
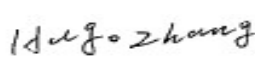
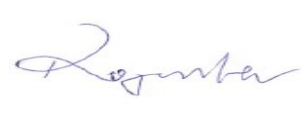




<p><b>TEST REPORT</b> <b>IEC 61683</b></p> <p><b>Photovoltaic systems – Power conditioners –</b> <b>Procedure for measuring efficiency</b></p>	
<b>Report Number.</b> .....	GZES191002576303
<b>Date of issue</b> .....	07/11/2019
<b>Total number of pages</b> .....	22
<b>Applicant's name</b> .....	EVOLVE ENERGY GROUP CO., LIMITED
<b>Address</b> .....	RM 702, 7/F FU FAI COMM CTR 27 HILLIER ST SHEUNG WAN, HK
<b>Test specification:</b>	
<b>Standard</b> .....	IEC 61683:1999 (First Edition)
<b>Test procedure</b> .....	Characteristic Examination
<b>Non-standard test method</b> .....	N/A
<b>Test Report Form No</b> .....	IEC61683A
<b>Test Report Form(s) Originator</b> .....	TÜV SÜD Product Service GmbH
<b>Master TRF</b> .....	Dated 2014-10
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<b>Test item description</b> ..... :	Solar Grid-tied Inverter
<b>Trade Mark</b> ..... :	
<b>Manufacturer</b> ..... :	EVOLVE ENERGY GROUP CO., LIMITED
<b>Address</b> ..... :	RM 702, 7/F FU FAI COMM CTR 27 HILLIER ST SHEUNG WAN, HK
<b>Model/Type reference</b> ..... :	EVVO 3200TL-AV, EVVO 3000TL-AV, EVVO 2700TL-AV, EVVO 2200TL-AV, EVVO 1600TL-AV, EVVO 1100TL-AV
<b>Ratings</b> ..... :	<p>EVVO 3200TL-AV          DC input: 50-550V Max.12A          AC output: 230Vac, 50Hz, Max.16A,3300VA</p> <p>EVVO 2700TL-AV          DC input: 50-550V Max.12A          AC output: 230Vac, 50Hz, Max.13A, 2700VA</p> <p><b>Serial Number:</b> SA3ES033K4P001  <b>Firmware version:</b> V100</p> <p>EVVO 2200TL-AV          DC input: 50-500V Max.12A          AC output: 230Vac, 50Hz, Max.10.6A, 2200VA</p> <p>EVVO 1600TL-AV          DC input: 50-500V Max.12A          AC output: 230Vac, 50Hz, Max.7.7A,1600VA</p> <p>EVVO 1100TL-AV          DC input: 50-500V Max.12A          AC output: 230Vac, 50Hz, Max.5.3A,1100VA</p> <p><b>Serial Number:</b> SA3ES027K4P020  <b>Firmware version:</b> V100</p> <p>EVVO 3000TL-AV          DC input: 50-550V Max.12A          AC output: 230Vac, 50Hz, Max.14.5A,3000VA  <b>Serial Number:</b> SA3ES030K4P001  <b>Firmware version:</b> V100</p>

<b>Testing procedure and testing location:</b>		
<input type="checkbox"/>	<b>CB Testing Laboratory:</b>	
<b>Testing location/ address.....:</b>		
<input type="checkbox"/>	<b>Associated CB Testing Laboratory:</b>	
<input checked="" type="checkbox"/>	<b>Testing procedure: TMP/CTF Stage 1:</b>	Shenzhen SOFAR SOLAR Co., Ltd.
<b>Testing location/ address.....:</b>		401, Building 4, AnTongDa Industrial Park, District 68, XingDong Community, XinAn Street, BaoAn District, Shenzhen City, Guangdong Province, P.R. China
<b>Tested by (name + signature).....:</b>		
	Hugo zhang (Project Engineer)	
<b>Approved by (name, function, signature.....:</b>		
	Roger Hu (Technical Reviewer)	
<input type="checkbox"/>	<b>Testing procedure: WMT/CTF Stage 2:</b>	
<input type="checkbox"/>	<b>Testing procedure: SMT/CTF Stage 3 or 4:</b>	

List of Attachments (including a total number of pages in each attachment):		
50Hz		
Attachment #	Description	Pages
Attachment I	Pictures of the EUT and Electrical Schemes	13pages
Attachment II	Testing Information	5 pages
Summary of testing:		
<p><b>Tests performed (name of test and test clause):</b></p> <p>Equipments has been tested according to the standard: IEC 61683:1999. Testing has been carried out at 50Hz.</p> <p>All applicable tests according to the above specified standard have been carried out.</p> <p>From the result of inspection and tests on the submitted sample, we conclude that it complies with the requirements of the standard.</p> <p><b>Remarks:</b> All the test results are from the report below:</p> <ul style="list-style-type: none"> <li>- IEC 61683:1999 (First Edition)</li> </ul> <p>Test Report No: 2219/0185-C-E1 which issued by SGS Tecnos, S.A. (Electrical Testing Laboratory) on 26/07/2019</p>	<p><b>Testing location:</b></p> <p>Shenzhen SOFAR SOLAR Co., Ltd. 401, Building 4, AnTongDa Industrial Park, District 68, XingDong Community, XinAn Street, BaoAn District, Shenzhen City, Guangdong Province, P.R. China</p> <p>(All clauses)</p>	
Summary of compliance with National Differences		
<p><b>List of countries addressed</b></p> <p>No National Differences are addressed to this test report</p>		

**Copy of marking plate(representative):**

<b>EVVO</b> Solar Grid-tied Inverter	
Model No:	EVVO 3200TL - AV
Max.DC Input Voltage	550V
Operating MPPT Voltage Range	50~550V
Max. Input Current	12A
Max. PV Isc	15A
Nominal Grid Voltage	L/N/PE, 230Vac
Max. Output Current	16A
Nominal Grid Frequency	50/60Hz
Max. Output Power	3300VA
Power Factor	1(adjustable +/-0.8)
Ingress Protection	IP65
Operating Temperature Range	-30°C~+60°C
Protective Class	Class I
Inverter Topology	Non-Isolated
Factory - Shenzhen China	
Manufacturer : EVOLVE ENERGY GROUP CO., LIMITED	
Address :RM 702, 7/F FU FAI COMM CTR 27 HILLIER ST	
SHEUNG WAN, HK	
Global Head Quarters	
371 Sidco Industrial Estate	
Chennai 600098 India	
VDE0126-1-1,VDE-AR-N4105, IEC61727,	
IEC62116, UTE C15-712-1,AS4777	
      	

**Note:**

1. The above markings are the minimum requirements required by the safety standard. For the final production samples, the additional markings which do not give rise to misunderstanding may be added.
2. Label is attached on the side surface of enclosure and visible after installation
3. Labels of other models are as the same wit EVVO 3200TL-AV's except the parameters of rating.

<b>Test item particulars</b> ..... :	Solar Grid-tied Inverter (Single Phase Inverter)
<b>Classification of installation and use</b> ..... :	Fixed(permanent connection)
<b>Supply Connection</b> .....	DC; PV
..... :	AC; Grid connection
<b>Possible test case verdicts:</b>	
- 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)
<b>Testing</b> ..... :	CTF Stage 1 procedure
<b>Date of receipt of test item</b> ..... :	N/A
<b>Date (s) of performance of tests</b> .....	From 30/04/2019 to 07/05/2019 (original) and 24/07/2019 to 25/07/2019 (E1).
<b>General remarks:</b>	
<p>“(See Enclosure #)” refers to additional information appended to the report.  “(See appended table)” refers to a table appended to the report.</p> <p>This document is issued by the Company subject to its General Conditions of Service printed overleaf, available on request or accessible at <a href="http://www.sgs.com/terms_and_conditions.htm">www.sgs.com/terms_and_conditions.htm</a> and, for electronic format documents, subject to Terms and Conditions for Electronic Documents at <a href="http://www.sgs.com/terms_e-document.htm">www.sgs.com/terms_e-document.htm</a>. Attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein. Any holder of this document is advised that information contained hereon reflects the Company’s findings at the time of its intervention only and within the limits of Client’s instructions, if any. The Company’s sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents. This document cannot be reproduced except in full, without prior written approval of the Company. Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law. Unless otherwise stated the results shown in this test report refer only to the sample(s) tested.</p> <p><b>Throughout this report a <input type="checkbox"/> comma / <input checked="" type="checkbox"/> point is used as the decimal separator.</b></p>	
<b>Manufacturer’s Declaration per sub-clause 4.2.5 of IEC 61851-1:</b>	
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..... :	<input type="checkbox"/> <b>Yes</b> <input checked="" type="checkbox"/> <b>Not applicable</b>
<b>When differences exist; they shall be identified in the General product information section.</b>	
<b>Name and address of factory (ies)</b> .....	Dongguan SOFAR SOLAR Co.,Ltd. 1F - 6F, Building E, No. 1 JinQi Road, Bihu Industrial Park, Wulian Village, Fenggang Town, Dongguan City,Guangdong Province,P.R. China.

**General product information:**

Product covered by this report is grid-connected PV inverter for indoor or outdoor installation. The connection to the DC input and AC output are through connectors.

The Solar inverter converts DC voltage into AC voltage.

The input and output are protected by varistors to Earth. The unit is providing EMC filtering at the output toward mains. The unit does not provide galvanic separation from input to output (transformerless). The output is switched off redundant by the high power switching bridge and a two relays. This assures that the opening of the output circuit can operate in case of one error.

**Equipment Under Testing:**

- EVVO 3200TL-AV
- EVVO 3000TL-AV
- EVVO 2700TL-AV
- EVVO 2200TL-AV
- EVVO 1600TL-AV
- EVVO 1100TL-AV

Model Number	EVVO 3200TL-AV	EVVO 3000TL-AV	EVVO 2700TL-AV	EVVO 2200TL-AV	EVVO 1600TL-AV	EVVO 1100TL-AV
Max. input voltage	550Vd.c.			500Vd.c		
Max. input current	12Ad.c.	12Ad.c.	12Ad.c.	12Ad.c.	12Ad.c.	12Ad.c.
Operating MPPT voltage range	50-550Vd.c.			50-500Vd.c.		
Full load DC Voltage Range	300-500 Vd.c.	275-500 Vd.c.	250-500 Vd.c.	200-450 Vd.c.	150-450 Vd.c.	110-450 Vd.c.
Rated voltage	360V					
Rated grid voltage	230Va.c.					
Rated grid frequency	50Hz					
Rated output power	3.3kW	3.0kW	2.7kW	2.2kW	1.6kW	1.1kW
Rated output current	13Aa.c.	13 Aa.c.	11.8Aa.c.	9.6Aa.c.	7Aa.c.	4.8Aa.c.
Max. Output Current	16Aa.c.	14.5 Aa.c.	13Aa.c.	10.6Aa.c.	7.7Aa.c.	5.3Aa.c.
Power factor	0.8 leading to 0.8 lagging					
Ambient temperature	-30 °C ~60°C					
Ingress protection	IP65					
Protective class	Class I					

The variants models have been included in this test report without tests because the following features don't change regarding to the tested model:

- Same connection system and hardware topology
- Same control algorithm.
- Same Firmware Version

IEC 61683: 1999			
Clause	Requirement – Test	Measuring result – Remark	Verdict
4	Efficiency measurement conditions		P
	Efficiency is measured under the conditions in the following clauses.		P
	Specific conditions may be excluded by mutual agreement when those conditions are outside the manufacturer's allowable operating range.		P
4.1	DC power source for testing		P
	For power conditioners operating with fixed input voltage, the d.c. power source is a storage battery or constant voltage power source to maintain the input voltage.		N/A
	For power conditioners that employ maximum power point tracking (MPPT) and shunt-type power conditioners, either a photovoltaic array or a photovoltaic array simulator is utilized.		P
4.2	Temperature		P
	All measurements are to be made at an ambient temperature of $25\text{ }^{\circ}\text{C} \pm 2\text{ }^{\circ}\text{C}$ .		N/A
	Other ambient temperatures may be allowed by mutual agreement. However, the temperature used must be clearly stated in all documentation.	By mutual agreement all measurements at 50 Hz have been carried out at $25^{\circ}\text{C} \pm 5^{\circ}\text{C}$	P
4.3	Output voltage and frequency		P
	The output voltage and frequency are maintained at the manufacturer's stated nominal values.	L/N/PE 230Vac, 50Hz	P
4.4	Input voltage		P
	Measurements performed in each of the following tests are repeated at three power conditioner input voltages: a) manufacturer's minimum rated input voltage; b) the inverter's nominal voltage or the average of its rated input range; c) 90 % of the inverter's maximum input voltage.		P
	In the case where a power conditioner is to be connected with a battery at its input terminals, only the nominal or rated input voltage may be applied.		N/A
4.5	Ripple and distortion		P
	Record input voltage and current ripple for each measurement. Also record output voltage and current distortion (if a.c.) or ripple (if d.c.). Ensure that these measurements remain within the manufacturer's specified values.		P
4.6	Resistive loads/utility grid		P



IEC 61683: 1999			
Clause	Requirement – Test	Measuring result – Remark	Verdict
	At unity power factor, or at the intrinsic power factor of grid-connected inverters without power factor adjustment, measure the efficiency for power levels of 10 %, 25 %, 50 %, 75 %, 100 % and 120 % of the inverter's rating.		P
	Stand-alone inverters are also measured at a power level of 5 % of rated. The power conditioner test is conducted with a specified resistive and reactive grid impedance.		N/A
4.7	Reactive loads		N/A
	For stand-alone inverters, measure the efficiency with a load which provides a power factor equal to the manufacturer's specified minimum level (or 0,25, whichever is greater) and at power levels of 25 %, 50 % and 100 % of rated VA.		N/A
	Repeat for power factors of 0,5 and 0,75 (do not go below the manufacturer's specified minimum PF) and power levels of 25 %, 50 %, and 100 % of rated VA.		N/A
4.8	Resistive plus non-linear loads		N/A
	For stand-alone inverters, measure the efficiency with a fixed non-linear load (total harmonic distortion (THD) = $(80 \pm 5) \%$ ) equal to $(25 \pm 5) \%$ of the inverter's rated VA plus sufficient resistive load in parallel to achieve a total load of 25 %, 50 % and 100 % of rated VA.		N/A
	Repeat the measurements with a fixed non-linear load equivalent to $(50 \pm 5) \%$ of the inverter's rated VA plus sufficient resistive load in parallel to achieve a total load of 50% and 100% of rated VA.		N/A
	The type of non-linear load must be clearly stated in all documentation.		N/A
4.9	Complex loads		N/A
	When a non-linear plus a sufficient reactive load condition is specified for stand-alone inverters, measure the efficiency with a fixed non-linear load (THD = $(80 \pm 5) \%$ ) equal to $(50 \pm 5) \%$ of the inverter's rated VA plus a sufficient reactive load (PF = 0,5) in parallel to achieve a total load of 50 % and 100 % of rated VA.		N/A
	The type of complex load is clearly stated in all documentation.		N/A
5	Efficiency calculations		P
5.1	Rated output efficiency		P

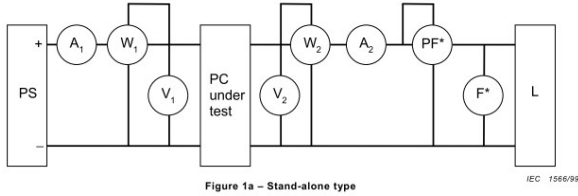
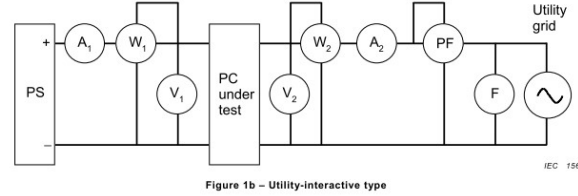
IEC 61683: 1999			
Clause	Requirement – Test	Measuring result – Remark	Verdict
5.2	Partial output efficiency		P
5.3	Energy efficiency		P
5.4	Efficiency tolerances		P
6	Conditions of loading for output ports		P
6.1	Test circuit		P
	Figure 1a is applied to standard-alone power conditioners		N/A
	 <p>Figure 1a – Stand-alone type</p> <p>IEC 1566/99</p>		N/A
	Figure 1b is applied to utility-interactive power conditioners		P
	 <p>Figure 1b – Utility-interactive type</p> <p>IEC 1567/99</p> <p>PC power conditioner  PS variable voltage-current d.c. power supply  A<sub>1</sub> DC ammeter  A<sub>2</sub> AC or d.c. ammeter  W<sub>1</sub> DC wattmeter  W<sub>2</sub> AC or d.c. wattmeter  L load  F frequency meter  V<sub>1</sub> DC voltmeter  V<sub>2</sub> AC or d.c. voltmeter  PF power factor meter</p>		P
6.2	Measurement procedure		P
7	Loss measurement		P
7.1	No-load loss		P
7.2	Standby loss		P
Annex A	Power conditioner description		P
Annex B	Power efficiency and conversion factor		P
Annex C	Weighted-average energy efficiency		P
Annex D	Derivation of efficiency tolerance in table 2		P

TABLE		Efficiency recording and efficient calculation sheet							
power conditioner type	Grid-connected								
Model:	EVVO 3200TL-AV								
Parameters of power conditioner	Minimum full load input voltage:300V Nominal voltage:360V 90% of the inverter's maximum input voltage:450V Rated output voltage: 230Vac Rated output frequency:50Hz Rated output power: 3300W								
PV input voltage	a) Manufacturer's minimum rated input voltage300V ( $\pm 4.5V$ )								
Temperature ( $^{\circ}C$ )	25 $^{\circ}C \pm 5^{\circ}C$								
Operating period for energy measurement (min)	2								
Percentage of rated output VA	/	10%	25%	50%	75%	100%	120%*	/	/
Input voltage (V)	/	297.3	300.2	299.8	299.7	302.9	/	/	/
Input voltage ripple (V)	/	1.1	1.5	1.6	2.0	0.9	/	/	/
Input current (A)	/	1.2	2.9	5.7	8.6	11.3	/	/	/
Input current ripple (A)	/	0.2	0.2	0.2	0.2	0.2	/	/	/
Input power (Pi) (W)	/	343	861	1722	2582	3435	/	/	/
Output power (Po) (W)	/	325	830	1664	2491	3304	/	/	/
Output efficiency(%)	/	94.71	96.44	96.66	96.49	96.18	/	/	/
Input energy (Wi) (Wh)	/	11.49	28.82	57.63	86.41	114.99	/	/	/
Output energy (Wo) (Wh)	/	10.88	27.80	55.71	83.39	110.60	/	/	/
Energy efficiency(%)	/	94.73	96.46	96.68	96.51	96.19	/	/	/
PV input voltage	b) The inverter's nominal voltage 360V( $\pm 5.4V$ )								
Temperature ( $^{\circ}C$ )	25 $^{\circ}C \pm 5^{\circ}C$								
Operating period for energy measurement (min)	2								
Percentage of rated output VA	/	10%	25%	50%	75%	100%	120%*	/	/
Input voltage (V)	/	358.2	359.9	360.4	359.5	359.0	/	/	/
Input voltage ripple (V)	/	1.4	1.4	1.0	1.2	0.9	/	/	/
Input current (A)	/	0.95	2.4	4.7	7.1	9.5	/	/	/

Input current ripple (A)	/	0.2	0.2	0.2	0.2	0.2	/	/	/
Input power (Pi) (W)	/	341	855	1710	2568	3416	/	/	/
Output power (Po) (W)	/	327	831	1663	2483	3296	/	/	/
Output efficiency(%)	/	95.93	97.23	97.30	96.70	96.48	/	/	/
Input energy (Wi) (Wh)	/	11.42	28.62	57.23	85.96	114.33	/	/	/
Output energy (Wo) (Wh)	/	10.96	27.82	55.67	83.12	110.30	/	/	/
Energy efficiency(%)	/	95.93	97.20	97.20	96.69	96.46	/	/	/
PV input voltage	c) 90% of the inverter's maximum input voltage 450V(±6.8V)								
Temperature (°C)	25°C ± 5°C								
Operating period for energy measurement (min)	2								
Percentage of rated output VA	/	10%	25%	50%	75%	100%	120%*	/	/
Input voltage (V)	/	445.5	451.0	450.2	449.9	450.2	/	/	/
Input voltage ripple (V)		1.3	1.9	1.6	5.8	8.8	/	/	/
Input current (A)	/	0.7	1.9	3.8	5.7	7.6	/	/	/
Input current ripple (A)		0.2	0.2	0.2	0.4	0.3	/	/	/
Input power (Pi) (W)	/	341	855	1711	2565	3417	/	/	/
Output power (Po) (W)	/	326	827	1661	2487	3305.	/	/	/
Output efficiency(%)	/	95.25	96.92	97.11	96.94	96.70	/	/	/
Input energy (Wi) (Wh)	/	11.42	28.62	57.29	85.86	114.39	/	/	/
Output energy (Wo) (Wh)	/	10.88	27.74	55.64	83.25	110.64	/	/	/
Energy efficiency(%)	/	95.21	96.93	97.13	96.96	96.72	/	/	/
Remark:									
*If limited by design, inverter is not capable to operate with the 120% of rated output load, test under this condition is waived;									

TABLE		Efficiency recording and efficient calculation sheet							
power conditioner type	Grid-connected								
Model:	EVVO 2700TL-AV								
Parameters of power conditioner	Minimum full load input voltage:250V Nominal voltage:360V 90% of the inverter's maximum input voltage: 450V Rated output voltage: 230Vac Rated output frequency:50Hz Rated output power: 2700W								
PV input voltage	a) Manufacturer's minimum rated input voltage 250V ( $\pm 3.8V$ )								
Temperature ( $^{\circ}C$ )	25 $^{\circ}C \pm 5^{\circ}C$								
Operating period for energy measurement (min)	2								
Percentage of rated output VA	/	10%	25%	50%	75%	100%	120%*	/	/
Input voltage (V)	/	246.8	249.4	248.76	248.1	247.9	/	/	/
Input voltage ripple (V)	/	1.1	0.9	0.9	2.0	1.4	/	/	/
Input current (A)	/	1.1	2.8	5.7	8.5	11.3	/	/	/
Input current ripple (A)	/	0.2	0.2	0.2	0.2	0.2	/	/	/
Input power (Pi) (W)	/	280	703	1407	2109	2810	/	/	/
Output power (Po) (W)	/	263	675	1357	2032	2703	/	/	/
Output efficiency(%)	/	93.63	95.99	96.46	96.37	96.18	/	/	/
Input energy (Wi) (Wh)	/	9.38	23.55	47.08	70.59	94.07	/	/	/
Output energy (Wo) (Wh)	/	8.79	22.61	45.42	68.03	90.47	/	/	/
Energy efficiency(%)	/	93.65	96.00	96.47	96.38	96.19	/	/	/
PV input voltage	b) The inverter's nominal voltage 360V( $\pm 5.4V$ )								
Temperature ( $^{\circ}C$ )	25 $^{\circ}C \pm 5^{\circ}C$								
Operating period for energy measurement (min)	2								
Percentage of rated output VA	/	10%	25%	50%	75%	100%	120%*	/	/
Input voltage (V)	/	360.3	360.1	360.7	359.9	358.8	/	/	/
Input voltage ripple (V)	/	1.2	1.5	2.9	6.7	4.5	/	/	/

Input current (A)	/	0.8	1.9	3.9	5.8	7.8	/	/	/
Input current ripple (A)	/	0.2	0.2	0.3	0.2	0.6	/	/	/
Input power (Pi) (W)	/	279	698	1397	2092	2785	/	/	/
Output power (Po) (W)	/	266	678	1360	2035	2704	/	/	/
Output efficiency(%)	/	95.44	97.12	97.39	97.29	97.12	/	/	/
Input energy (Wi) (Wh)	/	9.33	23.36	46.75	70.02	93.21	/	/	/
Output energy (Wo) (Wh)	/	8.90	22.69	45.52	68.12	90.54	/	/	/
Energy efficiency(%)	/	95.43	97.13	97.38	97.29	97.14	/	/	/
PV input voltage	c) 90% of the inverter's maximum input voltage 450V(±6.8V)								
Temperature (°C)	25°C ± 5°C								
Operating period for energy measurement (min)	2								
Percentage of rated output VA	/	10%	25%	50%	75%	100%	120%*	/	/
Input voltage (V)	/	454.8	448.8	451.4	450.7	450.3	/	/	/
Input voltage ripple (V)	/	1.1	0.8	1.7	1.7	5.3	/	/	/
Input current (A)	/	0.6	1.6	3.1	4.7	6.2	/	/	/
Input current ripple (A)	/	0.2	0.2	0.2	0.2	0.2	/	/	/
Input power (Pi) (W)	/	279	698	1398	2095	2792	/	/	/
Output power (Po) (W)	/	263	675	1358	2033	2704	/	/	/
Output efficiency(%)	/	94.47	96.72	97.10	97.02	96.86	/	/	/
Input energy (Wi) (Wh)	/	9.33	23.36	46.80	70.14	93.44	/	/	/
Output energy (Wo) (Wh)	/	8.81	22.59	45.44	68.06	90.52	/	/	/
Energy efficiency(%)	/	94.42	96.73	97.10	97.04	96.88	/	/	/
Remark:									
*If limited by design, inverter is not capable to operate with the 120% of rated output load, test under this condition is waived;									

TABLE	Efficiency recording and efficient calculation sheet								
power conditioner type	Grid-connected								
Model:	EVVO 2200TL-AV								
Parameters of power conditioner	Minimum full load input voltage:200V Nominal voltage:360V 90% of the inverter's maximum input voltage: 405V Rated output voltage: 230Vac Rated output frequency:50Hz Rated output power: 2200W								
PV input voltage	a) Manufacturer's minimum rated input voltage 200V( $\pm 3V$ )								
Temperature ( $^{\circ}C$ )	25 $^{\circ}C \pm 5^{\circ}C$								
Operating period for energy measurement (min)	2								
Percentage of rated output VA	/	10%	25%	50%	75%	100%	120%*	/	/
Input voltage (V)	/	199.5	199.6	200.2	199.5	199.4	/	/	/
Input voltage ripple (V)	/	1.2	1.4	1.6	1.7	2.2	/	/	/
Input current (A)	/	1.2	2.9	5.8	8.6	11.5	/	/	/
Input current ripple (A)	/	0.2	0.2	0.2	0.3	0.3	/	/	/
Input power (Pi) (W)	/	233	574	1152	1724	2296	/	/	/
Output power (Po) (W)	/	217	549	1106	1654	2198	/	/	/
Output efficiency(%)	/	93.13	95.70	96.07	95.95	95.74	/	/	/
Input energy (Wi) (Wh)	/	7.81	19.20	38.55	57.71	76.86	/	/	/
Output energy (Wo) (Wh)	/	7.28	18.38	37.05	55.39	73.62	/	/	/
Energy efficiency(%)	/	93.20	95.75	96.12	96.00	95.80	/	/	/
PV input voltage	b) The inverter's nominal voltage 360V( $\pm 5.4V$ )								
Temperature ( $^{\circ}C$ )	25 $^{\circ}C \pm 5^{\circ}C$								
Operating period for energy measurement (min)	2								
Percentage of rated output VA	/	10%	25%	50%	75%	100%	120%*	/	/
Input voltage (V)	/	356.5	357.4	357.5	357.6	355.8	/	/	/
Input voltage ripple (V)	/	1.1	2.4	1.5	7.3	10.1	/	/	/

Input current (A)	/	0.6	1.6	3.2	4.8	6.4	/	/	/
Input current ripple (A)	/	0.2	0.2	0.3	0.5	0.2	/	/	/
Input power (Pi) (W)	/	231	571	1139	1709	2267	/	/	/
Output power (Po) (W)	/	220	555	1110	1663	2203	/	/	/
Output efficiency(%)	/	95.55	97.16	97.42	97.31	97.16	/	/	/
Input energy (Wi) (Wh)	/	7.72	19.13	38.14	57.21	75.89	/	/	/
Output energy (Wo) (Wh)	/	7.38	18.60	37.17	55.70	73.77	/	/	/
Energy efficiency(%)	/	95.58	97.21	97.47	97.35	97.20	/	/	/
PV input voltage	c) 90% of the inverter's maximum input voltage 405V ( $\pm 6.1V$ )								
Temperature ( $^{\circ}C$ )	25 $^{\circ}C \pm 5^{\circ}C$								
Operating period for energy measurement (min)	2								
Percentage of rated output VA	/	10%	25%	50%	75%	100%	120%*	/	/
Input voltage (V)	/	399.5	400.6	401.8	401.4	400.9	/	/	/
Input voltage ripple (V)	/	1.2	0.9	1.8	6.6	3.5	/	/	/
Input current (A)	/	0.6	1.4	2.8	4.3	5.7	/	/	/
Input current ripple (A)	/	0.2	0.2	0.2	0.2	0.6	/	/	/
Input power (Pi) (W)	/	231	572	1140	1706	2269	/	/	/
Output power (Po) (W)	/	220	555	1110	1661	2205	/	/	/
Output efficiency(%)	/	95.20	97.00	97.34	97.31	97.19	/	/	/
Input energy (Wi) (Wh)	/	7.72	19.15	38.16	57.12	76.26	/	/	/
Output energy (Wo) (Wh)	/	7.35	18.59	37.16	55.61	74.15	/	/	/
Energy efficiency(%)	/	95.29	97.05	97.39	97.36	97.24	/	/	/
Remark:									
*If limited by design, inverter is not capable to operate with the 120% of rated output load, test under this condition is waived;									



TABLE		Efficiency recording and efficient calculation sheet							
power conditioner type	Grid-connected								
Model:	EVVO 1600TL-AV								
Parameters of power conditioner	Minimum full load input voltage:150V Nominal voltage:360V 90% of the inverter's maximum input voltage:405V Rated output voltage: 230Vac Rated output frequency:50Hz Rated output power: 1600W								
PV input voltage	a) Manufacturer's minimum rated input voltage 150V( $\pm 2.3V$ )								
Temperature ( $^{\circ}C$ )	25 $^{\circ}C \pm 5^{\circ}C$								
Operating period for energy measurement (min)	2								
Percentage of rated output VA	/	10%	25%	50%	75%	100%	120%*	/	/
Input voltage (V)	/	149.3	149.4	149.6	149.7	149.6	/	/	/
Input voltage ripple (V)	/	0.9	0.9	1.3	1.3	1.9	/	/	/
Input current (A)	/	1.1	2.8	5.6	8.4	11.2	/	/	/
Input current ripple (A)	/	0.2	0.3	0.2	0.2	0.3	/	/	/
Input power (Pi) (W)	/	166	419	844	1263	1681	/	/	/
Output power (Po) (W)	/	151	397	807	1208	1605	/	/	/
Output efficiency(%)	/	91.21	94.82	95.63	95.66	95.49	/	/	/
Input energy (Wi) (Wh)	/	5.56	14.02	28.24	42.27	56.5	/	/	/
Output energy (Wo) (Wh)	/	5.08	13.30	27.02	40.45	53.97	/	/	/
Energy efficiency(%)	/	91.24	94.85	95.66	95.70	95.52	/	/	/
PV input voltage	b) The inverter's nominal voltage 360V( $\pm 5.4V$ )								
Temperature ( $^{\circ}C$ )	25 $^{\circ}C \pm 5^{\circ}C$								
Operating period for energy measurement (min)	2								
Percentage of rated output VA	/	10%	25%	50%	75%	100%	120%*	/	/
Input voltage (V)	/	354.8	357.6	358.0	357.9	359.0	/	/	/
Input voltage ripple (V)	/	1.2	1.3	1.5	3.1	2.7	/	/	/

Input current (A)	/	0.4	1.1	2.3	3.5	4.6	/	/	/
Input current ripple (A)	/	0.2	0.2	0.3	0.2	0.5	/	/	/
Input power (Pi) (W)	/	158	407	821	1235	1650	/	/	/
Output power (Po) (W)	/	147	391	796	1199	1601	/	/	/
Output efficiency(%)	/	93.18	96.15	96.94	97.07	97.04	/	/	/
Input energy (Wi) (Wh)	/	5.28	13.62	27.49	41.35	55.24	/	/	/
Output energy (Wo) (Wh)	/	4.92	13.10	26.66	40.15	53.62	/	/	/
Energy efficiency(%)	/	93.22	96.19	96.99	97.09	97.09	/	/	/
PV input voltage									
c) 90% of the inverter's maximum input voltage 405V( $\pm 6.1V$ )									
Temperature ( $^{\circ}C$ )									
25 $^{\circ}C \pm 5^{\circ}C$									
Operating period for energy measurement (min)									
2									
Percentage of rated output VA	/	10%	25%	50%	75%	100%	120%*	/	/
Input voltage (V)	/	405.5	400.1	401.2	401.3	401.7	/	/	/
Input voltage ripple (V)	/	1.0	0.1	3.3	4.6	6.3	/	/	/
Input current (A)	/	0.4	1.0	2.1	3.1	4.1	/	/	/
Input current ripple (A)	/	0.2	0.2	0.2	0.2	0.4	/	/	/
Input power (Pi) (W)	/	157	405	819	1233	1644	/	/	/
Output power (Po) (W)	/	148	391	798	1201	1602	/	/	/
Output efficiency(%)	/	94.11	96.71	97.37	97.47	97.44	/	/	/
Input energy (Wi) (Wh)	/	5.25	13.54	27.54	41.26	55.04	/	/	/
Output energy (Wo) (Wh)	/	4.94	13.10	26.83	40.23	53.65	/	/	/
Energy efficiency(%)	/	94.15	96.75	97.41	97.51	97.47	/	/	/
Remark:									
*If limited by design, inverter is not capable to operate with the 120% of rated output load, test under this condition is waived;									

TABLE		Efficiency recording and efficient calculation sheet							
power conditioner type	Grid-connected								
Model:	EVVO 1100TL-AV								
Parameters of power conditioner	Minimum full load input voltage:110V Nominal voltage:360V 90% of the inverter's maximum input voltage: 405V Rated output voltage: 230Vac Rated output frequency:50Hz Rated output power: 1100W								
PV input voltage	a) Manufacturer's minimum rated input voltage 110V( $\pm 1.7V$ )								
Temperature ( $^{\circ}C$ )	25 $^{\circ}C \pm 5^{\circ}C$								
Operating period for energy measurement (min)	2								
Percentage of rated output VA	/	10%	25%	50%	75%	100%	120%*	/	/
Input voltage (V)	/	109.2	109.8	109.4	109.5	109.5	/	/	/
Input voltage ripple (V)	/	0.8	1.2	0.9	0.9	1.4	/	/	/
Input current (A)	/	1.1	2.7	5.3	8.0	10.7	/	/	/
Input current ripple (A)	/	0.2	0.2	0.2	0.2	0.2	/	/	/
Input power (Pi) (W)	/	116	292	585	877	1169	/	/	/
Output power (Po) (W)	/	102	272	554	832	1107	/	/	/
Output efficiency(%)	/	88.28	93.27	94.65	94.81	94.70	/	/	/
Input energy (Wi) (Wh)	/	3.87	9.77	19.58	29.37	39.13	/	/	/
Output energy (Wo) (Wh)	/	3.42	9.12	18.54	27.85	37.06	/	/	/
Energy efficiency(%)	/	88.31	93.31	94.68	94.84	94.73	/	/	/
PV input voltage	b) The inverter's nominal voltage 360V( $\pm 5.4V$ )								
Temperature ( $^{\circ}C$ )	25 $^{\circ}C \pm 5^{\circ}C$								
Operating period for energy measurement (min)	2								
Percentage of rated output VA	/	10%	25%	50%	75%	100%	120%*	/	/
Input voltage (V)	/	355.6	355.8	358.0	358.3	358.0	/	/	/
Input voltage ripple (V)	/	1.1	1.1	2.4	3.8	5.7	/	/	/

Input current (A)	/	0.3	0.8	1.6	2.4	3.2	/	/	/
Input current ripple (A)	/	0.2	0.2	0.2	0.3	0.3	/	/	/
Input power (Pi) (W)	/	105	280	567	855	1142	/	/	/
Output power (Po) (W)	/	95	266	547	828	1107	/	/	/
Output efficiency(%)	/	90.20	95.05	96.53	96.88	96.98	/	/	/
Input energy (Wi) (Wh)	/	3.52	9.38	18.98	28.61	38.22	/	/	/
Output energy (Wo) (Wh)	/	3.18	8.92	18.33	27.73	37.08	/	/	/
Energy efficiency(%)	/	90.22	95.11	96.57	96.92	97.01	/	/	/
PV input voltage	c) 90% of the inverter's maximum input voltage 405V(±6.1V)								
Temperature (°C)	25°C ± 5°C								
Operating period for energy measurement (min)	2								
Percentage of rated output VA	/	10%	25%	50%	75%	100%	120%*	/	/
Input voltage (V)	/	407.1	399.4	400.4	401.2	401.6	/	/	/
Input voltage ripple (V)	/	1.0	1.0	2.9	1.2	3.0	/	/	/
Input current (A)	/	0.3	0.7	1.4	2.1	2.9	/	/	/
Input current ripple (A)	/	0.2	0.2	0.2	0.3	0.2	/	/	/
Input power (Pi) (W)	/	118	291	566	853	1139	/	/	/
Output power (Po) (W)	/	108	278	548	830	1109	/	/	/
Output efficiency(%)	/	91.99	95.79	97.00	97.30	97.39	/	/	/
Input energy (Wi) (Wh)	/	3.95	9.72	18.94	28.55	38.11	/	/	/
Output energy (Wo) (Wh)	/	3.63	9.32	18.38	27.79	37.13	/	/	/
Energy efficiency(%)	/	91.98	95.83	97.04	97.33	97.43	/	/	/
Remark:									
*If limited by design, inverter is not capable to operate with the 120% of rated output load, test under this condition is waived;									

TABLE	Efficiency recording and efficient calculation sheet								
power conditioner type	Grid-connected								
Model:	EVVO 3000TL-AV								
Parameters of power conditioner	Minimum full load input voltage:275V Nominal voltage:360V 90% of the inverter's maximum input voltage: 450V Rated output voltage: 230Vac Rated output frequency:50Hz Rated output power:3000W								
PV input voltage	a) Manufacturer's minimum rated input voltage 275V( $\pm 4.1V$ )								
Temperature ( $^{\circ}C$ )	25 $^{\circ}C \pm 5^{\circ}C$								
Operating period for energy measurement (min)	1								
Percentage of rated output VA	/	10%	25%	50%	75%	100%	120%*	/	/
Input voltage (V)	/	277.0	276.3	275.5	275.3	275.3	/	/	/
Input voltage ripple (V)	/	0.4	0.3	0.3	0.4	0.9	/	/	/
Input current (A)	/	1.1	2.8	5.7	8.5	11.3	/	/	/
Input current ripple (A)	/	0.2	0.2	0.2	0.2	0.2	/	/	/
Input power (Pi) (W)	/	317	780	1560	2338	3117	/	/	/
Output power (Po) (W)	/	290	748	1506	2258	3006	/	/	/
Output efficiency(%)	/	92.85	95.80	96.56	96.58	96.44	/	/	/
Input energy (Wi) (Wh)	/	10.45	26.12	56.21	78.27	103.89	/	/	/
Output energy (Wo) (Wh)	/	9.70	25.02	50.42	75.60	100.18	/	/	/
Energy efficiency(%)	/	92.84	95.79	96.68	96.59	96.43	/	/	/
PV input voltage	b) The inverter's nominal voltage 360V( $\pm 5.4V$ )								
Temperature ( $^{\circ}C$ )	25 $^{\circ}C \pm 5^{\circ}C$								
Operating period for energy measurement (min)	1								
Percentage of rated output VA	/	10%	25%	50%	75%	100%	120%*	/	/
Input voltage (V)	/	356.6	359.5	360.0	359.5	358.9	/	/	/
Input voltage ripple (V)	/	0.7	2.7	5.2	7.8	8.6	/	/	/

Input current (A)	/	0.9	2.2	4.3	6.5	8.7	/	/	/
Input current ripple (A)	/	0.5	0.3	0.1	0.2	0.5	/	/	/
Input power (Pi) (W)	/	311	776	1549	2319	3135	/	/	/
Output power (Po) (W)	/	294	751	1507	2257	3048	/	/	/
Output efficiency(%)	/	94.56	96.78	97.33	97.34	97.21	/	/	/
Input energy (Wi) (Wh)	/	10.39	25.96	51.84	77.62	104.94	/	/	/
Output energy (Wo) (Wh)	/	94.54	25.12	50.45	75.56	102.01	/	/	/
Energy efficiency(%)	/	94.57	96.79	97.32	97.34	97.21	/	/	/
PV input voltage									
c) 90% of the inverter's maximum input voltage 450V(±6.8V)									
Temperature (°C)									
25°C ± 5°C									
Operating period for energy measurement (min)									
1									
Percentage of rated output VA	/	10%	25%	50%	75%	100%	120%*	/	/
Input voltage (V)	/	453.5	452.63	451.1	449.9	449.3	/	/	/
Input voltage ripple (V)	/	0.9	2.1	3.8	4.7	5.7	/	/	/
Input current (A)	/	0.68	1.72	3.4	5.2	6.9	/	/	/
Input current ripple (A)	/	0.3	0.5	0.1	0.1	0.4	/	/	/
Input power (Pi) (W)	/	311	776	1550	2323	3112	/	/	/
Output power (Po) (W)	/	287	744	1502	2254	3018	/	/	/
Output efficiency(%)	/	92.42	95.84	96.89	97.04	96.99	/	/	/
Input energy (Wi) (Wh)	/	10.40	24.89	51.89	77.75	104.18	/	/	/
Output energy (Wo) (Wh)	/	9.61	25.97	50.27	75.44	101.03	/	/	/
Energy efficiency(%)	/	92.40	95.85	96.88	97.02	96.99	/	/	/
Remark:									
*If limited by design, inverter is not capable to operate with the 120% of rated output load, test under this condition is waived;									

<b>TABLE</b>	No load loss	<b>P</b>
power conditioner type	Utility-interactive	
EVVO 3200TL-AV		
Measure input voltage (V)	360.4	
Measured input power(W)	3.337	
EVVO 3000TL-AV		
Measure input voltage (V)	360.0	
Measured input power(W)	3.541	
EVVO 2700TL-AV		
Measure input voltage (V)	356.0	
Measured input power(W)	3.541	
EVVO 2200TL-AV		
Measure input voltage (V)	360.3	
Measured input power(W)	2.380	
EVVO 1600TL-AV		
Measure input voltage (V)	360.4	
Measured input power(W)	3.032	
EVVO 1100TL-AV		
Measure input voltage (V)	360.4	
Measured input power(W)	3.060	
Remark: No load loss is measured when the power conditioner works at rated input voltage and it's load is disconnected.		

TABLE	Standby loss	P
power conditioner type	Utility-interactive	
EVVO 3200TL-AV		
Measure input voltage (V)	230.0	
Measured input power(W)	0.229	
EVVO 3000TL-AV		
Measure input voltage (V)	230.0	
Measured input power(W)	0.235	
EVVO 2700TL-AV		
Measure input voltage (V)	230.0	
Measured input power(W)	0.235	
EVVO 2200TL-AV		
Measure input voltage (V)	229.3	
Measured input power(W)	0.238	
EVVO 1600TL-AV		
Measure input voltage (V)	234.0	
Measured input power(W)	0.235	
EVVO1100TL-AV		
Measure input voltage (V)	237.6	
Measured input power(W)	0.240	
Remark: Standby loss is measured when the power conditioner works at rated input voltage and in standby mode.		

--- End of test report---



# **ATTACHMENT I**

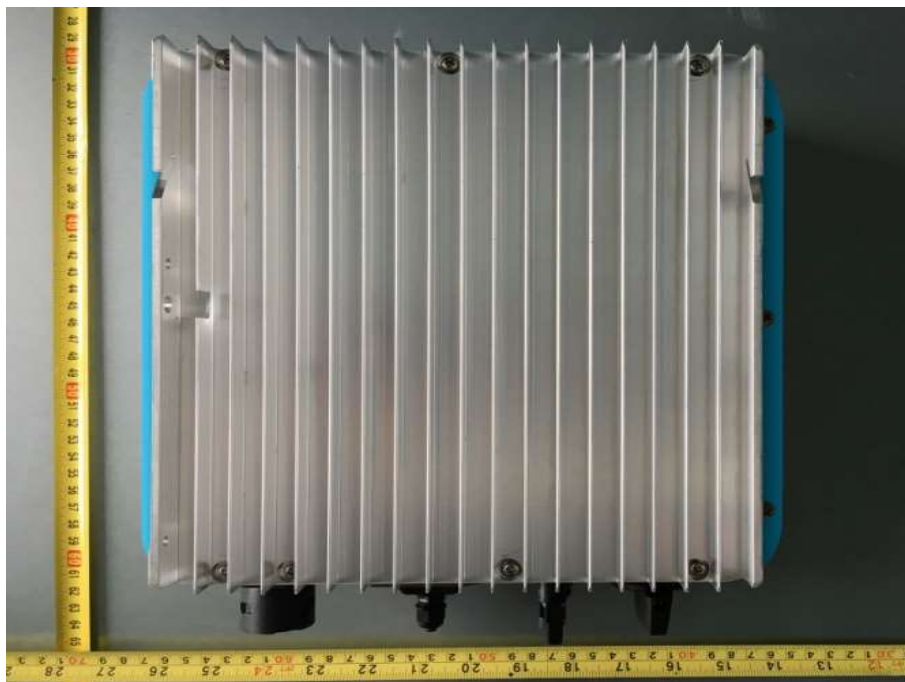
**(Pictures of the EUT and Electrical Schemes)**

## 1 PICTURES

Front view 1(EVVO 2700TL-AV, EVVO 3000TL-AV, EVVO 3200TL-AV)



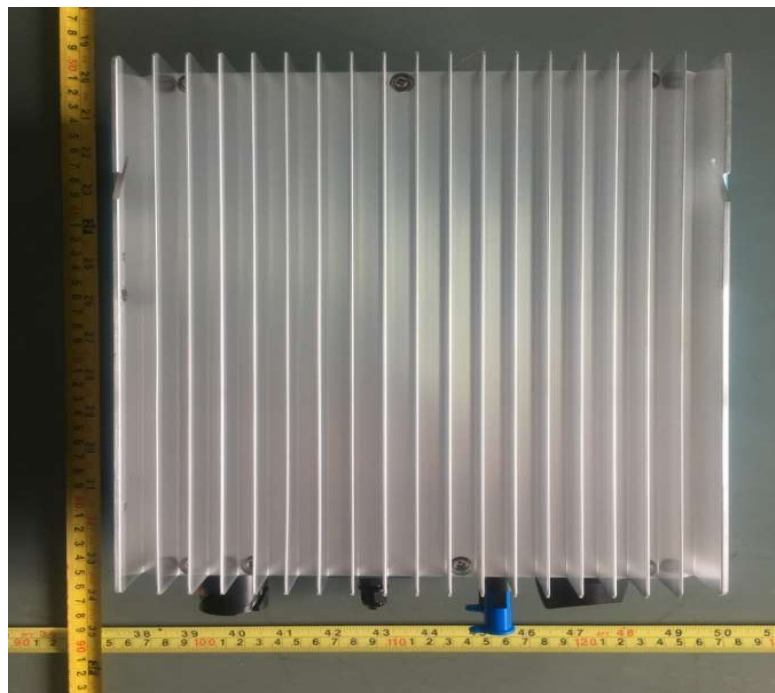
Back view 1(EVVO 2700TL-AV, EVVO 3000TL-AV, EVVO 3200TL-AV)



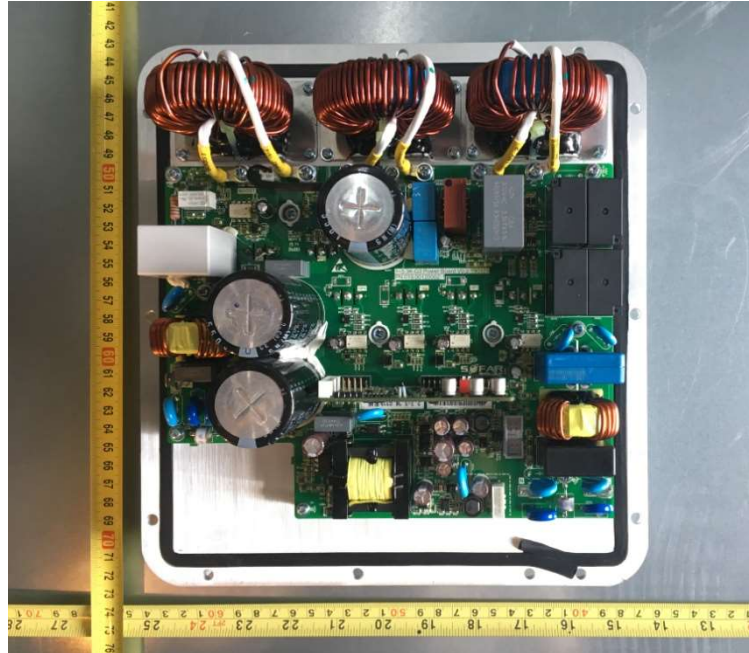
Front view 2 (EVVO 1100TL-AV, EVVO 1600TL-AV, EVVO 2200TL-AV)



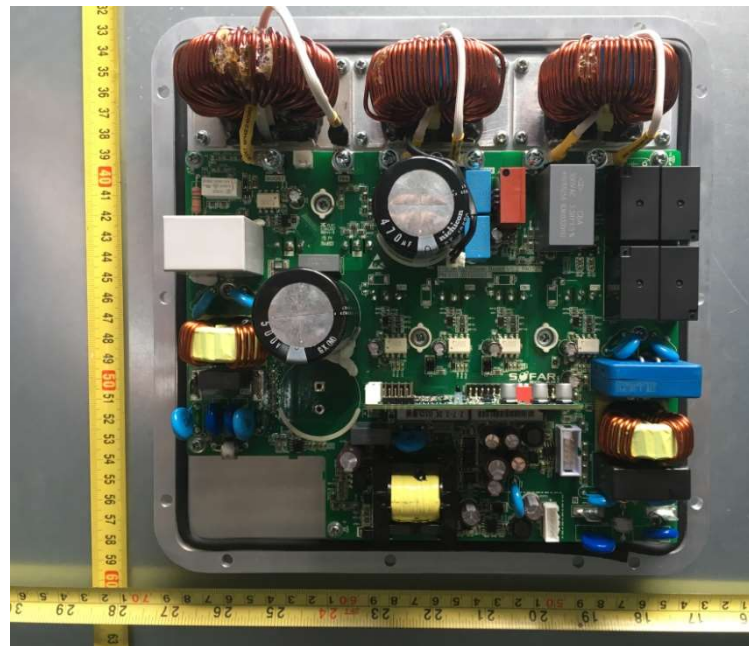
Back view 2 (EVVO 1100TL-AV, EVVO 1600TL-AV, EVVO 2200TL-AV)



Internal view of enclosure (EVVO 2700TL-AV, EVVO 3000TL-AV, EVVO 3200TL-AV)

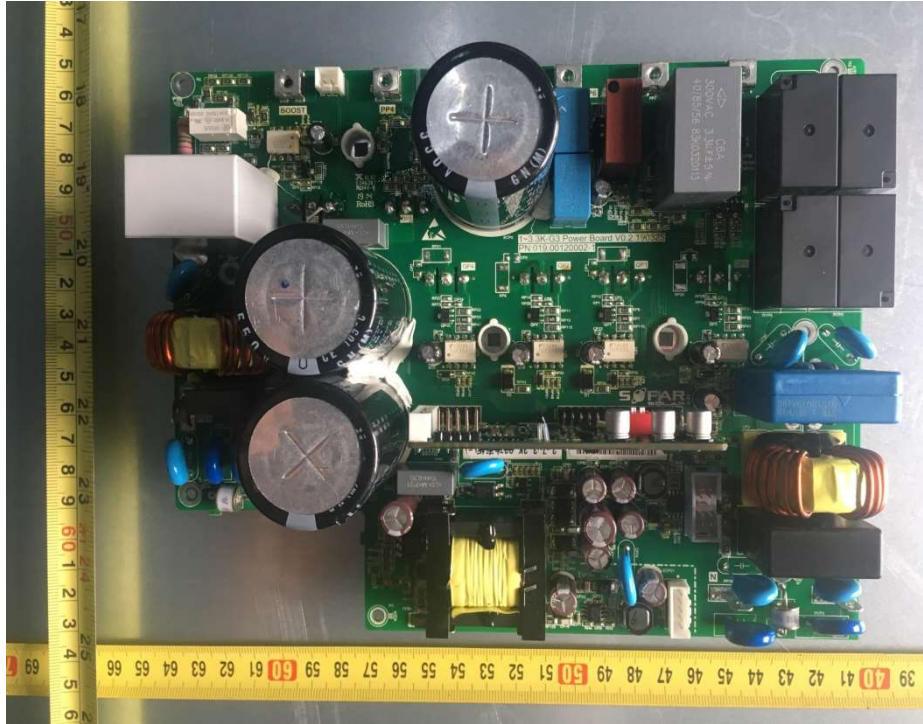


Internal view of enclosure (EVVO 1100TL-AV, EVVO 1600TL-AV, EVVO 2200TL-AV)

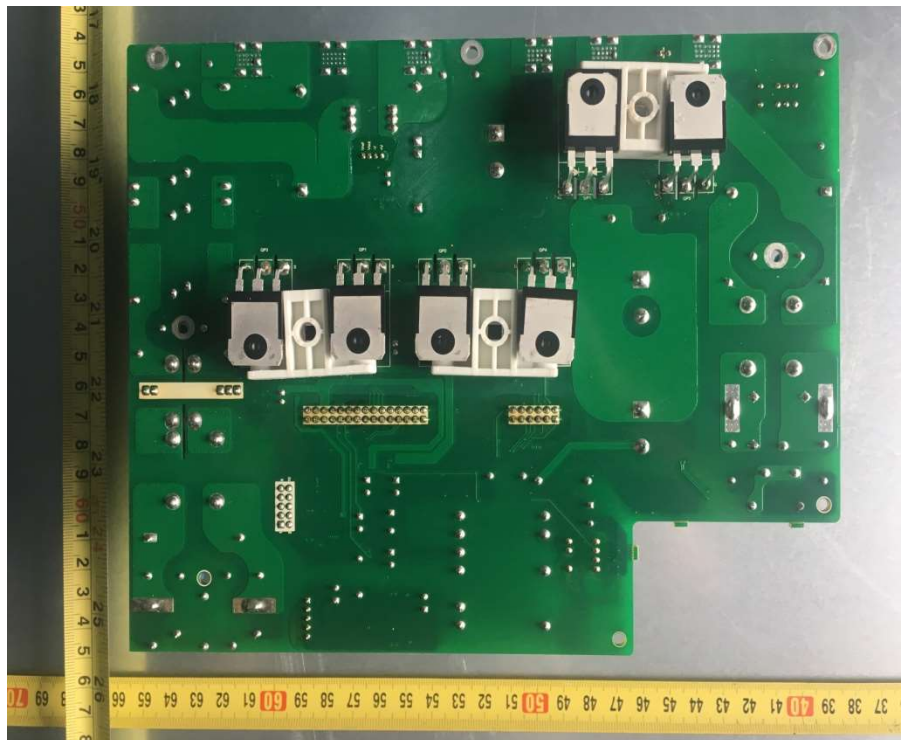




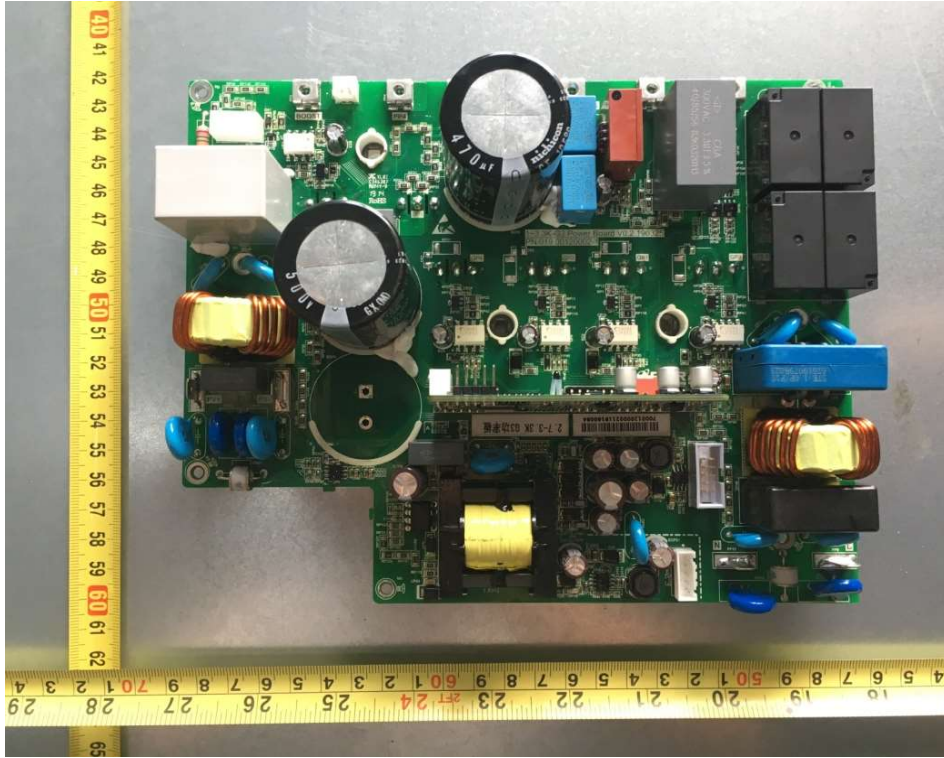
Front side of main board 1(EVVO 2700TL-AV, EVVO 3000TL-AV, EVVO 3200TL-AV)



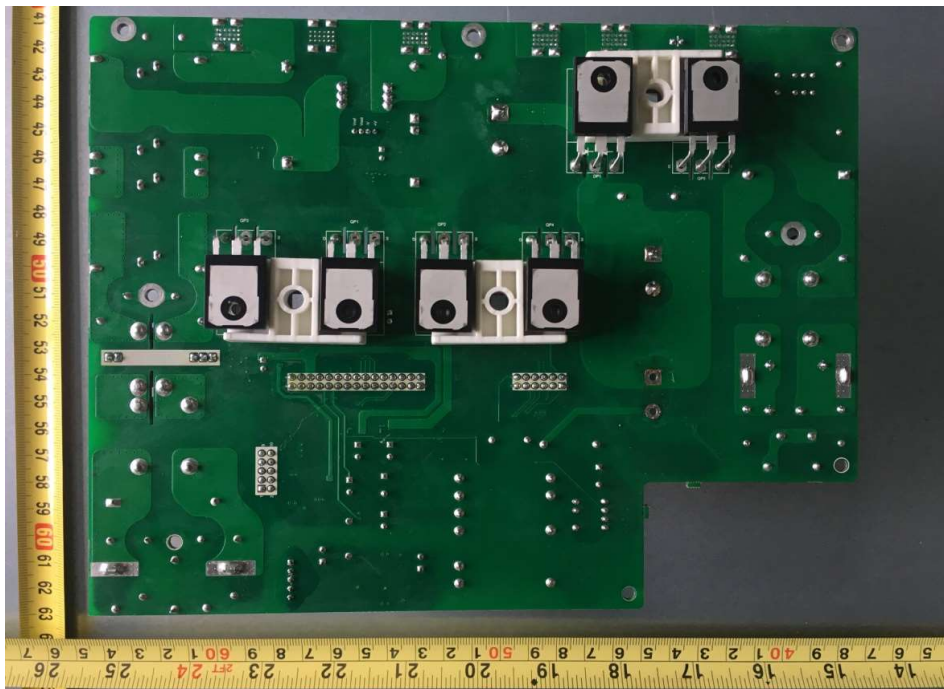
Back side of main board 1(EVVO 2700TL-AV, EVVO 3000TL-AV, EVVO 3200TL-AV)



Front side of main board 2 (EVVO 1100TL-AV, EVVO 1600TL-AV, EVVO 2200TL-AV)

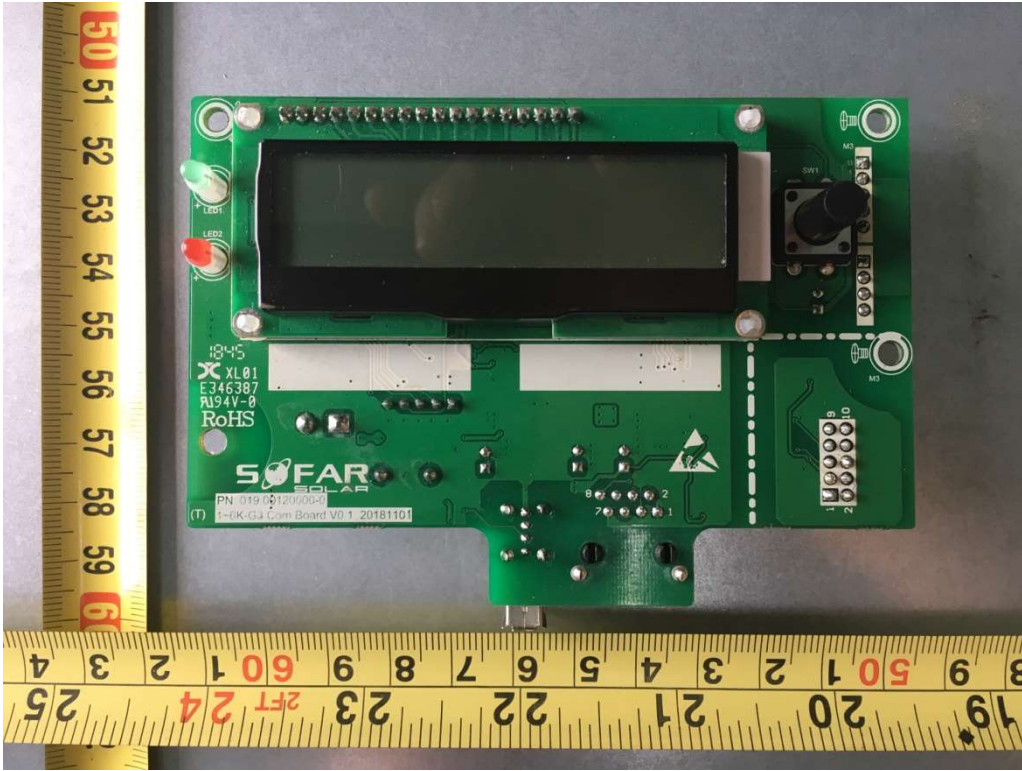


Back side of main board (EVVO 1100TL-AV, EVVO 1600TL-AV, EVVO 2200TL-AV)

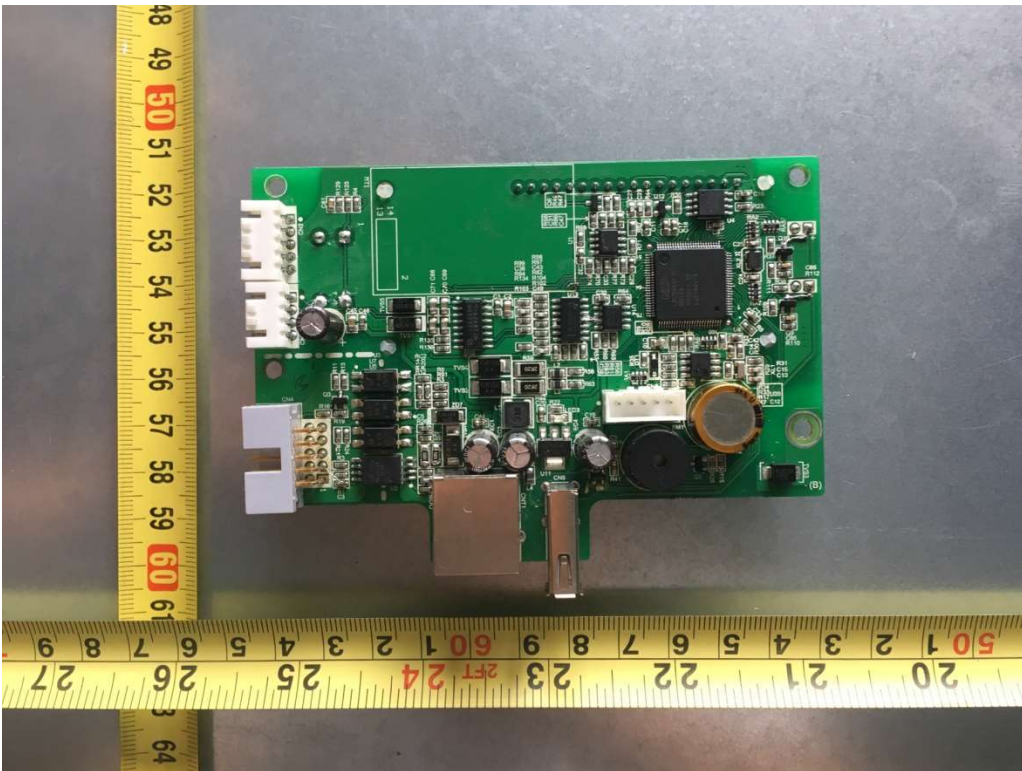




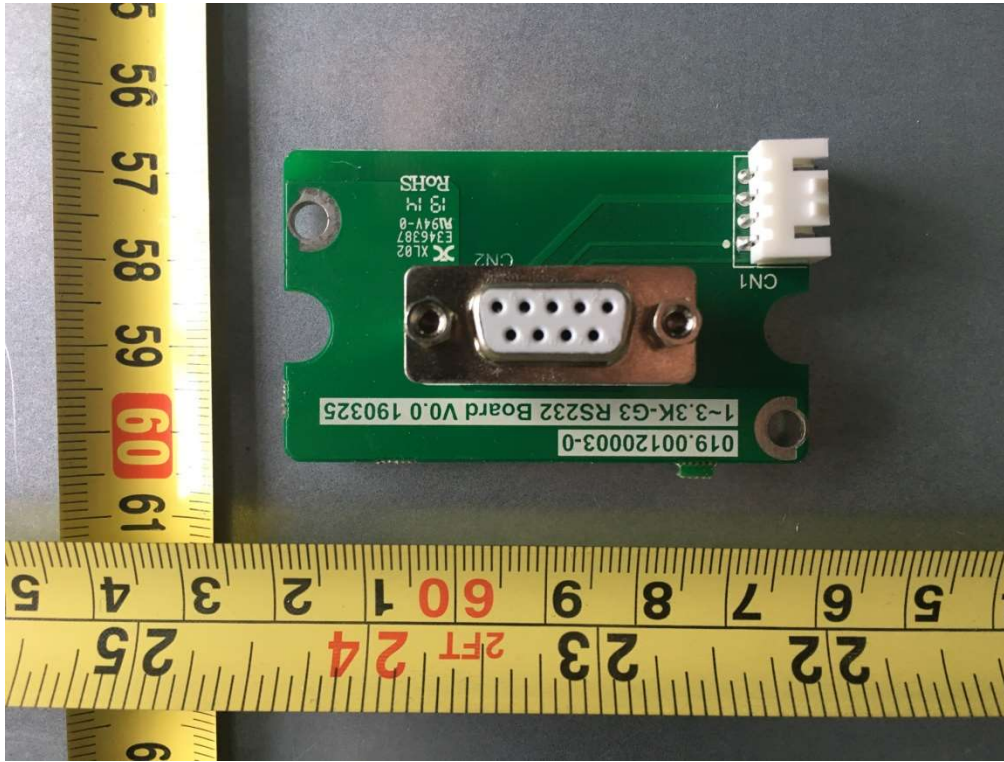
Front side of Control board



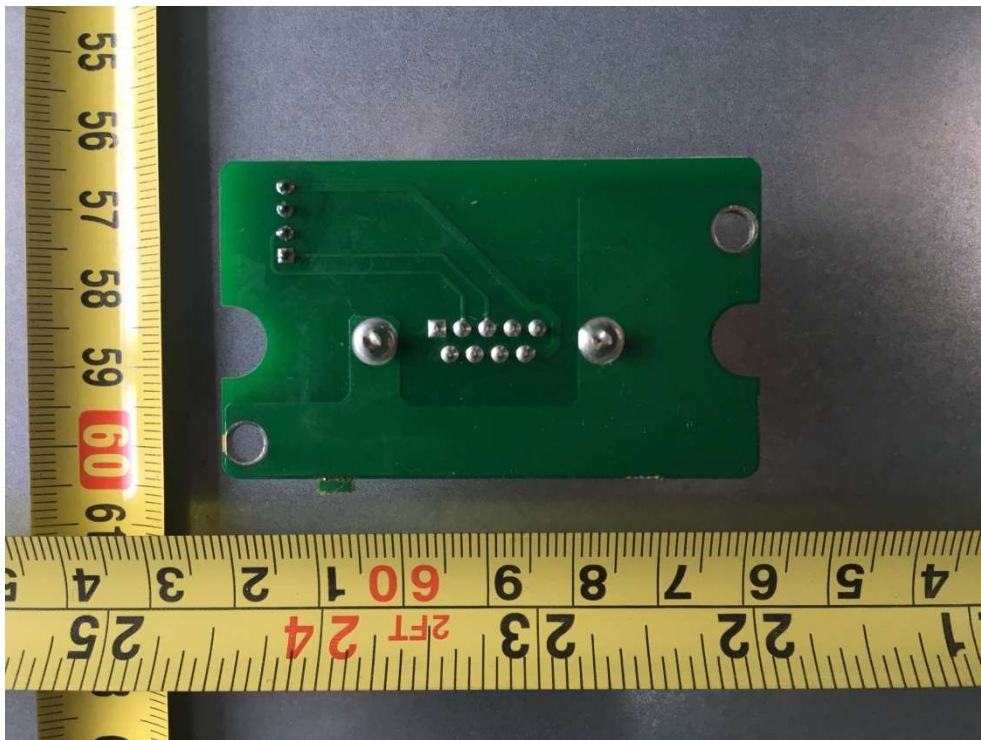
Back side of Control board



Front view of RS 232 board



Back view of RS 232 board





Connection interface



Side View



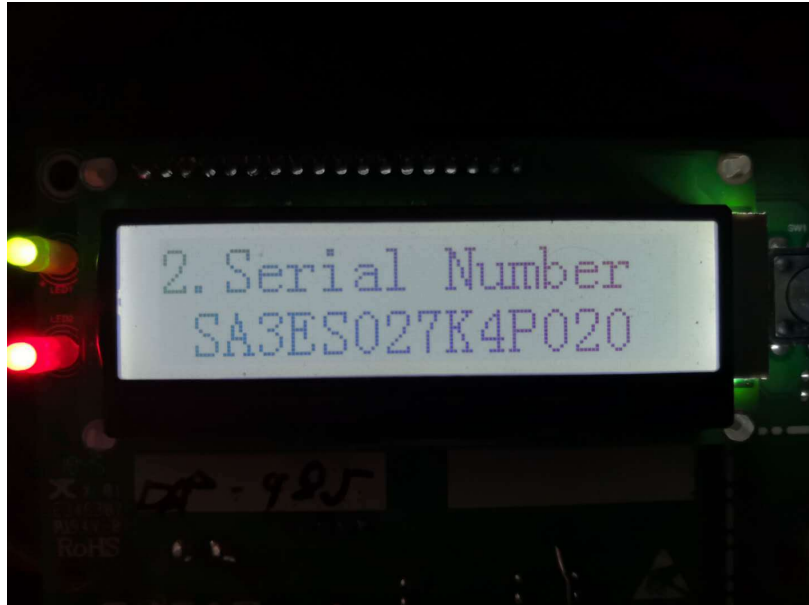
Grounding



Software Number (EVVO 2700TL-AV, EVVO 3000TL-AV, EVVO 3200TL-AV)



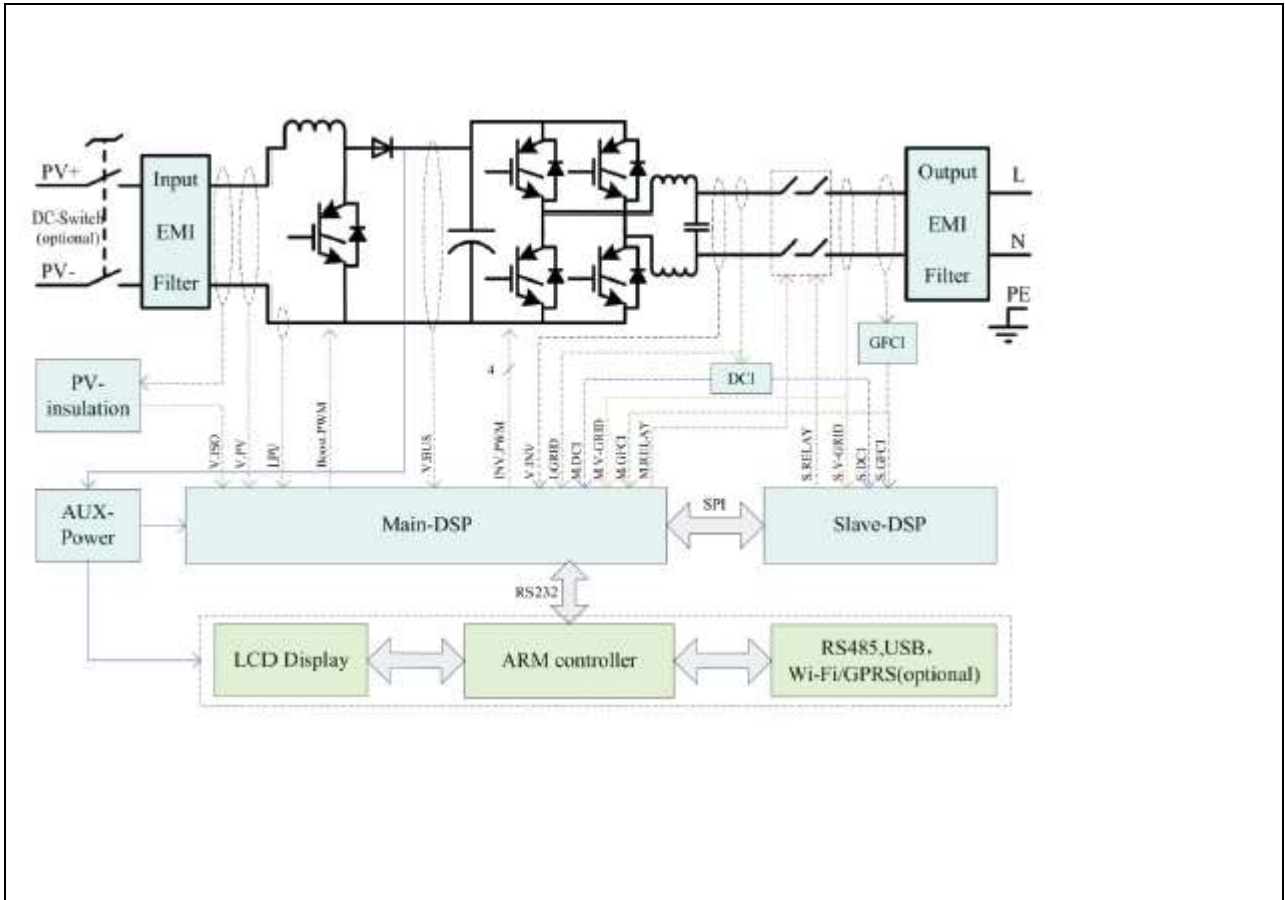
Software Number (EVVO 1100TL-AV, EVVO 1600TL-AV, EVVO 2200TL-AV)



Software version



2 ELECTRICAL SCHEMES



## **ATTACHMENT II**

**(Testing information)**

**1 TESTING CIRCUIT**

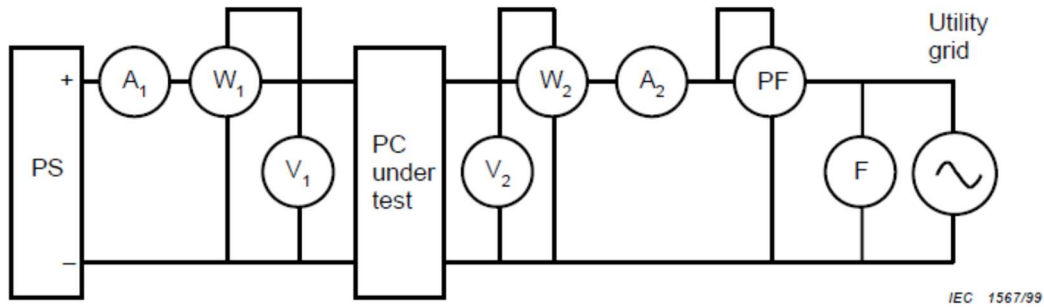


Figure 1b – Utility-interactive type

- |   |                                     |
|---|-------------------------------------|
| PC power conditioner                          | L load                              |
| PS variable voltage-current d.c. power supply | F frequency meter                   |
| A <sub>1</sub> DC ammeter                     | V <sub>1</sub> DC voltmeter         |
| A <sub>2</sub> AC or d.c. ammeter             | V <sub>2</sub> AC or d.c. voltmeter |
| W <sub>1</sub> DC wattmeter                   | PF power factor meter               |
| W <sub>2</sub> AC or d.c. wattmeter           |                                     |

Current and voltage clamps have been connected to the inverter input/output for all the tests.  
 All the tests and checks have been performed in accordance with the reference standard under testing.

**2 TESTING EQUIPMENT**

From	No.	Equipment Name	Model No.	Equipment No.	Calibration Date	Equipment calibration due date
Sofarsolar	1	Digital oscilloscope	DS05014A	MY5007026 6	2019-02-13	2020-02-12
	2	Voltage probe	SI-9110	111541	2019-02-13	2020-02-12
	3	Voltage probe	SI-9110	152627	2019-02-13	2020-02-12
	4	Voltage probe	SI-9110	111134	2019-02-13	2020-02-12
	5	Power analyzer	WT3000	91N610888	2019-02-13	2020-02-12
	6	Current probe	i1000s	29503223	2019-02-13	2020-02-12
	7	Current probe	i1000s	30413448	2019-02-13	2020-02-12
	8	Current probe	CP5150	C150150008	2019-02-13	2020-02-12
	9	Temperature & Humidity meter	TH101B	2010302452 20	2019-02-13	2020-02-12
	10	Temperature & Humidity Chamber	HGTP-225R	HG1303080 1	2019-02-13	2020-02-12
SGS	11	True RMS Multimeter	Fluke / 289C	GZE012-53	2019-02-26	2020-02-25

Items	Specifications
1) PV array simulator	
a) Voltage range	0 – 1000Vdc ( 0.01V step)
b) Current range	0 – 40A ( 0.01A step)
2) AC power source	
a) Output wiring	Three phase
b) Output capacity	30KVA
c) Output voltage	10-300Vrms
d) Output frequency	45-65Hz
e) Voltage stability	± 100ppm/°C
f) Output voltage distortion	0.05% max.
3) Digital meter	
a) Voltage range	0 – 1000Vdc, 0 – 600Vrms
b) Current range	0 – 30A
c) Frequency range ( accuracy)	0.2%
d) Measurement items	Voltage (V)    Current (A)    Active power (W) Reactive power (Var) Volt-ampere (VA) Power factor (PF) Frequency (Hz) Electric energy (Wh)
4) Waveform recorder	
a) Sampling speed	1M/s
b) Recording device	Memory record and USB reading
c) Time accuracy	± 500ppm
5) AC load	
a) Resistive load	Maximum voltage: 300Vrms Current range: 0 – 100A Capacity: 30KW
b) Inductive load	Maximum voltage: 300Vrms Current range: 0 – 100A Capacity: 30KVA
c) Capacitive load	Maximum voltage: 300Vrms Current range: 0 – 100A Capacity: 30KVA



**3 MEASUREMENT UNCERTAINTY**

<b>Magnitude</b>	<b>Uncertainty</b>
Voltage measurement	±1.5 %
Current measurement	±2.0 %
Frequency measurement	±0.2 %
Time measurement	±0.2 %
Power measurement	±2.5 %
Phase Angle	±1°
Temperature	±3° C
<p>Note1: Measurements uncertainties showed in this table are maximum allowable uncertainties. The measurement uncertainties associated with other parameters measured during the tests are in the laboratory at disposal of the petitioner.</p> <p>Note2: Where the standard requires lower uncertainties that those in this table. Most restrictive uncertainty has been considered.</p>	