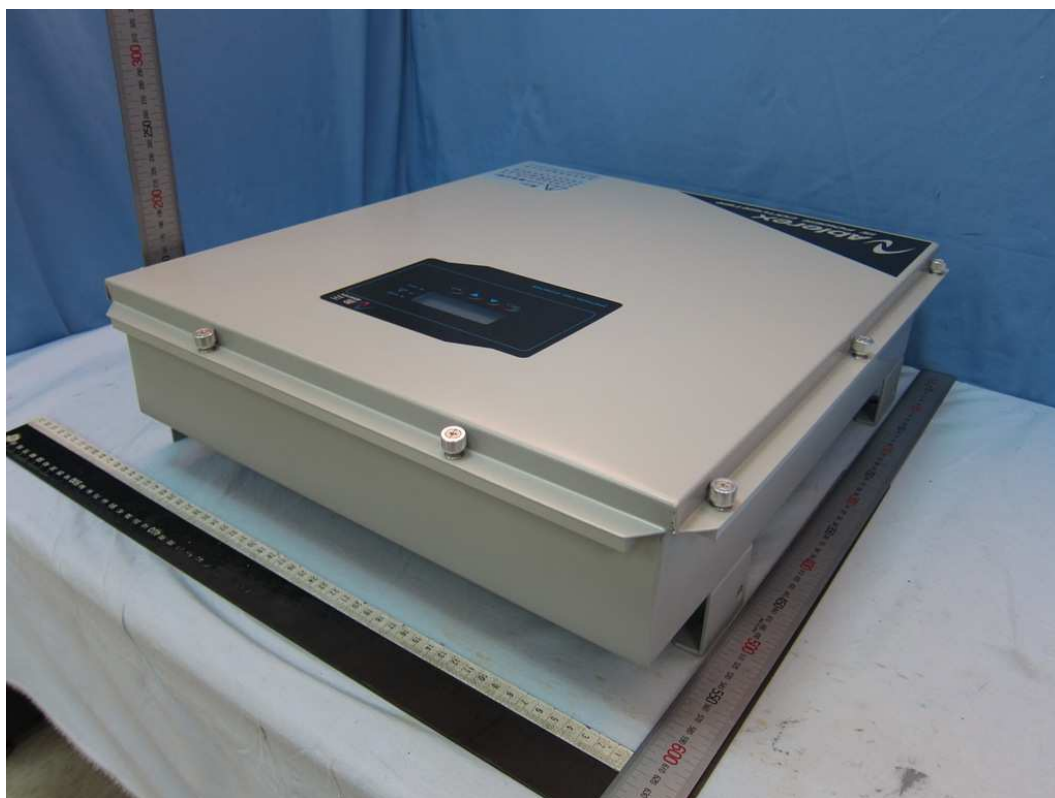




**Enclosure right/bottom side (ES 5500T)**



**Enclosure left/top (ES 5500T)**



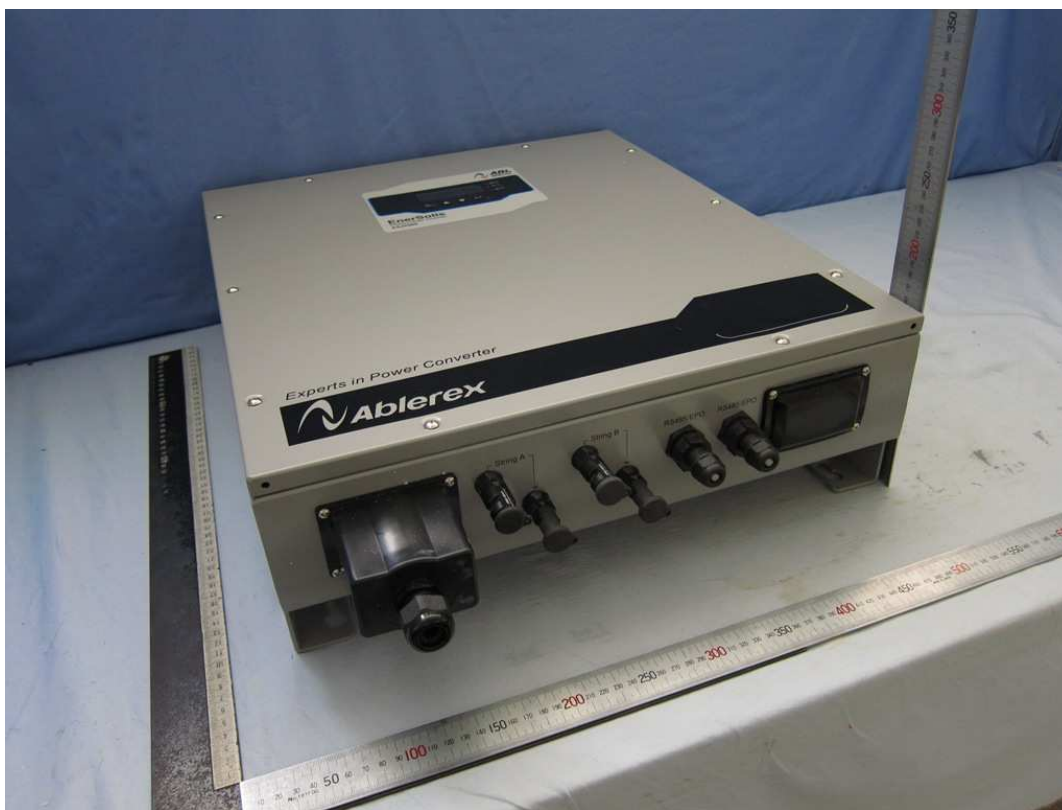
**Inverter (ES 5500T, Alternate construction)  
Enclosure front**



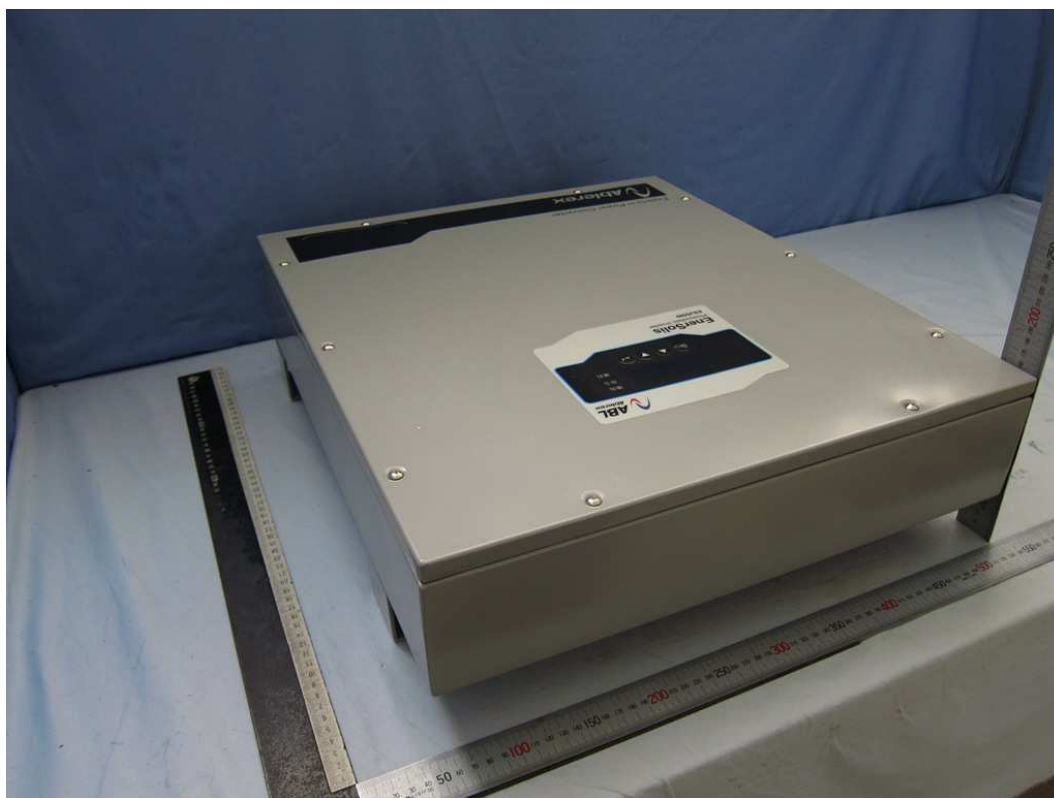
**Inverter (ES 5500T, Alternate construction)  
AC-DC section**



**Enclosure left /bottom side (ES 5500T, Alternate construction)**



**Enclosure right/top (ES 5500T, Alternate construction)**





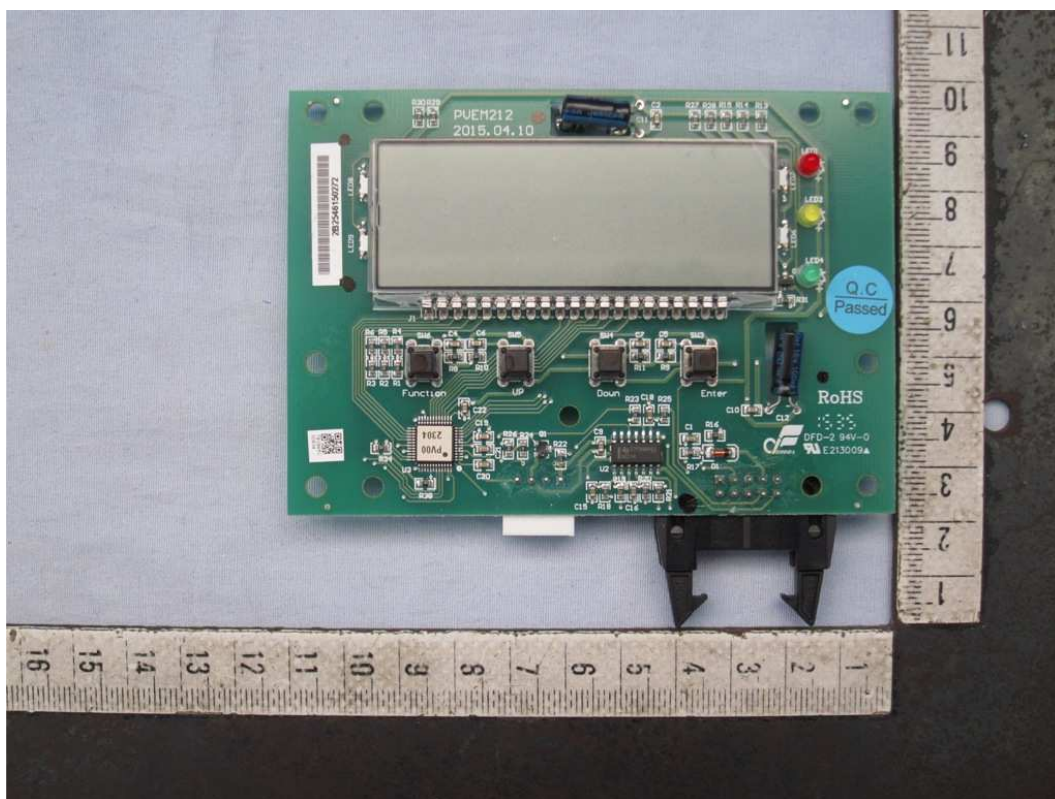
**Interior view (ES 5500T)**



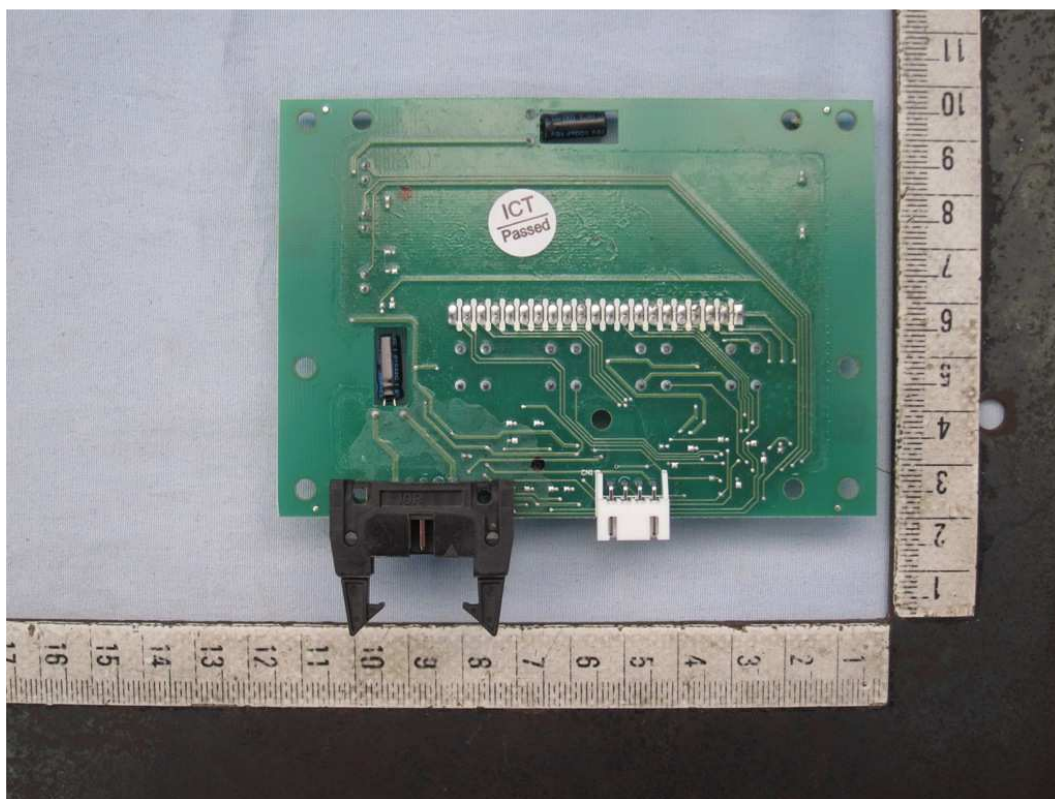
**Interior view (ES 5500T)**



**LCD Display Board\_component side view**

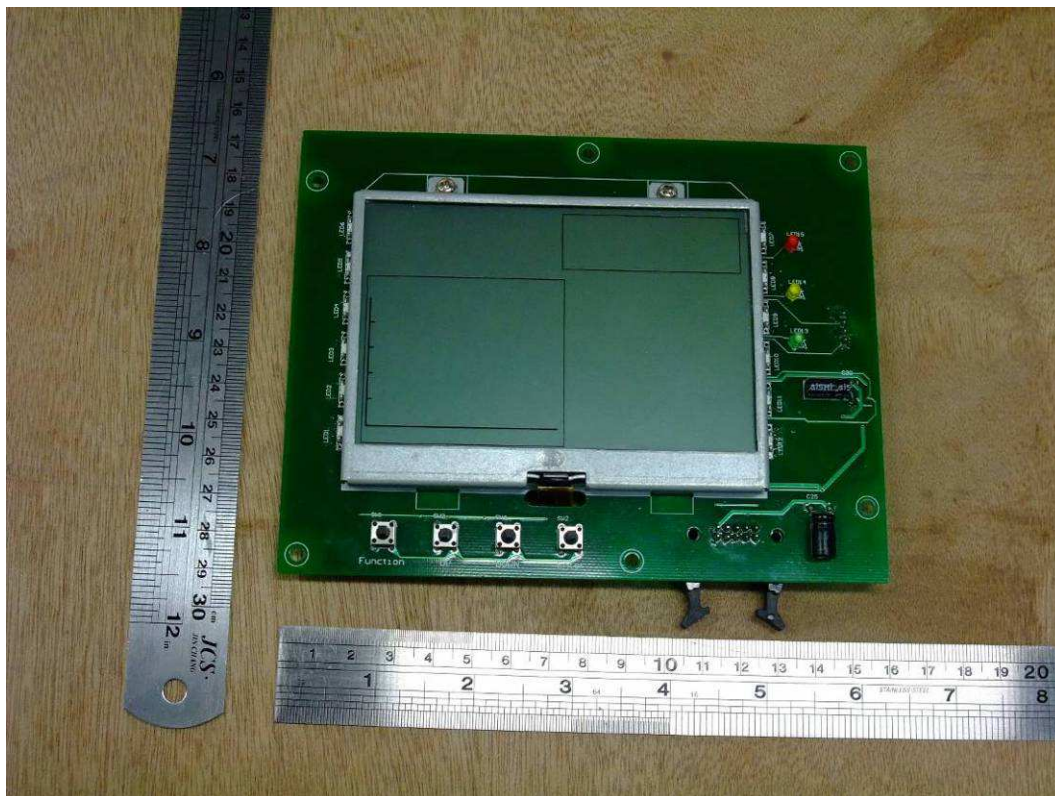


**LCD Display driver Board\_Solder side view**

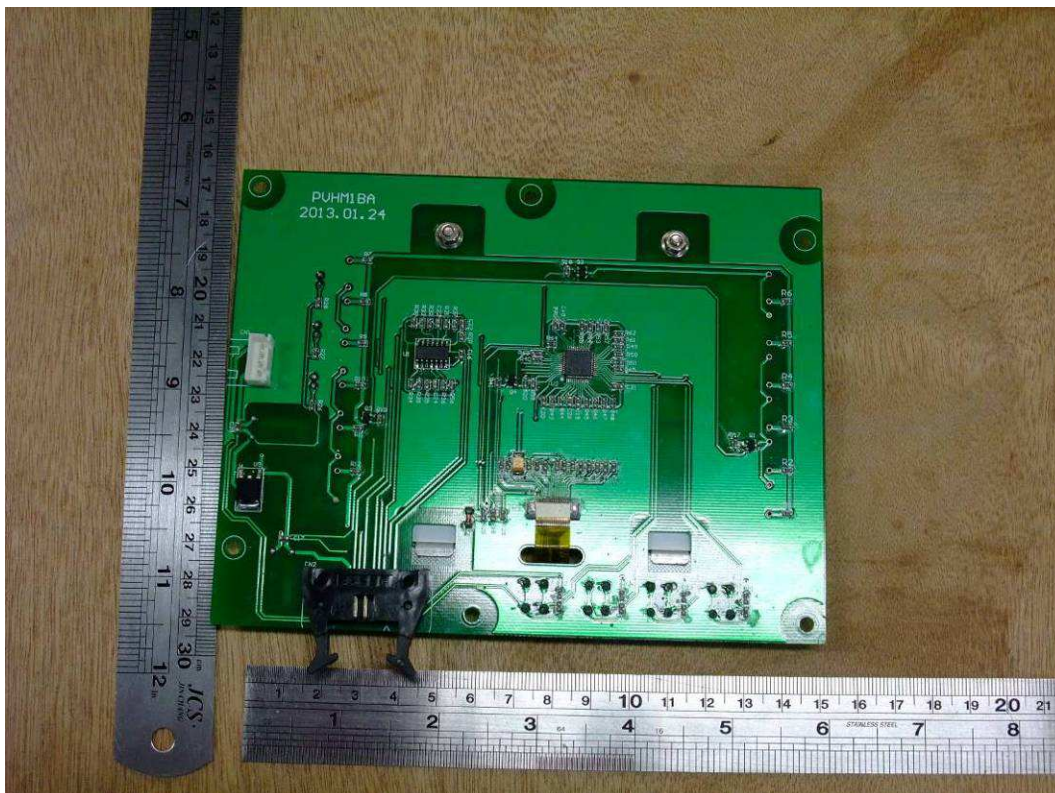




**Alternate LCD panel board\_component side view**

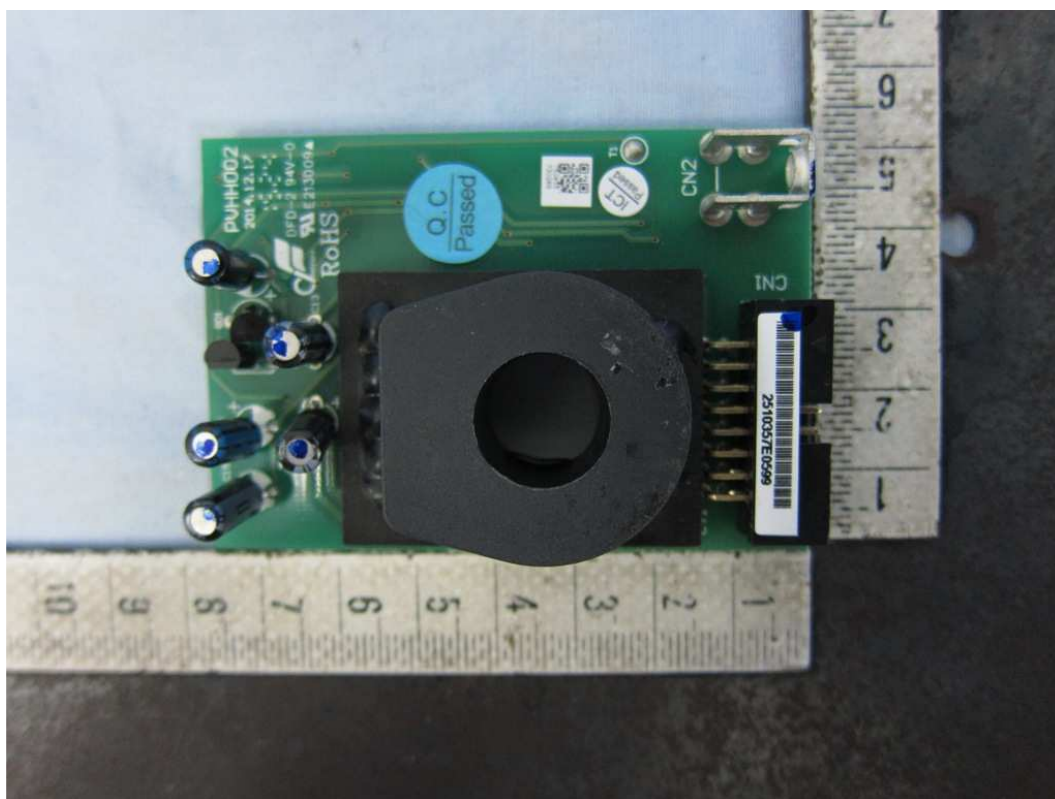


**Alternate LCD panel board\_Solder side view**

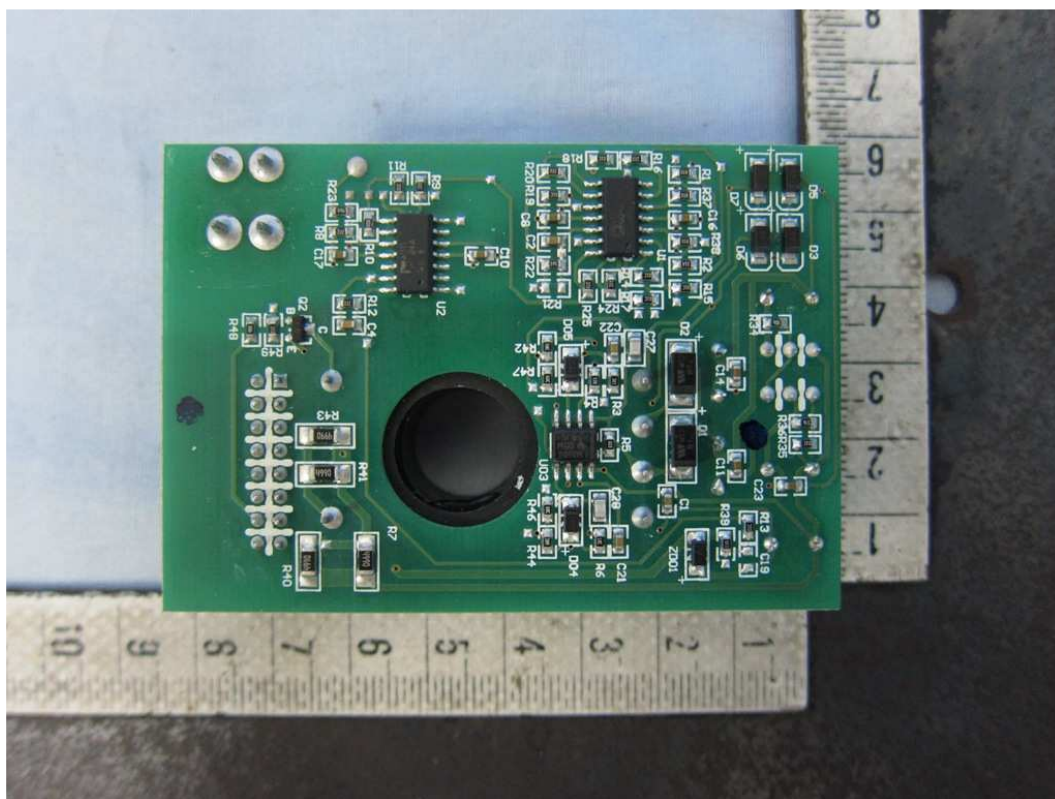




**RCMU Board\_component side view**

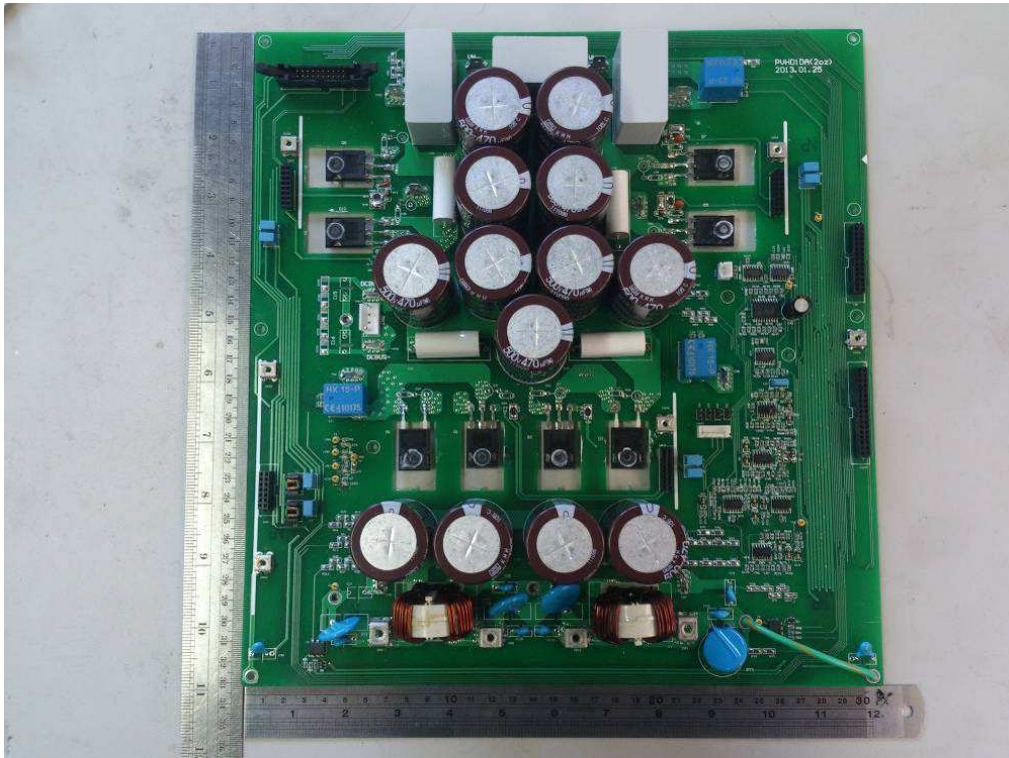


**RCMU Board\_Solder side view**

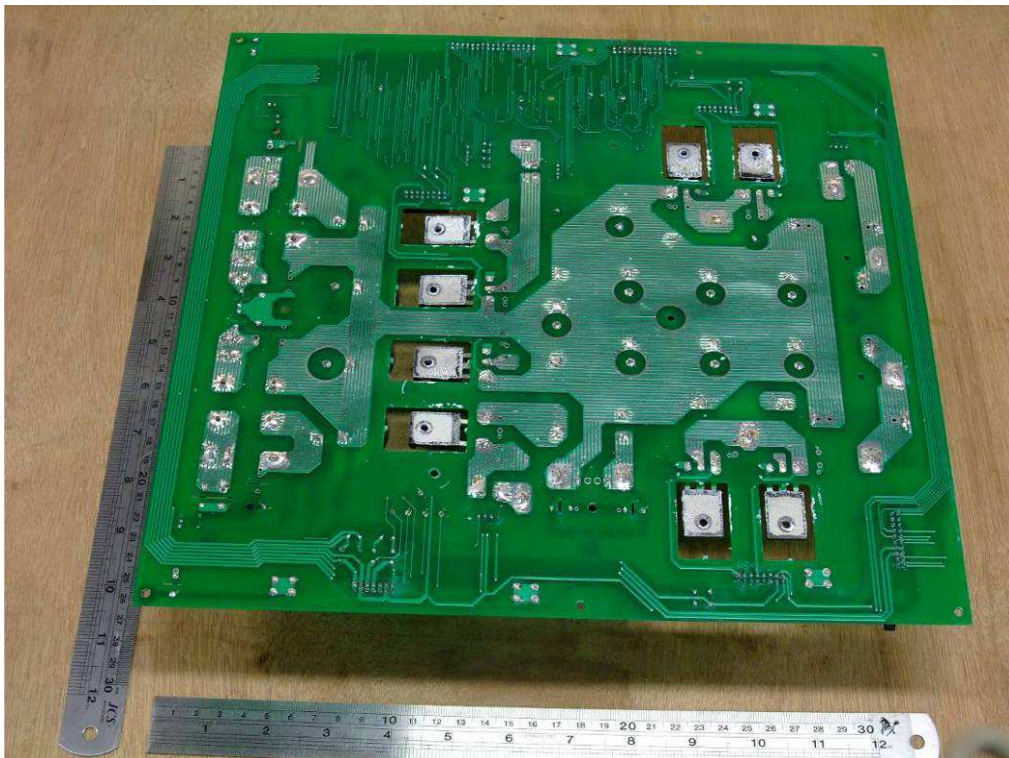




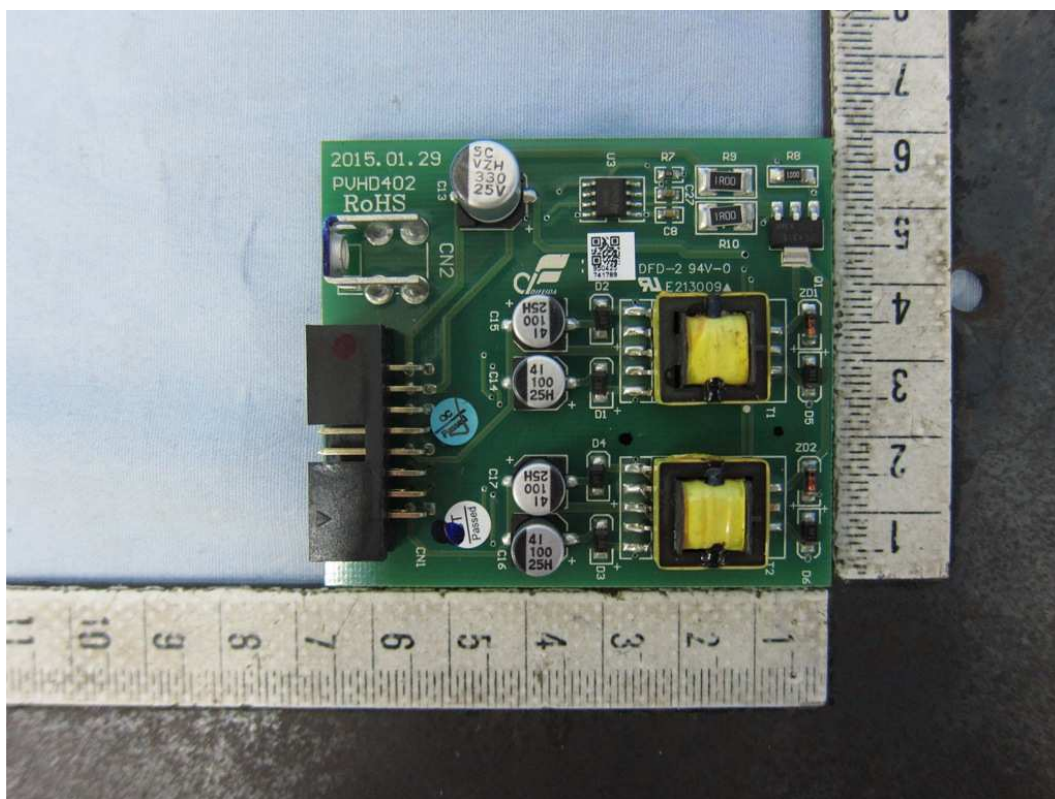
**PSDR Board\_component side view**



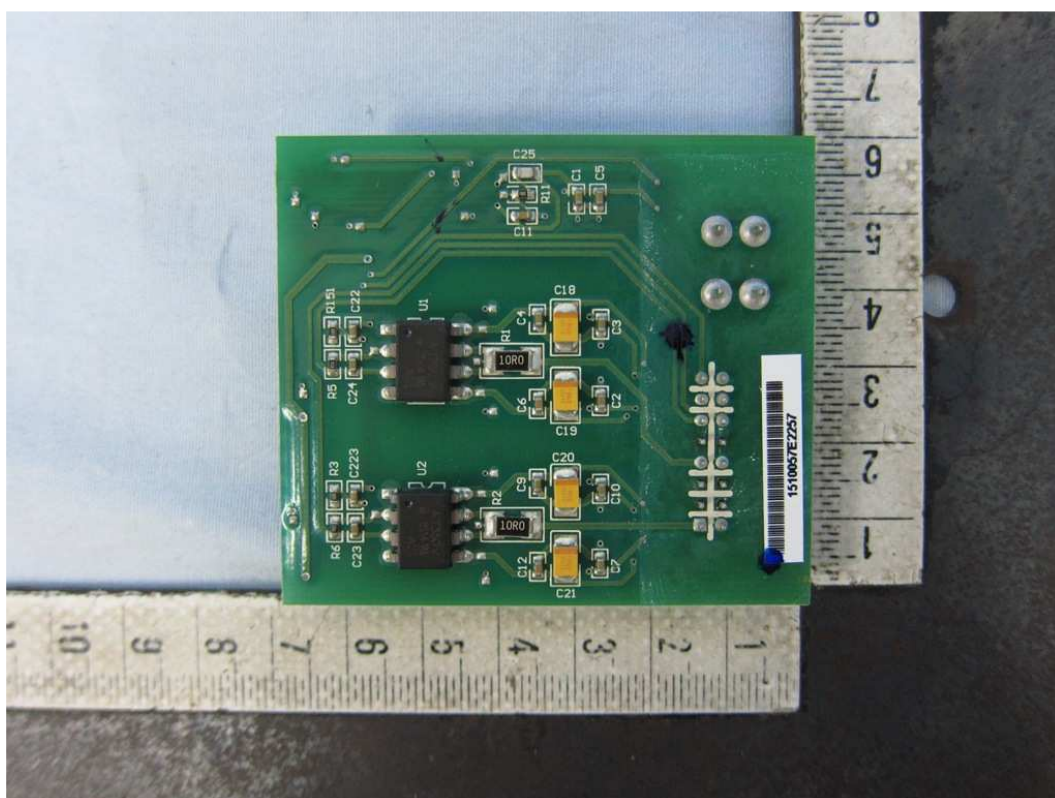
**PSDR Board\_Solder side view**



**Gate Driver Board\_component side view**



**Gate Driver Board\_Solder side view**





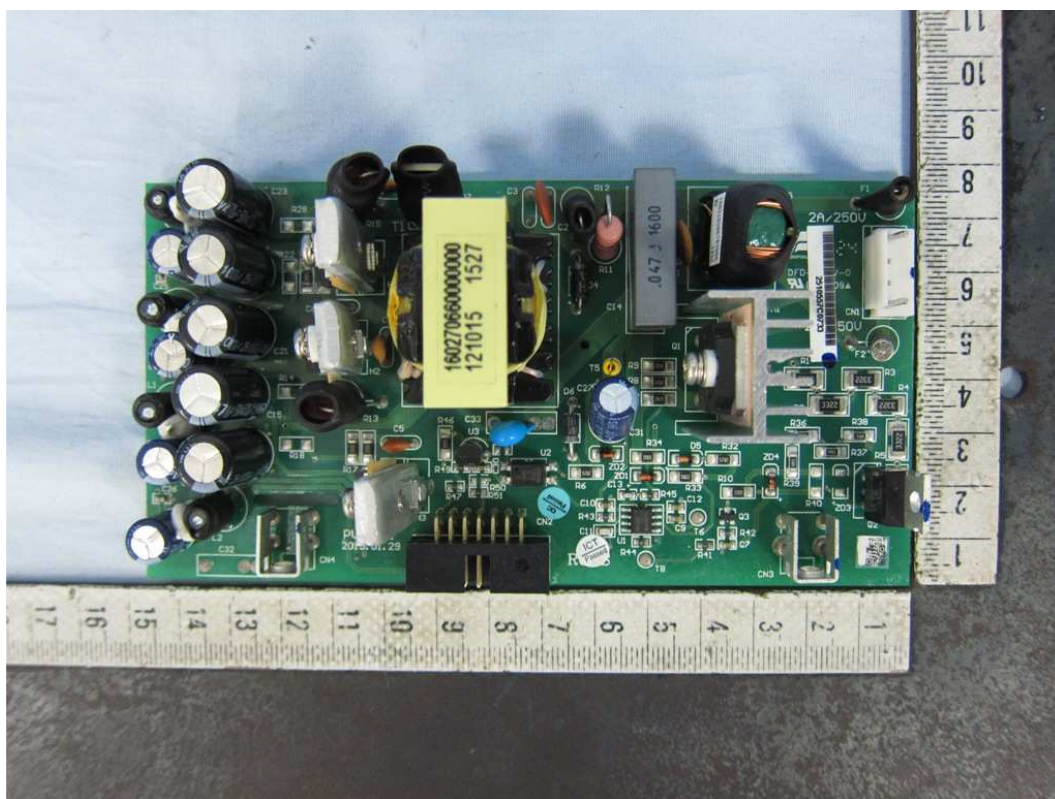
**Control Board\_component side view**



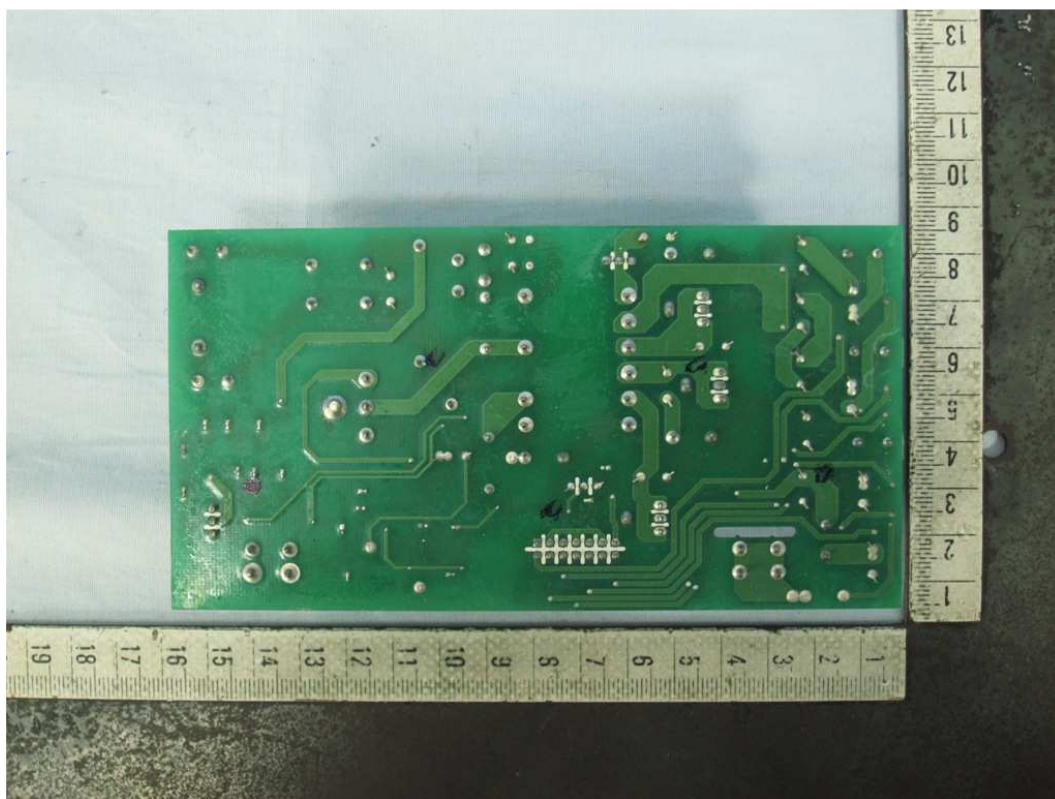
**Control Board\_Solder side view**



**Auxiliary Power Board\_component side view**

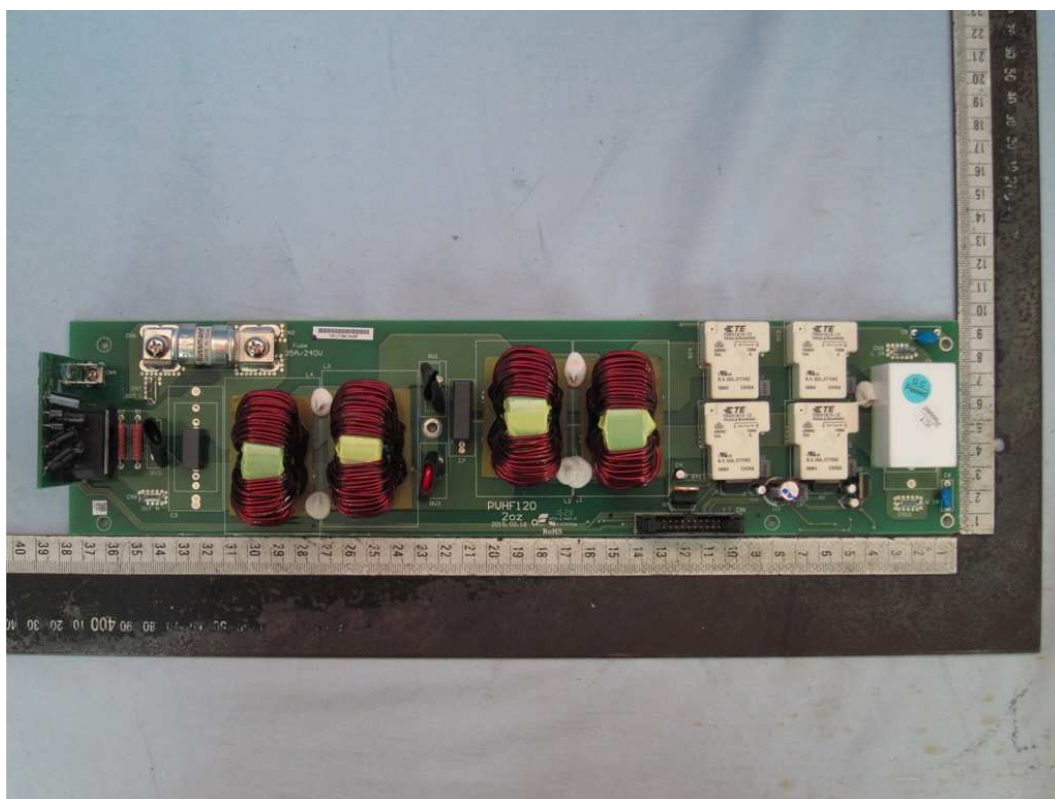


**Auxiliary Power Board\_Solder side view**

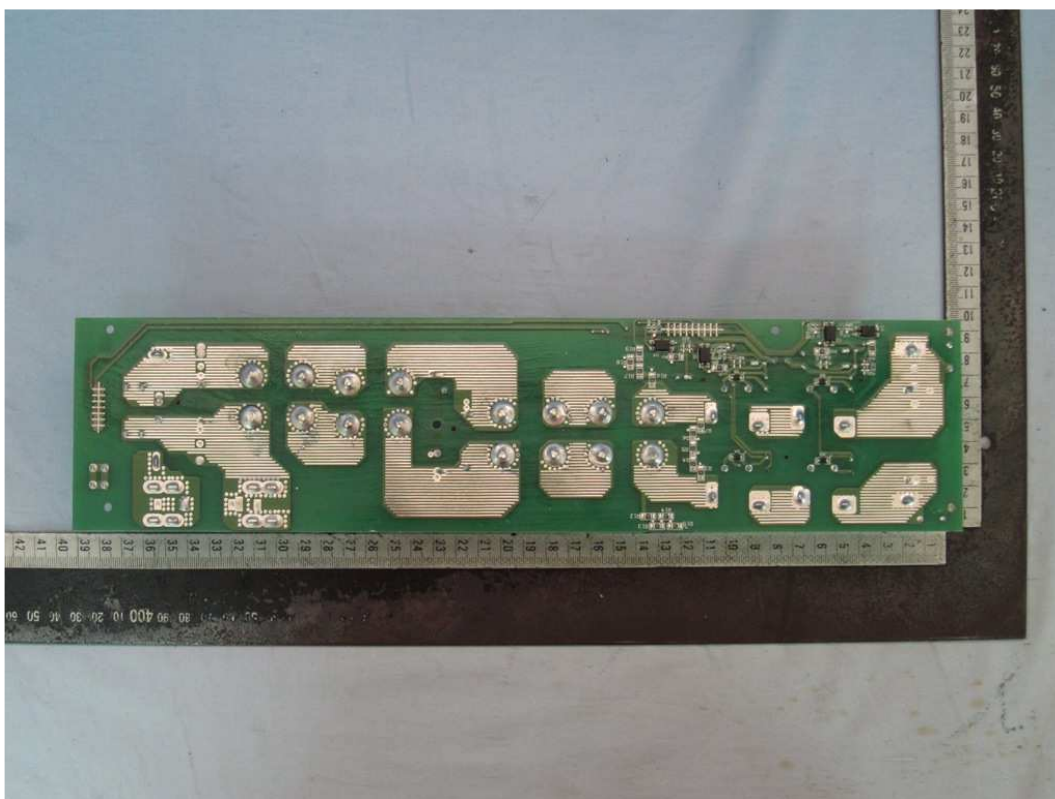




**Output EMI Board\_component side view**



**Output EMI Board\_Solder side view**



# **Annex 2**

## **Test equipment list**

**Testing Location:** Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch

**Date(s) of performance test:** 1) 2013-06-10 to 2013-06-28  
2) 2017-04-10 to 2017-04-14

Equipment	Internal No.	Manufacturer	Type	Serial No.	Last Calibration
Thermo-Hygro Graph	50	Isuzs	3-3122	70860282	2016-12-02
Programable DC Source	184	CHROMA	62150H-1000S	62150EF00143	Monitor by Power Analyzer
Precision Power Analyzer	215	YOKOGAWA	WT-3000	91M534527	
Scope Corder	216	YOKOGAWA	DL850	91M534532	
Programable AC Source	217	CHROMA	61512	615120000372	Monitor by Power Analyzer
Programable DC Source	218	CHROMA	62150H-1000S	62150EF00455	
Atmospheric pressure gauge	226	Testo	Testo 511	39108378	2016-06-08