



TEST ACCORDING TO EN 50530:2010/A1:2013 OVERALL EFFICIENCY OF GRID CONNECTED PHOTOVOLTAIC INVERTERS

Test Report Number: **GZES210101088601**
Tested Model: **SOFAR 20KTLX-G3, SOFAR 15KTLX-G3,
SOFAR 5KTLM-G2**
Variant Model.....: **N/A**

APPLICANT

Name.....: Shenzhen SOFARSOLAR Co., Ltd.
Address: 401, Building 4, AnTongDa Industrial Park, District 68,
XingDong Community, XinAn Street, BaoAn District,
Shenzhen City, Guangdong Province, P.R. China

TESTING LABORATORY

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Guangzhou Branch
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Hugo Zhang

Reviewed & Approved by.....: Roger Hu
(Technical Reviewer)

Roger Hu

Date of issue: **23/02/2021**

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Test Report Historical Revision:

Test Report Version	Date	Resume
GZES210101088601	23/02/2021	First Issuance

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EN 50530:2010/A1:2013**1 SCOPE**

SGS-CSTC Standards Technical Services Co., Ltd. Guangzhou Branch has been contract by Shenzhen SOFARSOLAR Co., Ltd., in order to perform the testing according to following standards:

:

- **EN 50530:2010/A1:2013.** Overall efficiency of grid connected photovoltaic inverters.

2 GENERAL INFORMATION

2.1 Testing Period and Climatic conditions

The necessary testing has been performed between the 17th of Jan. and the 31th of Jan. of 2021.

All the tests and checks have been performed in accordance with the reference Standard (the tests are done at $25 \pm 5^\circ\text{C}$, $96 \text{ kPa} \pm 10 \text{ kPa}$ and $50\% \text{ RH} \pm 10\% \text{ RH}$).

SITE TEST

Name : Shenzhen SOFARSOLAR Co., Ltd.
 Address : 401, Building 4, AnTongDa Industrial Park, District 68,
 XingDong Community, XinAn Street, BaoAn District,
 Shenzhen City, Guangdong Province, P.R. China

2.2 Equipment under Testing

Test Item

Apparatus type/ Installation : Solar Grid-tied Inverter
 Manufacturer/ Supplier/ Installer : **Shenzhen SOFARSOLAR Co., Ltd.**

Trade mark :



Type : SOFAR
 Model : SOFAR 20KTLX-G3, SOFAR 15KTLX-G3,
 SOFAR 5KTLM-G2

Serial Number : --
 Software Version : --
 Rated Characteristics : See page 7
 Date of manufacturing: 2020

Test item particulars

Input DC
 Output AC
 Class of protection against electric shock Class I
 Degree of protection against moisture IP 65
 Type of connection to the main supply Fixed installation
 Cooling group Heat sink
 Modular No
 Internal Transformer No

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Rating Plate:

SOFAR SOLAR Solar Grid-tied Inverter

Model No: SOFAR 20KTLX-G3

Max. DC Input Voltage ----- 1100V

Operating MPPT Voltage Range ----- 140~1000V

Max. Input Current ----- 26A/26A

Max. PV Isc ----- 36A/36A

Nominal Grid Voltage ----- 3/N/PE,380/400V

Max. Output Current ----- 3x31.9A

Nominal Grid Frequency ----- 50/60Hz

Nominal Output Power ----- 20000W

Max. Output Power ----- 22000VA

Power Factor ----- 1 (adjustable+/-0.8)

Ingress Protection ----- IP65

Operating Temperature Range ----- -30°C~ +60°C

Protective Class ----- Class I

Made in China

Manufacturer : Shenzhen SOFAR SOLAR Co.,Ltd.
 Address : 401, Building 4, AnTongDa Industrial Park,
 District 68, XingDong Community, XinAn Street,
 BaoAn District, Shenzhen, China
 VDE0126-1-1, VDE-AR-N4 105, G99, IEC61727
 IEC62116, UTE C 15-712-1, AS4777

SOFAR SOLAR Solar Grid-tied Inverter

Model No: SOFAR 15KTLX-G3

Max. DC Input Voltage ----- 1100V

Operating MPPT Voltage Range ----- 140~1000V

Max. Input Current ----- 26A/26A

Max. PV Isc ----- 36A/36A

Nominal Grid Voltage ----- 3/N/PE,380/400V

Max. Output Current ----- 3x23.9A

Nominal Grid Frequency ----- 50/60Hz

Nominal Output Power ----- 15000W

Max. Output Power ----- 16500VA

Power Factor ----- 1 (adjustable+/-0.8)

Ingress Protection ----- IP65

Operating Temperature Range ----- -30°C~ +60°C

Protective Class ----- Class I

Made in China

Manufacturer : Shenzhen SOFAR SOLAR Co.,Ltd.
 Address : 401, Building 4, AnTongDa Industrial Park,
 District 68, XingDong Community, XinAn Street,
 BaoAn District, Shenzhen, China
 VDE0126-1-1, VDE-AR-N4 105, G99, IEC61727
 IEC62116, UTE C 15-712-1, AS4777

SOFAR SOLAR Solar Grid-tied Inverter

Model No: SOFAR 5KTLM-G2

Max. DC Input Voltage ----- 600V

Operating MPPT Voltage Range ----- 90~580V

Max. Input Current ----- 2x11A

Max. PV Isc ----- 2x13.2A

Nominal Grid Voltage ----- 230V

Max. Output Current ----- 22.8A

Nominal Grid Frequency ----- 50/60Hz

Nominal Output Power ----- 5000W

Max. Output Power ----- 5000VA

Power Factor ----- 1 (adjustable+/-0.8)

Ingress Protection ----- IP65

Operating Temperature Range ----- -25°C~ +60°C

Protective Class ----- Class I

Inverter Topology ----- Non-Isolated

Manufacturer : Shenzhen SOFARSOLAR Co.,Ltd.
 Address : 401, Building 4, AnTongDa Industrial Park,
 District 68, XingDong Community, XinAn Street,
 BaoAn District, Shenzhen, China

SAA180100
 VDE0126-1-1, G99, EN50438, AS4777
 IEC62116, IEC61727

EN 50530:2010/A1:2013

Model fully tested:

- SOFAR 20KTLX-G3,
- SOFAR 15KTLX-G3,
- SOFAR 5KTLM-G2

The results obtained apply only to the particular sample tested that is the subject of the present test report. The most unfavorable result values of the verifications and tests performed are contained herein. Throughout this report a comma (point) is used as the decimal separator.

Model Number	SOFAR 20KTLX-G3	SOFAR 15KTLX-G3	SOFAR 5KTLM-G2
PV input			
Max. DC Input Voltage	1100Vd.c.	1100Vd.c.	600Vd.c.
Operating MPPT Voltage Range	140-1000Vd.c.	140-1000Vd.c.	90-580Vd.c.
Full load MPP DC voltage range	480-850Vd.c.	420-850Vd.c.	250-520Vd.c.
Max. input current	26A/26A	26A/26A	11A/11A
Max. PV Isc	36A/36A	36A/36A	13.2A/13.2A
AC output			
Nominal Grid Voltage	3P/N/PE 230/400Vac	3P/N/PE 230/400Vac	230Vac
Max. Output Current	3 x 31.9A	3 x 23.9A	22.8A
Rated grid frequency	50Hz	50Hz	50HZ
Rated output power	20kW	15kW	5kW
Power Factor	1(adjustable+/-0.8)	1(adjustable+/-0.8)	1(adjustable+/-0.8)
Ingress Protection	IP65	IP65	IP65
Protective Class	I	I	I

2.3 Manufacturer and Factory information

Manufacturer Name..... : **Shenzhen SOFARSOLAR Co., Ltd.**
 Manufacturer Address : 401, Building 4, AnTongDa Industrial Park,
 District 68, XingDong Community, XinAn Street,
 BaoAn District, Shenzhen City, Guangdong
 Province, P.R. China.

Factory Name : **Dongguan SOFAR SOLAR Co., Ltd.**
 Factory Address : 1F - 6F, Building E, No. 1 JinQi Road, Bihu
 Industrial Park, Wulian Village, Fenggang Town,
 Dongguan City, Guangdong Province, P.R. China.

2.4 Test Equipment List

From	No.	Equipment Name	Model No.	Equipment No.	Calibration Date	Equipment calibration due date
Sofar Solar	1	Voltage probe	SanHua / SI-9110	111539	2021/01/05	2022/01/04
	2	Voltage probe	SanHua / SI-9110	111134	2021/01/05	2022/01/04
	3	Power analyzer	ZLG / PA3000	C820200565180922 0002	2021/01/05	2022/01/04
	4	Current probe	CYBERTEK / CP1000A	C181000922	2021/01/05	2022/01/04
	5	Current probe	CYBERTEK / CP1000A	C181000929	2021/01/05	2022/01/04
	6	Voltage probe	SanHua / SI-9110	152655	2021/01/05	2022/01/04
	7	Current probe	CYBERTEK / CP1000A	C191000141	2021/01/05	2022/01/04
SGS	8	True RMS Multimeter	Fluke / 187	22930028 (GZE012-53)	2020/02/21	2021/02/20

2.5 Measurement Uncertainty

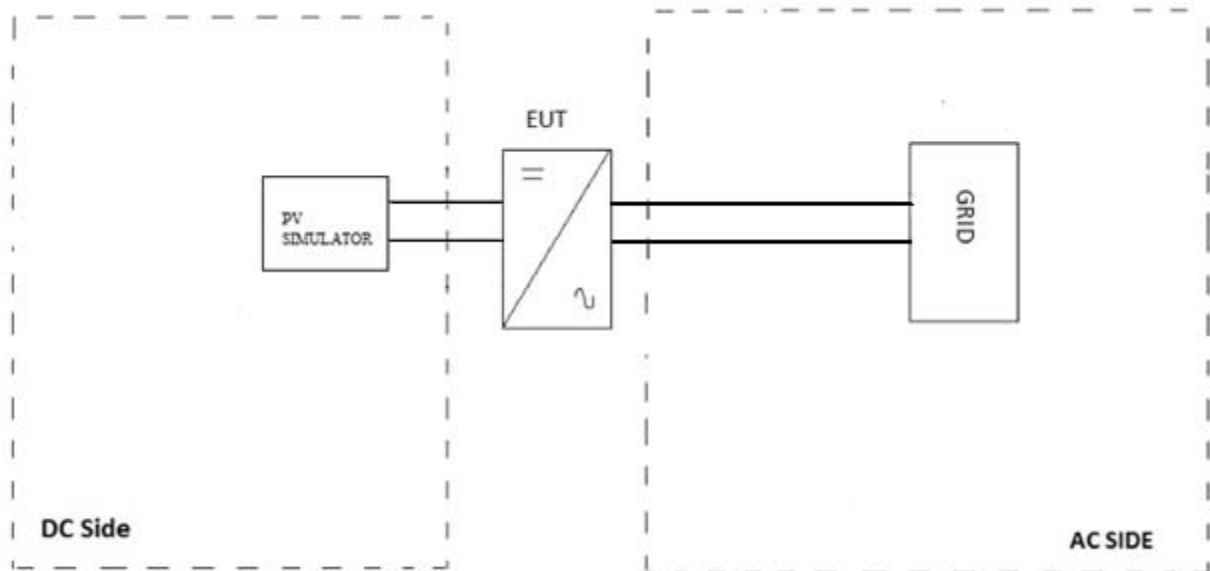
Voltage measurement uncertainty	±1.5 %
Current measurement uncertainty	±2.0 %
Frequency measurement uncertainty	±0.2 %
Time measurement uncertainty	±0.2 %
Power measurement uncertainty	±2.5 %
Phase Angle	±1°
cosφ	±0.01
Note: The measurement uncertainties associated with other parameters measured during the tests are in the laboratory at disposal of the solicitant.	

2.6 Definitions

EUT	Equipment Under Testing	Q_n	Nominal Reactive Power
$I_{DC,I}$	Sampled value of the inverter's input current	S_n	Nominal Apparent Power (Inverter)
I_n	Nominal Current (Inverter)	T_M	Overall measuring period
p.u	Per unit	$U_{DC,I}$	Sampled value of the inverter's input voltage
P_{DC}	Measured input power of the device under test	U_n	Nominal Voltage
$P_{MPP,PVS}$	MPP power provided by the PV simulator	ΔT	Period between two subsequent sample values
P_n	Nominal Active Power (Inverter)	η	Efficiency

2.7 TEST SET UP OF THE DIFFERENT STANDARDS.

Below is the simplified construction of the test set up.



Different equipment has been used to take measures as it shows in chapter 2.3. Current and voltage clamps have been connected to the inverter output for all the tests.

All the tests described in the following pages have used this specified test setup.

The test bench used includes:

EQUIPMENT	MARK / MODEL	RATED CHARACTERISTICS	OWNER / ID.CODE
AC source	Kewell / KACM-75-33	Voltage: 0-600 V 75kVA	Sofarsolar/BZ-EP-L001
PV source(*)	Kewell / IVS-60KW	Voltage: 0 - 1000 V 60kW	Sofarsolar /BZ-EP-L002
Programmable ac load	QUNLING / ACLT-3820	Voltage: 0-600 V 60kVA	Sofarsolar /BZ-EP-L003

(*) Validation by SGS. The report of verification is in the laboratory at disposal of the requestor.

3 RESUME OF TEST RESULTS

INTERPRETATION KEYS

- Test object does meet the requirement **P** Pass
- Test object does not meet the requirement **F** Fails
- Test case does not apply to the test object **N/A** Not applicable
- To make a reference to a table or an annex..... See additional sheet
- To indicate that the test has not been realized..... **N/R** Not realized

STANDARD SECTION	STANDARD REQUIREMENTS	
	EN 50530:2010/A1:2013	
4.3	Static MPPT efficiency	P
4.3.1	Test conditions for the Static MPPT efficiency	P
4.3.2	Measurement procedure	P
4.3.3	Evaluation – Calculation of static MPPT efficiency	P
4.5	Static power conversion efficiency	P
4.5.1	Test conditions for the static power conversion efficiency	P
4.5.2	Measurement procedure	P
4.5.3	Evaluation – Calculation of the static conversion efficiency	P
5	Calculation of the overall efficiency	P

4 TEST RESULTS

4.1 STATIC MPPT EFFICIENCY TEST

Static MPPT efficiency test has been performed according to point 4.3 of the standard.

The MPPT efficiency describes the accuracy of an inverter to set the maximum power point on the characteristic curve of a PV generator. It is determined from the sampled instantaneous values of voltage and current at the input.

$$\eta_{MPPTstat} = \frac{1}{P_{MPP,PVS} \cdot T_M} \sum_i U_{DC,i} \cdot I_{DC,i} \cdot \Delta T$$

See point 2.5 (Definitions) of this report. The following table shows the results of this test:

Model: SOFAR 20KTLX-G3									
MPP voltage of the simulated I/V characteristic	Simulated I/V characteristic	MPP power of the simulated I/V characteristic normal-ised to rated DC power, $P_{MPP,PVS}/P_{DC}(\%)$							
		0.05	0.10	0.20	0.25	0.30	0.50	0.75	1.00
U min 480 Vdc	c-Si	99.90	99.85	99.91	99.90	99.89	99.92	99.98	99.96
U nom 650 Vdc		99.90	99.86	99.94	99.92	99.93	99.90	99.95	99.98
U max 800 Vdc		99.93	99.95	99.94	99.95	99.94	99.96	99.96	99.95
Model: SOFAR 15KTLX-G3									
MPP voltage of the simulated I/V characteristic	Simulated I/V characteristic	MPP power of the simulated I/V characteristic normal-ised to rated DC power, $P_{MPP,PVS}/P_{DC}(\%)$							
		0.05	0.10	0.20	0.25	0.30	0.50	0.75	1.00
U min 420 Vdc	c-Si	99.88	99.81	99.89	99.85	99.80	99.96	99.97	99.96
U nom 650 Vdc		99.89	99.94	99.91	99.91	99.92	99.95	99.91	99.95
U max 850 Vdc		99.89	99.93	99.95	99.95	99.96	99.96	99.94	99.96
Model: SOFAR 5KTLX-G2									
MPP voltage of the simulated I/V characteristic	Simulated I/V characteristic	MPP power of the simulated I/V characteristic normal-ised to rated DC power, $P_{MPP,PVS}/P_{DC}(\%)$							
		0.05	0.10	0.20	0.25	0.30	0.50	0.75	1.00
U min 250 Vdc	c-Si	99.64	99.89	99.93	99.94	99.95	99.96	99.96	99.97
U nom 360 Vdc		99.85	99.92	99.95	99.95	99.96	99.96	99.97	99.96
U max 520 Vdc		99.85	99.91	99.96	99.95	99.97	99.97	99.98	99.98

4.2 DYNAMIC MPPT EFFICIENCY TEST

Test for the dynamic MPPT efficiency are to be performed with the following sequences. The percentage specification of the radiation intensity is related to standard test conditions (STC). 100 % corresponds to 1 000 W/m² at 25 °C.

4.2.1 Test sequence with ramps 10 % - 50 % PDCn

The test has been performed according to point Annex B.2 of the standard.

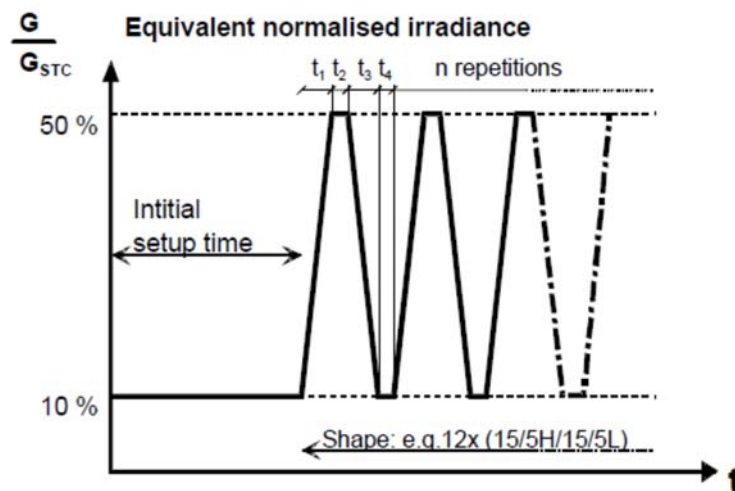


Figure B.1 – Test sequence for fluctuations between small and medium irradiation intensities

Model: SOFAR 20KTLX-G3							
From-to W/m ²	Delta W/m ²					Waiting time setting s	
100-500	400					300	
# Number	Slope W/m ² /s	Ramp UP s	Dwell time s	Ramp DN s	Dwell time s	Duration s	Efficiency (%)
2	0.5	800	10	800	10	3540	99.97
2	1	400	10	400	10	1940	99.95
3	2	200	10	200	10	1560	99.91
4	3	133	10	133	10	1447	99.83
6	5	80	10	80	10	1300	99.64
8	7	57	10	57	10	1374	99.59
10	10	40	10	40	10	1700	99.64
10	14	29	10	29	10	1071	99.50
10	20	20	10	20	10	900	99.35
10	30	13	10	13	10	767	99.26
10	50	8	10	8	10	660	98.49

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Model: SOFAR 15KTLX-G3							
From-to W/m ²	Delta W/m ²					Waiting time setting s	
100-500	400					300	
# Number	Slope W/m ² /s	Ramp UP s	Dwell time s	Ramp DN s	Dwell time s	Duration s	Efficiency (%)
2	0.5	800	10	800	10	3540	99.95
2	1	400	10	400	10	1940	99.95
3	2	200	10	200	10	1560	99.94
4	3	133	10	133	10	1447	99.93
6	5	80	10	80	10	1300	99.88
8	7	57	10	57	10	1374	99.80
10	10	40	10	40	10	1700	99.57
10	14	29	10	29	10	1071	99.37
10	20	20	10	20	10	900	99.19
10	30	13	10	13	10	767	99.16
10	50	8	10	8	10	660	98.90

Model: SOFAR 5KTLX-G2							
From-to W/m ²	Delta W/m ²					Waiting time setting s	
100-500	400					300	
# Number	Slope W/m ² /s	Ramp UP s	Dwell time s	Ramp DN s	Dwell time s	Duration s	Efficiency (%)
2	0.5	800	10	800	10	3540	99.84
2	1	400	10	400	10	1940	99.45
3	2	200	10	200	10	1560	99.66
4	3	133	10	133	10	1447	99.51
6	5	80	10	80	10	1300	99.23
8	7	57	10	57	10	1374	98.76
10	10	40	10	40	10	1700	99.20
10	14	29	10	29	10	1071	98.77
10	20	20	10	20	10	900	98.18
10	30	13	10	13	10	767	98.36
10	50	8	10	8	10	660	98.44

4.2.2 Test sequence with ramps 30 % - 100 % PDCn

The test has been performed according to point Annex B.3 of the standard.

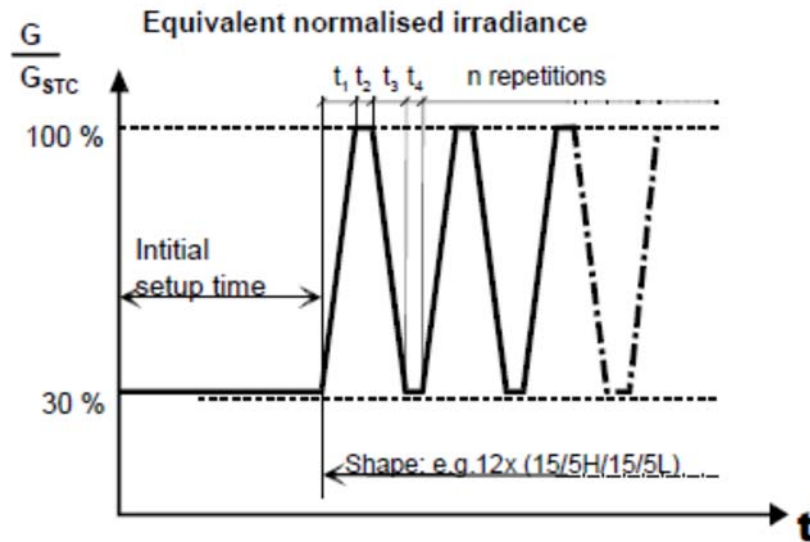


Figure B.2 – Test sequence for fluctuations between medium and high irradiation intensities

Model: SOFAR 20KTLX-G3							
From-to W/m ²	Delta W/m ²					Waiting time setting s	
300-1000	700					300	
# Number	Slope W/m ² /s	Ramp UP s	Dwell time s	Ramp DN s	Dwell time s	Duration s	Efficiency (%)
10	10	70	10	70	10	1900	99.94
10	14	50	10	50	10	1500	99.95
10	20	35	10	35	10	1200	99.92
10	30	23	10	23	10	967	99.90
10	50	14	10	14	10	780	99.89
10	100	7	10	7	10	640	99.78

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Model: SOFAR 15KTLX-G3							
From-to W/m ²	Delta W/m ²					Waiting time setting s	
300-1000	700					300	
# Number	Slope W/m ² /s	Ramp UP s	Dwell time s	Ramp DN s	Dwell time s	Duration s	Efficiency (%)
10	10	70	10	70	10	1900	99.96
10	14	50	10	50	10	1500	99.95
10	20	35	10	35	10	1200	99.92
10	30	23	10	23	10	967	99.90
10	50	14	10	14	10	780	99.89
10	100	7	10	7	10	640	99.68

Model: SOFAR 5KTLX-G2							
From-to W/m ²	Delta W/m ²					Waiting time setting s	
300-1000	700					300	
# Number	Slope W/m ² /s	Ramp UP s	Dwell time s	Ramp DN s	Dwell time s	Duration s	Efficiency (%)
10	10	70	10	70	10	1900	99.86
10	14	50	10	50	10	1500	99.91
10	20	35	10	35	10	1200	99.71
10	30	23	10	23	10	967	99.81
10	50	14	10	14	10	780	99.79
10	100	7	10	7	10	640	99.68

EN 50530:2010/A1:2013
4.2.3 Start-up and shut-down test with slow ramps

The test has been performed according to point Annex B.4 of the standard.

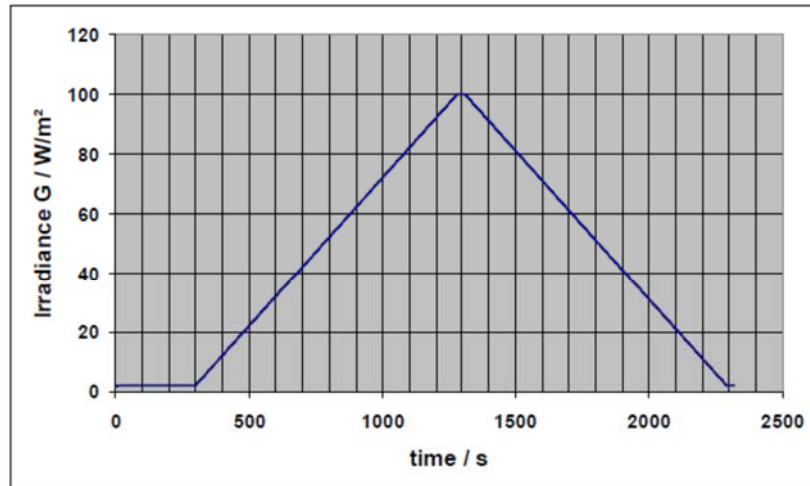


Figure B.3 – Test sequence for the start-up and shut-down test of grid connected inverters

Model: SOFAR 20KTLX-G3							
From-to W/m ²	Delta W/m ²		Dwell time setting s			Waiting time setting s	
10-100	90		30			300	
# Number	Slope W/m ² /s	Ramp UP s	Dwell time s	Ramp DN s	Dwell time s	Duration s	Efficiency (%)
1	0.1	980	30	980	30	2320	99.83

Model: SOFAR 15KTLX-G3							
From-to W/m ²	Delta W/m ²		Dwell time setting s			Waiting time setting s	
10-100	90		30			300	
# Number	Slope W/m ² /s	Ramp UP s	Dwell time s	Ramp DN s	Dwell time s	Duration s	Efficiency (%)
1	0.1	980	30	980	30	2320	99.70

Model: SOFAR 5KTLX-G2							
From-to W/m ²	Delta W/m ²		Dwell time setting s			Waiting time setting s	
10-100	90		30			300	
# Number	Slope W/m ² /s	Ramp UP s	Dwell time s	Ramp DN s	Dwell time s	Duration s	Efficiency (%)
1	0.1	980	30	980	30	2320	97.66

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4.3 STATIC POWER CONVERSION EFFICIENCY

Static power conversion efficiency test has been performed according to point 4.5 of the standard. Rated output efficiency shall be calculated from measured data as follows:

$$\eta_R = (P_o / P_i) \times 100$$

where

η_R is the rated output efficiency (%);

P_o is the rated output power from power conditioner (kW);

P_i is the input power to power conditioner at rated output (kW).

The following table shows the results of this test:

Model: SOFAR 20KTLX-G3									
MPP voltage of the simulated I/V-characteristic	Simulated I/V characteristic	Power conversion efficiency (%)							
		0.05	0.10	0.20	0.25	0.30	0.50	0.75	1.00
U min 480 Vdc	c-Si	95.87	97.81	98.05	98.14	98.23	98.56	98.52	98.38
U nom 650 Vdc		96.73	98.01	98.52	98.58	98.58	98.68	98.63	98.47
U max 800 Vdc		95.89	97.83	98.19	98.30	98.45	98.59	98.52	98.39
Model: SOFAR 15KTLX-G3									
MPP voltage of the simulated I/V-characteristic	Simulated I/V characteristic	Power conversion efficiency (%)							
		0.05	0.10	0.20	0.25	0.30	0.50	0.75	1.00
U min 420 Vdc	c-Si	95.80	97.71	97.98	98.07	98.23	98.51	98.44	98.35
U nom 650 Vdc		96.38	97.75	98.33	98.45	98.52	98.64	98.58	98.46
U max 850 Vdc		95.60	97.72	98.12	98.28	98.43	98.52	98.51	98.39
Model: SOFAR 5KTLX-G2									
MPP voltage of the simulated I/V-characteristic	Simulated I/V characteristic	Power conversion efficiency (%)							
		0.05	0.10	0.20	0.25	0.30	0.50	0.75	1.00
U min 250 Vdc	c-Si	94.88	96.21	97.13	97.35	97.65	97.70	97.30	97.00
U nom 360 Vdc		95.67	97.51	97.81	97.85	97.91	98.15	97.99	97.96
U max 520 Vdc		95.20	97.42	97.50	97.60	97.62	97.77	97.65	97.55

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4.4 OVERALL EFFICIENCY

Overall efficiency test has been performed according to point 5 of the standard.

The overall efficiency has been calculated according the following equation:

$$\eta_t = \eta_{conv} \cdot \eta_{MPPTstat} = \frac{P_{AC}}{P_{MPP,PVS}}$$

The following table shows the results of this test:

Model: SOFAR 20KTLX-G3									
MPP voltage of the simulated I/V-characteristic	Simulated I/V characteristic	Overall efficiency (%)							
		0.05	0.10	0.20	0.25	0.30	0.50	0.75	1.00
U min 480 Vdc	c-Si	95.77	97.66	97.96	98.04	98.12	98.48	98.50	98.34
U nom 650 Vdc		96.67	98.05	98.45	98.66	98.70	98.70	98.42	98.33
U max 800 Vdc		96.63	97.87	98.46	98.50	98.51	98.58	98.58	98.45
Model: SOFAR 15KTLX-G3									
MPP voltage of the simulated I/V-characteristic	Simulated I/V characteristic	Overall efficiency (%)							
		0.05	0.10	0.20	0.25	0.30	0.50	0.75	1.00
U min 420 Vdc	c-Si	95.69	97.52	97.87	97.92	98.03	98.47	98.41	98.31
U nom 650 Vdc		96.67	98.05	98.45	98.66	98.70	98.70	98.42	98.33
U max 850 Vdc		96.27	97.69	98.24	98.36	98.44	98.59	98.49	98.41
Model: SOFAR 5KTLX-G2									
MPP voltage of the simulated I/V-characteristic	Simulated I/V characteristic	Overall efficiency (%)							
		0.05	0.10	0.20	0.25	0.30	0.50	0.75	1.00
U min 250 Vdc	c-Si	94.54	96.10	97.06	97.29	97.60	97.66	97.26	96.97
U nom 360 Vdc		96.67	98.05	98.45	98.66	98.70	98.70	98.42	98.33
U max 520 Vdc		95.53	97.43	97.76	97.80	97.87	98.11	97.96	97.92

4.5 EUROPEAN EFFICIENCY

European efficiency test has been performed according to point annex D.1 of the standard.

For the calculation of a weighted European MPPT and conversion efficiency the following formula and factors are to be applied:

$$\eta_{MPPTstat, EUR} = a_{EU_1} \cdot \eta_{MPP_1} + a_{EU_2} \cdot \eta_{MPP_2} + a_{EU_3} \cdot \eta_{MPP_3} + a_{EU_4} \cdot \eta_{MPP_4} + a_{EU_5} \cdot \eta_{MPP_5} + a_{EU_6} \cdot \eta_{MPP_6} \quad (D.1)$$

a_{EU_j} weighting factor

η_{MPP_i} static MPPT efficiency at partial MPP power MPP_i

Table D.1 – Weighting factors and partial MPP power levels for the calculation of the European efficiency

Weighting Factor	a_{EU_1}	a_{EU_2}	a_{EU_3}	a_{EU_4}	a_{EU_5}	a_{EU_6}
	0.03	0.06	0.13	0.1	0.48	0.2
Partial MPP power $P_{MPP, PVs} / P_{DC, r}$	MPP_1	MPP_2	MPP_3	MPP_4	MPP_5	MPP_6
	0.05	0.1	0.2	0.3	0.5	1

Model: SOFAR 20KTLX-G3

$$\eta_{MPPTstat, EUR(c-si)} = \mathbf{98.32\%}$$

Model: SOFAR 15KTLX-G3

$$\eta_{MPPTstat, EUR(c-si)} = \mathbf{98.27\%}$$

Model: SOFAR 5KTLX-G2

$$\eta_{MPPTstat, EUR(c-si)} = \mathbf{97.56\%}$$

4.6 CEC EFFICIENCY

European efficiency test has been performed according to point annex D.2 of the standard.

For the calculation of a weighted CEC MPPT and conversion efficiency the following formula and factors are to be applied:

$$\eta_{MPPTstat,CEC} = a_{CEC_1} \cdot \eta_{MPP_1} + a_{CEC_2} \cdot \eta_{MPP_2} + a_{CEC_3} \cdot \eta_{MPP_3} + a_{CEC_4} \cdot \eta_{MPP_4} + a_{CEC_5} \cdot \eta_{MPP_5} + a_{CEC_6} \cdot \eta_{MPP_6} \quad (D.2)$$

a_{CEC_i} weighting factor

η_{MPP_i} static MPPT efficiency at partial MPP power MPP_i

Table D.2 – Weighting factors and partial MPP power levels for the calculation of the CEC efficiency (California Energy Commission)

Weighting Factor	a_{CEC_1}	a_{CEC_2}	a_{CEC_3}	a_{CEC_4}	a_{CEC_5}	a_{CEC_6}
	0.04	0.05	0.12	0.21	0.53	0.05
Partial MPP power $P_{MPP,PVS}/P_{DC,r}$	MPP_1	MPP_2	MPP_3	MPP_4	MPP_5	MPP_6
	0.1	0.2	0.3	0.5	0.75	1

Model: SOFAR 20KTLX-G3

$$\eta_{MPPTstat,CEC(c-si)} = \mathbf{98.45\%}$$

Model: SOFAR 15KTLX-G3

$$\eta_{MPPTstat,CEC(c-si)} = \mathbf{98.39\%}$$

Model: SOFAR 5KTLX-G2

$$\eta_{MPPTstat,CEC(c-si)} = \mathbf{97.63\%}$$

5 PICTURES

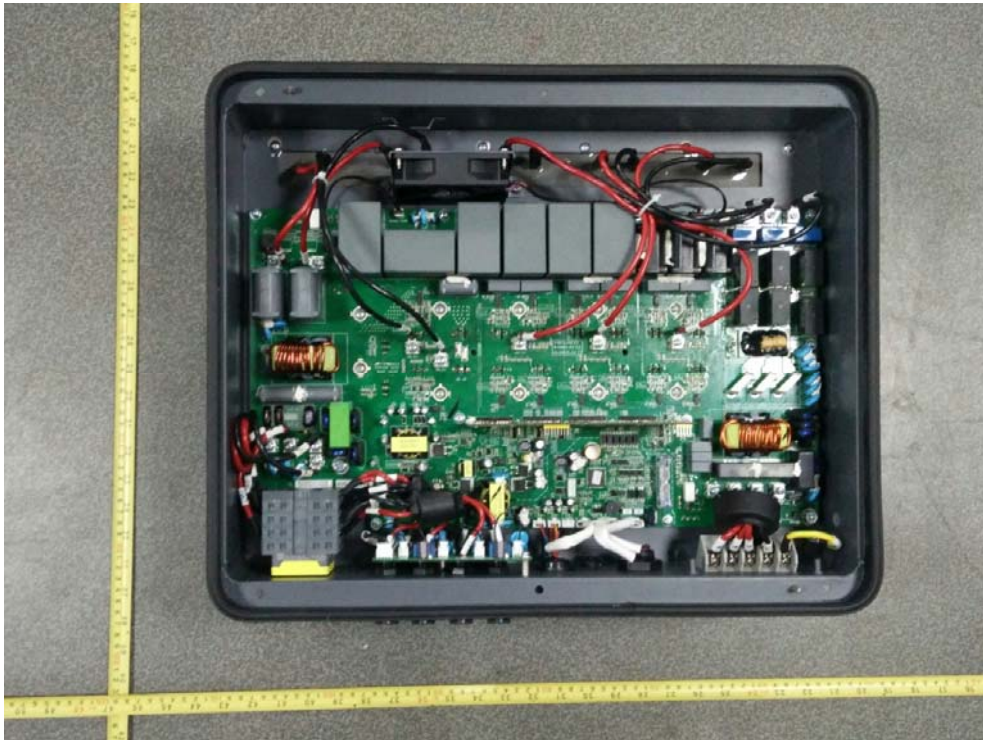
General view of SOFAR 20KTLX-G3



Back view of SOFAR 20KTLX-G3



Internal view of SOFAR 20KTLX-G3



Connection interface of SOFAR 20KTLX-G3



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General view of SOFAR 15KTLX-G3



Back view of SOFAR 15KTLX-G3



Internal view of SOFAR 15KTLX-G3



Connection interface of SOFAR 15KTLX-G3



General view of SOFAR 5KTLX-G2

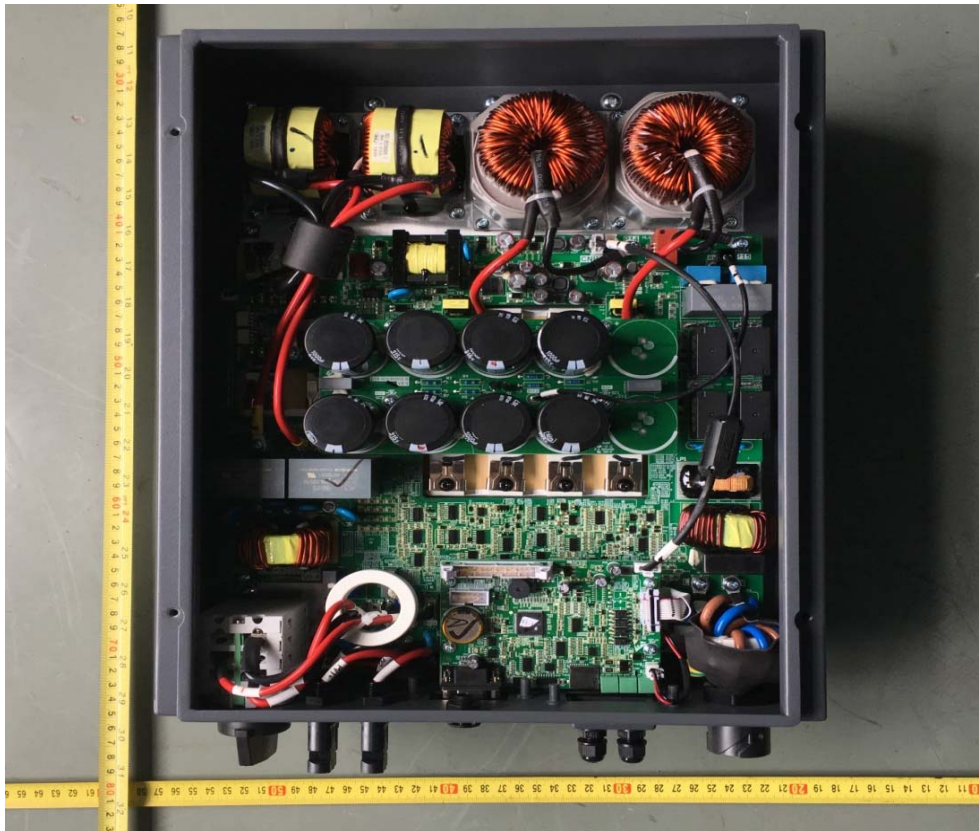


Back View of SOFAR 5KTLX-G2



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Invernal View of SOFAR 5KTLX-G2



Connection interface of SOFAR 5KTLX-G2



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