Product Service

TEST REPORT

PPP 59020A:2013 Rev. 00

TÜV SÜD Test Report for System Voltage Durability Test for Crystalline Silicon Modules – Design Qualification and Type Approval

Report reference No. ..... :	68.290.14.052.01
Date of issue ..... :	2014-09-24
Project handler..... ..... :	Cavic Wu
Testing laboratory ..... :	TÜV SÜD Certification and Testing (China) Co., Ltd. Shenzhen Branch
Address ..... :	Building 12&13, Zhiheng Wisdomland Business Park, Nantou Checkpoint Road 2, Nanshan District, Shenzhen City, 518052, P. R. China
Testing location ..... :	Yangzhou Opto-Electrical Products Testing Institute No. 10 West Kaifa Road, Yangzhou, 225009 Jiangsu, P. R. China
Client..... :	Chinaland Solar Energy Co., Ltd.
Client number..... ..... :	73925
Address ..... :	Liaoyuan Road, Feidong New City, Economic Development Zone, 231600 Hefei, Anhui Province, PEOPLE'S REPUBLIC OF CHINA
Contact person.....	Mr. Meng Xiangfa
Standard ..... :	This TÜV SÜD test report form is based on the following requirements: IEC 61215:2005; IEC 61730-1/A2:2013; IEC 61730-2/A1:2011; PPP 59020A:2013 Rev. 00
TRF originated by..... :	TÜV SÜD Product Service GmbH, Dipl.-Ing. Alexander Krenz
Copyright blank test report..... :	This test report is based on the content of the standard (see above). The test report considered selected clauses of the a.m. standard(s) and experience gained with product testing. It was prepared by TÜV SÜD Product Service GmbH. TÜV SÜD Group takes no responsibility for and will not assume liability for damages resulting from the reader's interpretation of the reproduced material due to its placement and context.
Test procedure ..... :	☐ GS, ☒ TÜV Mark, ☐ EU-Directive, ☐ without certification
Non-standard test method ..... :	N/A
National deviations..... :	N/A
Number of pages (Report)..... :	17
Number of pages (Attachments)..... :	N/A
Compiled by .... : Cavic Wu	Approved by .....: Symbol Zhao
(+ signature)	(+ signature)

TÜV®

Product Service

Test sample……..:	CHN245-60P
Type of test object .....:	Poly-crystalline Silicon Photovoltaic Module
Trademark.....:	
Model and/or type reference .....:	a) 72 cells: CHN285-72P, CHN290-72P, CHN295-72P, CHN300-72P, CHN305-72P, CHN310-72P, CHN315-72P; b) 60 cells: CHN235-60P, CHN240-60P, CHN245-60P, CHN250-60P, CHN255-60P, CHN260-60P, CHN265-60P; c) 54 cells: CHN210-54P, CHN215-54P, CHN220-54P, CHN225-54P, CHN230-54P, CHN235-54P;
Rating(s).....:	Rated Output Power at STC: a) 285 W, 290 W, 295 W, 300 W, 305 W, 310 W, 315 W b) 235 W, 240 W, 245 W, 250 W, 255 W, 260 W, 265 W c) 210 W, 215 W, 220 W, 225 W, 230 W, 235 W
Manufacturer.....:	Chinaland Solar Energy Co., Ltd.
Manufacturer number… .....:	73925
Address.....:	Liaoyuan Road, Feidong New City, Economic Development Zone, 231600 Hefei, Anhui Province, PEOPLE'S REPUBLIC OF CHINA
Sub-contractors/ tests (clause) .....:	See under summary of testing, page 3
Name.....:	See under summary of testing, page 3

Order description… .....:		
	☒	Complete test according to TRF
	☐	Partial test according to manufacturer's specifications
	☐	Preliminary test
	☐	Spot check

Date of order…….....:	2014-07-23
Date of receipt of test item .....:	2014-08-28
Date(s) of performance of test .....:	2014-08-29 ~ 2014-09-03

Test item particulars:

The system voltage durability test according to PPP 59020A were performed on samples CHN245-60P, and the test results were positive.

Attachments: N/A

TÜV®

Product Service

Summary of testing:

Tests performed (name of test and test clause):	**Testing location:**
Initial measurements: 6.1) Preconditioning 6.2) MST 01: Visual inspection 6.3) 10.2: Maximum power determination 6.4) 10.3 insulation test 6.5) MST 13: Ground continuity test **6.6) Damp heat test applied with voltage stress** in accordance with IEC 60068-2-78 **Final measurements:** 6.7) 10.15: Wet leakage current test 6.8) 10.2: Maximum power determination 6.9) MST 01: Visual inspection 6.10) 10.3 insulation test	Yangzhou Opto-Electrical Products Testing Institute No.10 West Kaifa Road, Yangzhou, 225009 Jiangsu, P. R. China

Summary of compliance with National Differences: N/A

Copy of marking plate:

Product Service

Test item particulars .....:	
Accessories and detachable parts included in the evaluation ..... :	N/A
Option included ..... :	N/A
Possible test case verdicts:	
- test case does not apply to the test object ..... :	N/A
- test object does meet the requirement ..... :	P (Pass)
- test object does not meet the requirement ..... :	F (Fail)
Abbreviations used in the report:	
STC – Standard Test Conditions	Vmp – Maximum power voltage
Imp – Maximum power current	Voc – Open circuit voltage
Isc – Short circuit current	Pmp – Maximum power

General remarks:

The test results presented in this report relate only to the object tested.
This report shall not be reproduced, except in full, without the written approval of the Issuing testing laboratory.
"(see Enclosure #)" refers to additional information appended to the report.
"(see appended table)" refers to a table appended to the report.

Throughout this report a point is used as the decimal separator.
Summary of contents provided on the last page of this report.

Factory: Chinaland Solar Energy Co., Ltd.

Address: Liaoyuan Road, Feidong New City, Economic Development Zone, 231600 Hefei, Anhui Province, PEOPLE'S REPUBLIC OF CHINA

General product information and considerations:

Product Electrical Ratings:

Type or model number	CHN245-60P
Voc (Vdc)	36.1
Isc (Adc)	8.63
Vmp (Vdc)	30.4
Imp (Adc)	8.05
Pmp (W)	245
Deviation of Pmp at STC	±5%
Maximum system voltage (V)	1000
Maximum over-current protection rating (A)	15
Application Class	A

Information for testing sample:

Sample #	Type	Series number
1	CHN245-60P	CHN1408880010
2	CHN245-60P	CHN1408880013
3	CHN245-60P	CHN1408880016
4	CHN245-60P	CHN1408880011
5	CHN245-60P	CHN1408880012

Description of module construction: **(Manufactories and part numbers, unless otherwise specified)**	
Sample.....:	Random sampling from production ☐ Prototype submitted by client ☒
Module	CHN245-60P
Front Cover.....:	Material: Tempered glass, thickness: 3.2 mm Nanjing Solglass Science & technology Co., Ltd.
Rear Cover .....:	Type: FPE350Cw, Color: White, material: PVDF/Adhesive/PET/ Adhesive/PE, thickness: 20/5/250/5/60 (µm), Max. voltage: 1057 V Lucky Film Co., LTD.
Encapsulation material .....:	Material: EVA , Type:HBL9160D-905(glass side)+ HBL9160D-709(substrate side), combined use only Nanjing Hongbaoli New Materials Co., Ltd.
Frame .....:	Type : 6063-T5, Material: Anodized aluminum Zhang Jia Gang Da Yang Aluminum Industry CO.,LTD.
Dimensions (l x w x h) [mm] .....:	1640x990x35
Module area [m²] .....:	1.62
Adhesives (junction box) .....:	Type : MH-3668, Color: White, RTI: 105°C Jiangsu MingHao New Mstar Technology Ltd
Minimum distance between current-carrying parts and module edge [mm]	14
Cell	
Cell (include type).....:	Poly c-Si
Cells (l x w) [mm].....:	156x156
Cell thickness [µm] .....:	200±20
Cell area [cm²] .....:	243.36
Number of cells.....:	60
Components	
Cells per bypass diode .....:	20
Type of bypass diode .....:	Schottky, Type: THY2550 PanJit International Inc.
No. of bypass diodes .....:	3
Cell- and string connectors.....:	Tin-coated copper ribbon, Material: Sn63Pb37 For cell interconnector: Cross section: 0.25 x 1.6 (mm), For string connector: Cross section: 0.35 x 6.0 (mm) Baoding Yitong PV Science & Technology Co., Ltd.
Junction box .....:	Type : PV-JM805A, 1000V DC, 15A, -40 to +85°C, IP67

	Zhejiang Jiaming Tianheyuan Photovoltaics Technology Co., Ltd.
Cable .....:	Type : PV1-F, 1 x 4.0 mm^2 Zhejiang Jiaming Tianheyuan Photovoltaics Technology Co., Ltd.
Connectors .....:	Type: PV-JM601, 30A Zhejiang Jiaming Tianheyuan Photovoltaics Technology Co., Ltd.
Adhesives (frame) .....:	Type : MH-3668, Color: White, RTI: 105°C Jiangsu MingHao New Mstar Technology Ltd
Potting material (junction box).....:	N/A
Other	
Others.....:	Insulation material between string connectors: Same as Rear Cover Fixing Tape: TERAOKA SEISAKUSHO CO., LTD., 631S#25 Fluxing agent: Asahi Solder Technology (Wuxi) Co. Ltd., ANX3012

PPP 59020A			
Clause	**Requirement + Test**	**Result--Remark**	**Verdict**
3	**Samples**		**P**
	─ Two representative and identical samples for each polarity of the system voltage that is specified or allowed in the module documentation and one control sample shall be provided		P
	─ One sample for only one voltage polarity with respect to earth ground		N/A
	─ PV module provided with means for grounding then they constitute a part of the test sample.	With grounding	P
4	**MARKING**		**P**
	Name, monogram or symbol of manufacturer ..... :	Yes, on label	P
	Type or model number..... :	Yes, on label	P
	Serial number ..... :	Yes, on module front side	P
	Polarity of terminals or leads ..... :	Yes, +/- on cable and	P
	Maximum system voltage ..... :	Yes, 1000V	P
	Nominal and minimum values of maximum output power at STC ..... :	Yes, on label	P
	The date and place of manufacture..... :	Yes, Traceable by serial	P
6	**Test procedures**		**N/A**
6.1	**Preconditioning**		N/A
	─ All modules, including the control, shall be exposed to sunlight (either real or simulated) to an irradiation level of 5 $kWhm^{-2}$ to 20 $kWhm^{-2}$ while open circuited in accordance with Clause 5 of IEC 61215.	See table 6.1 Performed by manufacturer	N/A
	Initial Measurements		**P**
	─ Tests according to IEC 61215		—
6.3	10.2: Maximum power determination	See table 6.3	P
6.4	10.3 insulation test	See table 6.4	P
	─ Tests according to IEC 61730-2		—
6.2	MST 01: Visual inspection	See table 6.2	P
6.5	MST 13: Ground continuity test	See table 6.5	P

Product Service

PPP 59020A			
Clause	**Requirement + Test**	**Result--Remark**	**Verdict**
6.6	**Damp heat test applied with voltage stress**		**P**
	– Test according to IEC 60068-2-78	See table 6.6	P
	Final Measurements		P
	– Tests according to IEC 61215		—
6.7	10.15: Wet leakage current test	See table 6.7	P
6.8	10.2: Maximum power determination	See table 6.8	P
6.10	10.3 insulation test	See table 6.10	P
	– Tests according to IEC 61730-2		—
6.9	c) MST 01: Visual inspection	See table 6.9	P
5	**Requirements**		**P**
	The degradation of maximum output power between initial and final power measurement does not exceed 5%	See table 6.8	P
	There is no visual evidence of a major defect, as defined in Clause 7 of IEC 61215 and Clause 10.1.3 of IEC 61730-2	See table 6.9	P
	The wet leakage current test requirements are met at the end of each sequence	See table 6.7	P
	The insulation test requirements are met at the beginning and the end of each sequence	See table 6.4 and 6.10	P
	Specific requirements of the individual test components are met		N/A

6.1	TABLE: Preconditioning	—
Test Date [YYYY-MM-DD] start/end .....:	N/A	—
Total irradiation dosage [kWh/m^2].....:	N/A	—
Supplementary information: Preconditioning was performed by manufacturer		

6.2	TABLE: Visual inspection (Initial)	P
Test Date [YYYY-MM-DD]…….....:	2014-08-29	—

Sample No.	Nature and position of initial findings – comments or attach photos	Verdict
1	No major defects found	P
2	No major defects found	P
3	No major defects found	P
4	No major defects found	P
5	No major defects found	P
Supplementary information: N/A		

6.3	TABLE: I-V characteristic (Initial)	P
Test Date [YYYY-MM-DD]…….....:	2014-08-29	—
Radiant Source……..:	☒ Solar simulator ☐ Natural Sunlight	
Module temperature [°C]..... :	Corrected to 25	—
Irradiance [W/m^2]..... :	Corrected to 1000	—

Sample No.	Voc [V]	Vmp [V]	Isc [A]	Imp [A]	Pmp [W]	FF[%]
1	37.8	30.5	8.63	8.19	249.5	76.5
2	37.8	30.3	8.66	8.23	249.3	76.1
3	37.8	30.3	8.65	8.25	249.8	76.4
4	38.0	30.3	8.61	8.23	249.2	76.6
5	38.0	30.3	8.64	8.25	250.0	76.5
Supplementary information: N/A						

6.4	TABLE: Insulation test (initial)			P
Test Date [YYYY-MM-DD] ..... :		2014-08-29		—
Test Voltage applied [V] ..... :		3000/1000		—

Sample #	Measured	Required	Dielectric breakdown		Result
	MΩ	MΩ	Yes (description)	No	
1	5000	24.7	—	No	P
2	5000	24.7	—	No	P
3	5000	24.7	—	No	P
4	5000	24.7	—	No	P

5		24.7	—	No	P
Supplementary information: Size of module [m²]: 1.62 The maximum measurement range of the equipment is 5000 MΩ.					

6.5	**TABLE: MST 13 – ground continuity test (Initial)**			**P**
	Maximum over-current protection rating (A) .....:	15		—
	Current applied (A) ..... :	37.5		
	Location of designated grounding point.....:	Long frame side		—
	Location of second contacting point.....:	Opposite side		—
Sample No.	Position in test sequence:	Voltage (V)	Resistance (Ω)	Result
2	Initial examination	0.3000	0.008	P
3	Initial examination	0.1500	0.004	P
4	Initial examination	0.3000	0.008	P
5	Initial examination	0.2625	0.007	P
Supplementary information: N/A				

6.6	**TABLE: Damp heat test applied with voltage stress**	—
Test Date [YYYY-MM-DD] start/end .....:	2014-08-30 / 2014-09-03	—
Chamber air temperature (°C) ..... :	85 ± 2	—
Chamber relative humidity (% RH) ..... :	85 ± 5	—
Test duration hours (h) ..... :	96	—
Sample #	Applied voltage stress (V) and polarities	—
2	1000 V d.c., positive system bias voltage	—
3	1000 V d.c., positive system bias voltage	—
4	1000 V d.c., negative system bias voltage	—
5	1000 V d.c., negative system bias voltage	—
Supplementary information: The method of mounting grounding implemented according to the user manual installation method.		

6.7	**TABLE: Wet leakage current test (final)**		**P**
Test Date [YYYY-MM-DD]……..…..:	2014-09-03		—
Test voltage applied [V] ……..:	1000		—
Module maximum system voltage rating (V, DC)..... :	1000		—
Solution resistivity [Ω cm], < 3,500 Ω cm at 22 ± 3 ℃.....:	2265		—
Sample No.	Measured [MΩ]	Limit [MΩ]	Verdict
1	376.7	24.7	P
2	367.7	24.7	P
3	708.9	24.7	P
4	605.4	24.7	P
5	669.3	24.7	P

Product Service

Supplementary information: Size of module [m²]: 1.62
Test according to CTL decision sheet no. DSH 0757, instead of IEC 61215:2005 Ed.2 Clause 10.15.2.a) use IEC 61646:2008 Ed.2 Clause 10.15.2.a).

6.8	**TABLE: Maximum power determination (final)**							**P**
Test Date [YYYY-MM-DD] start-end.....:	2014-09-03							—
Module temperature [°C] low-high .....:	Corrected to 25							—
Irradiance [W/m2] low-high.....:	Corrected to 1000							—
Sample #	Voc [V]	Vmp [V]	Isc [A]	Imp [A]	FF [%]	Pmp [W]	Degradation [%]	Limit [%]
1	37.8	30.4	8.59	8.15	76.3	247.6	-0.76	—
2	37.8	30.1	8.58	8.18	76.1	246.4	-1.16	5
3	37.8	30.2	8.59	8.17	76.0	246.5	-1.32	5
4	37.8	30.4	8.58	8.15	76.4	247.5	-0.68	5
5	37.8	30.3	8.57	8.15	76.4	247.2	-1.12	5
Supplementary information: Crystalline silicon module: Pmp degradation after this test ≤ 5%								

6.9	**TABLE: Visual inspection (final)**	P
Test Date [YYYY-MM-DD]……..…..:	2014-09-03	—
Sample No.	Nature and position of initial findings – comments or attach photos	Verdict
1	No major defects found	P
2	No major defects found	P
3	No major defects found	P
4	No major defects found	P
5	No major defects found	P
Supplementary information: N/A		

6.10	**Table: Insulation test (final)**				P
Test Date [YYYY-MM-DD] ..... :	2014-09-03				—
Test Voltage applied [V] ..... :	3000/1000				—
Sample #	Measured	Required	Dielectric breakdown		Result
	MΩ	MΩ	Yes (description)	No	
1	5000	24.7	—	No	P
2	5000	24.7	—	No	P
3	5000	24.7	—	No	P
4	5000	24.7	—	No	P
5	5000	24.7	—	No	P
Supplementary information: Size of module [m²]: 1.62 The maximum measurement range of the equipment is 5000 MΩ.					

Annex 1: List of measurement equipment

Description	Identification #	Application
Lamp	SB08111	Visual inspection
Measuring tape	SB08102	Visual inspection
Camera	SB08092	Visual inspection
Ruler	SB08108	Visual inspection
Illuminance meter	SB08125	Visual inspection
Pulsed solar simulator	SB08001	Maximum power determination
Electrical safety compliance analyzer	SB10018	Insulation test/Wet leakage current test
Conductivity meter	SB08054	Wet leakage current test
Wet leakage current tester	SB08079	Wet leakage current test
Ground continuity tester	SB08047	Ground continuity test
Chamber	SB09008	Damp heat test applied with voltage stress

Annex 2: Statement of the estimated uncertainty of the test results

Power: 2.6% (K=2)

Annex 3: Photos of samples

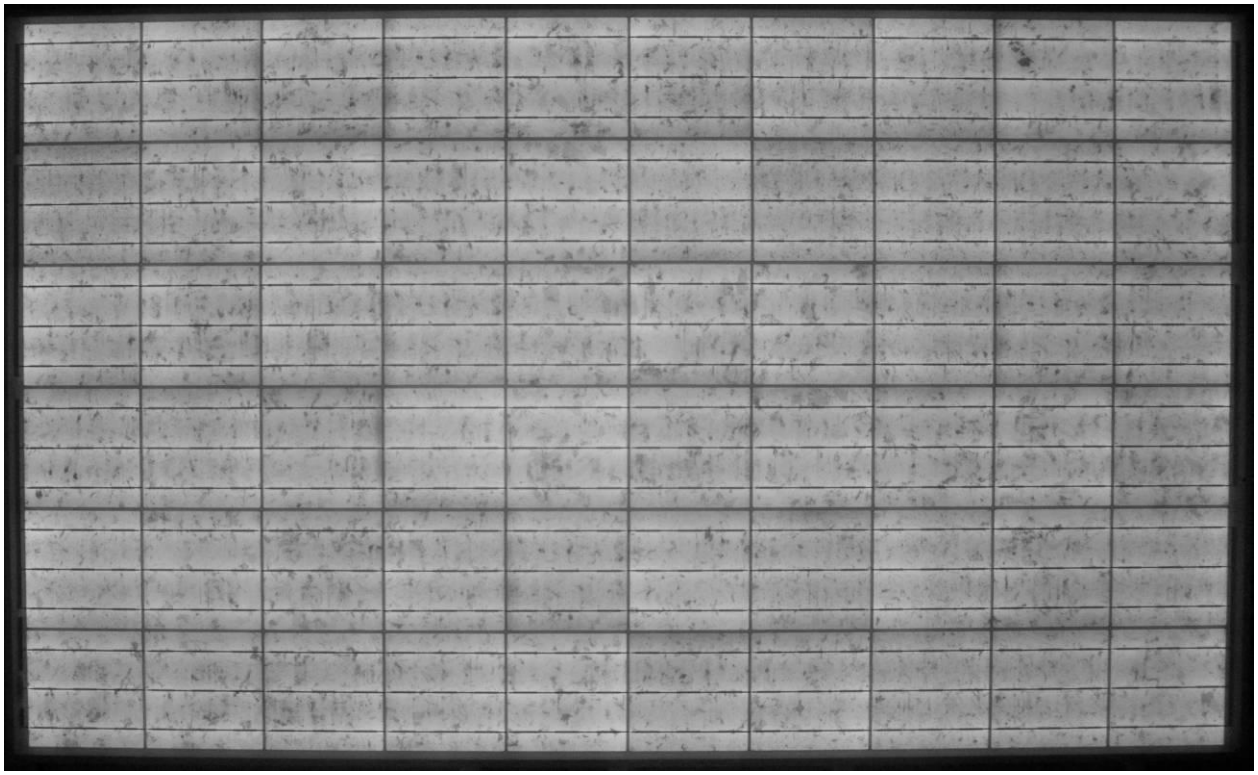

Fig. 1 - Electroluminescence photos for sample #1 (Initial)

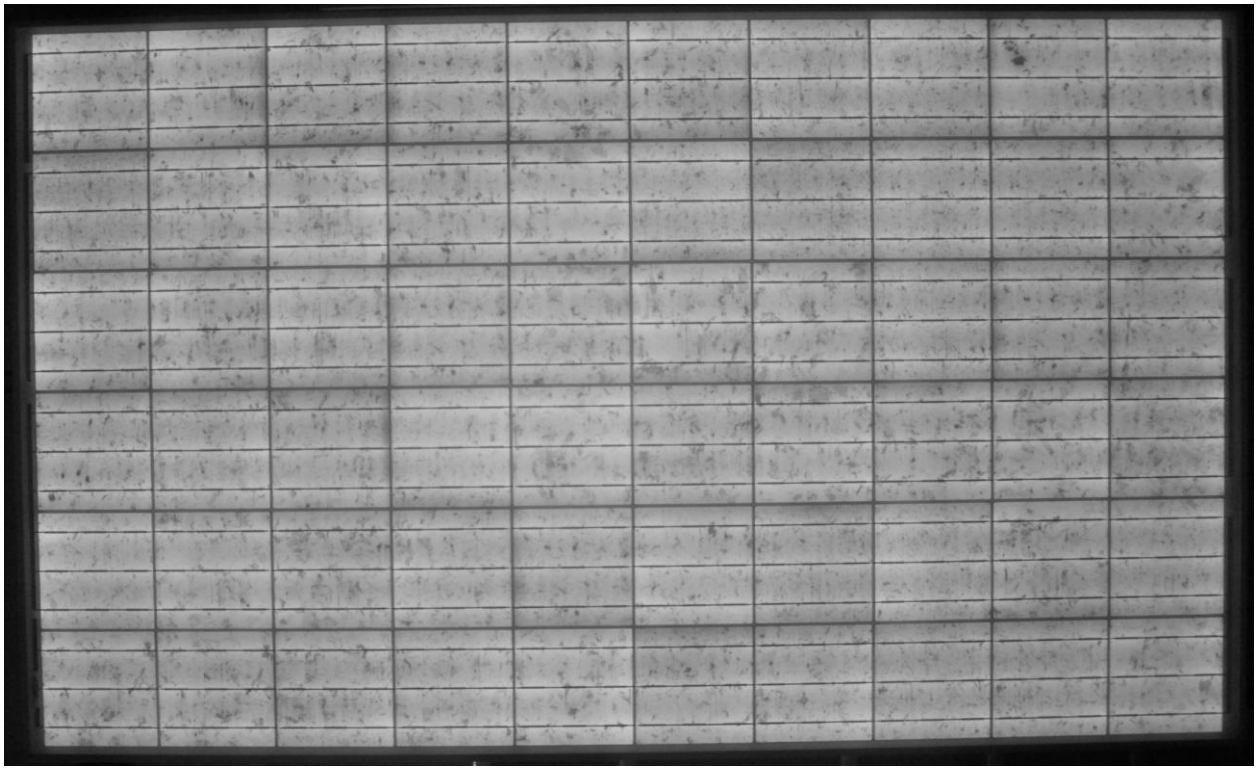

Fig. 2 - Electroluminescence photos for sample #1 (Final)

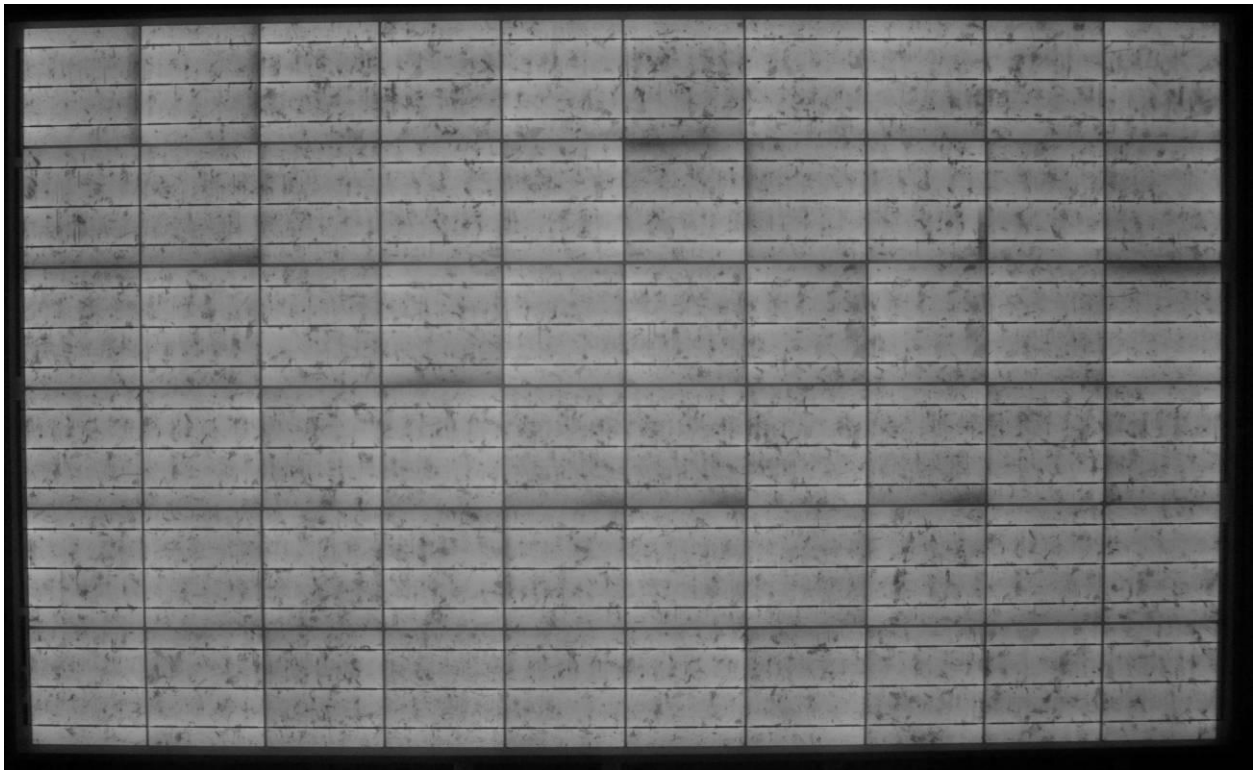

Fig. 3 - Electroluminescence photos for sample #2 (Initial)

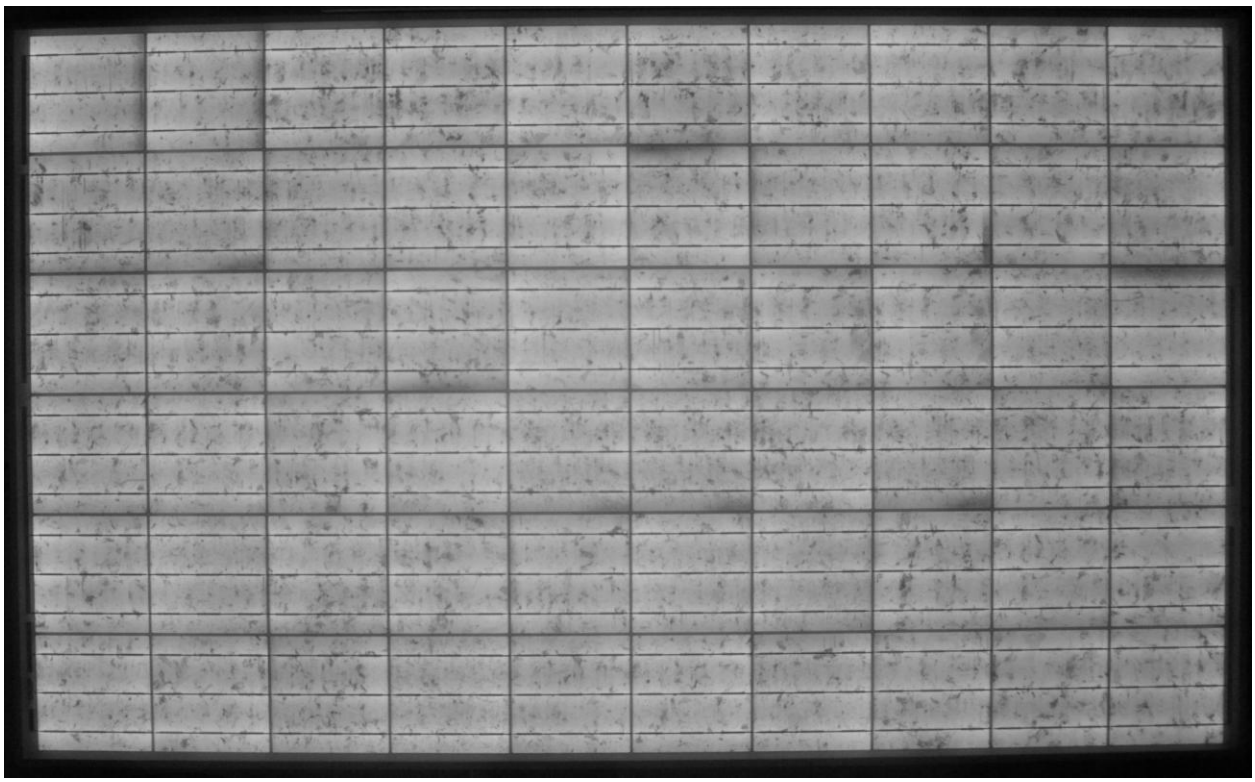

Fig. 4 - Electroluminescence photos for sample #2 (Final)

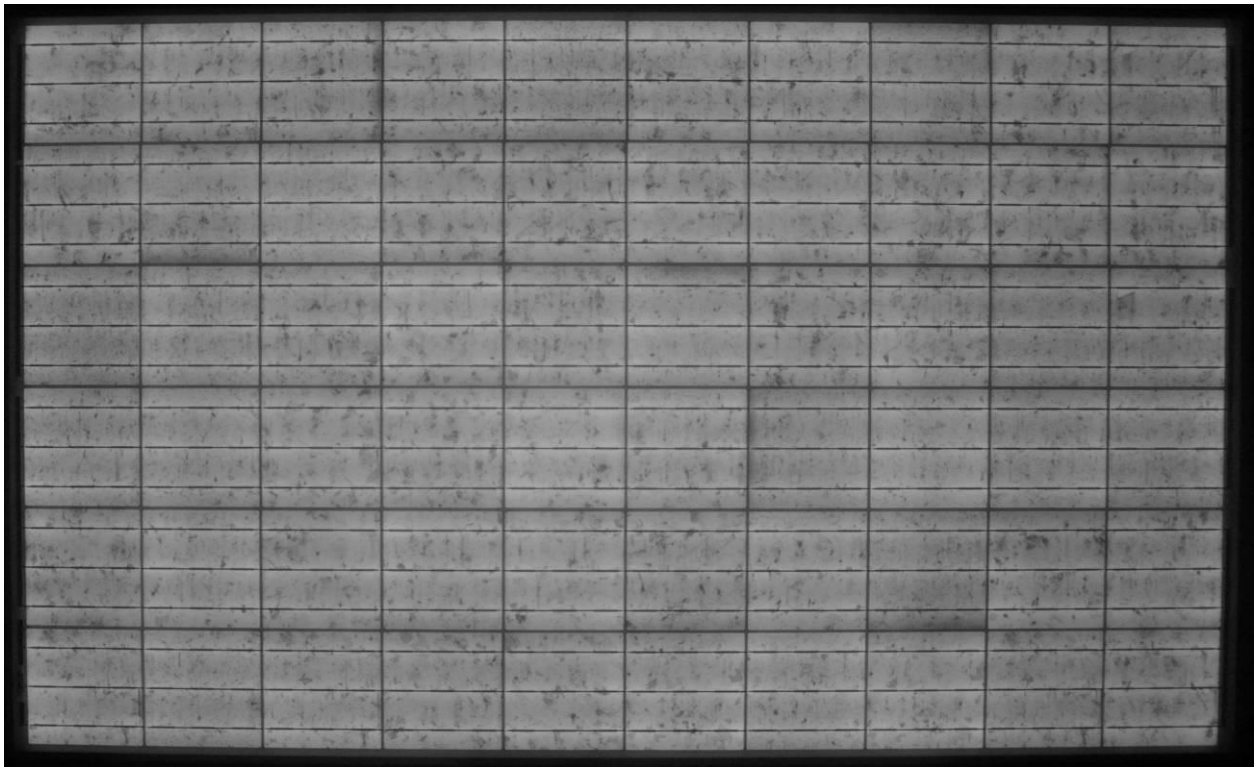

Fig. 5 - Electroluminescence photos for sample #3 (Initial)

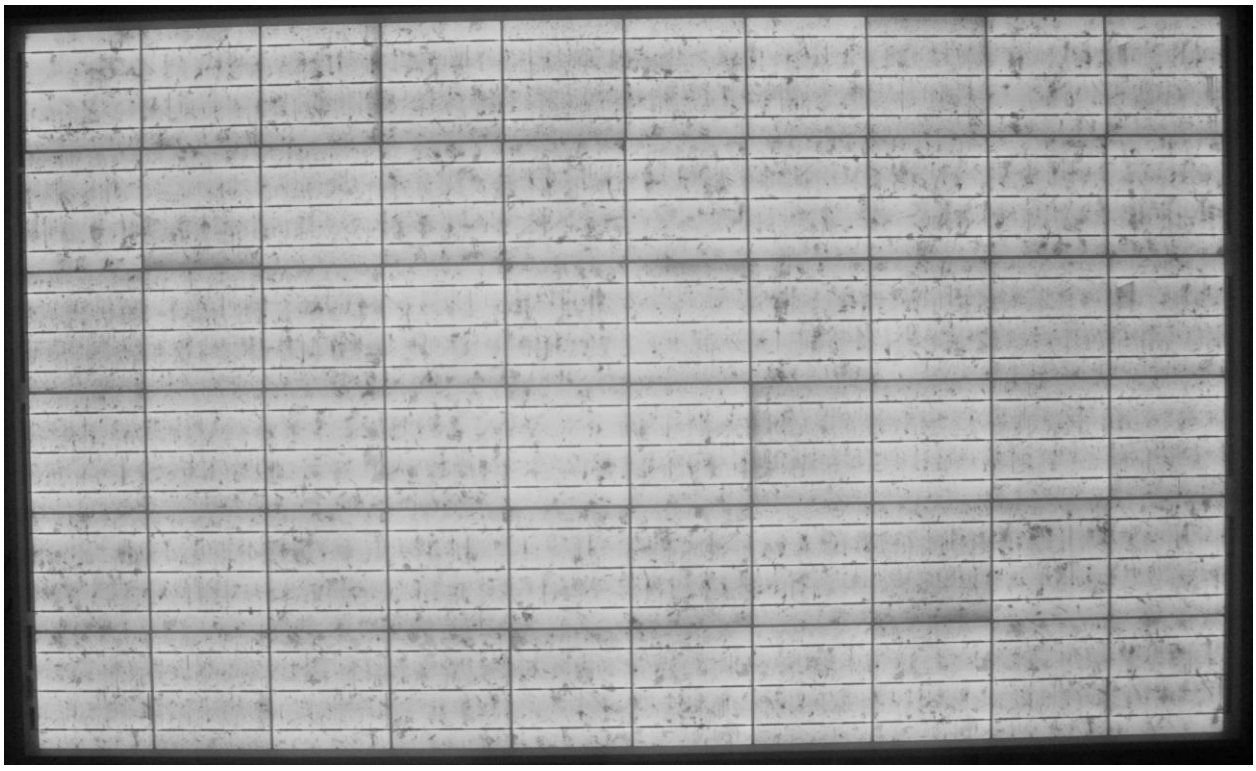

Fig. 6 - Electroluminescence photos for sample #3 (Final)

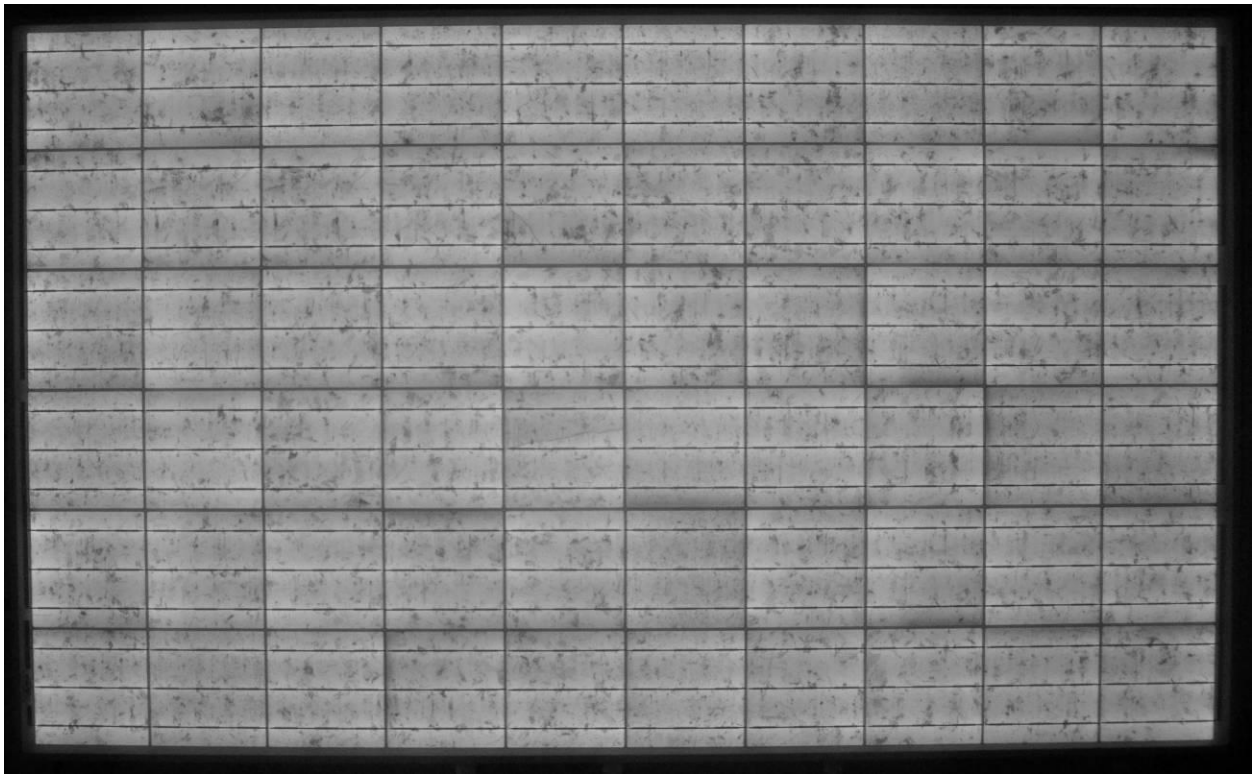

Fig. 7 - Electroluminescence photos for sample #4 (Initial)

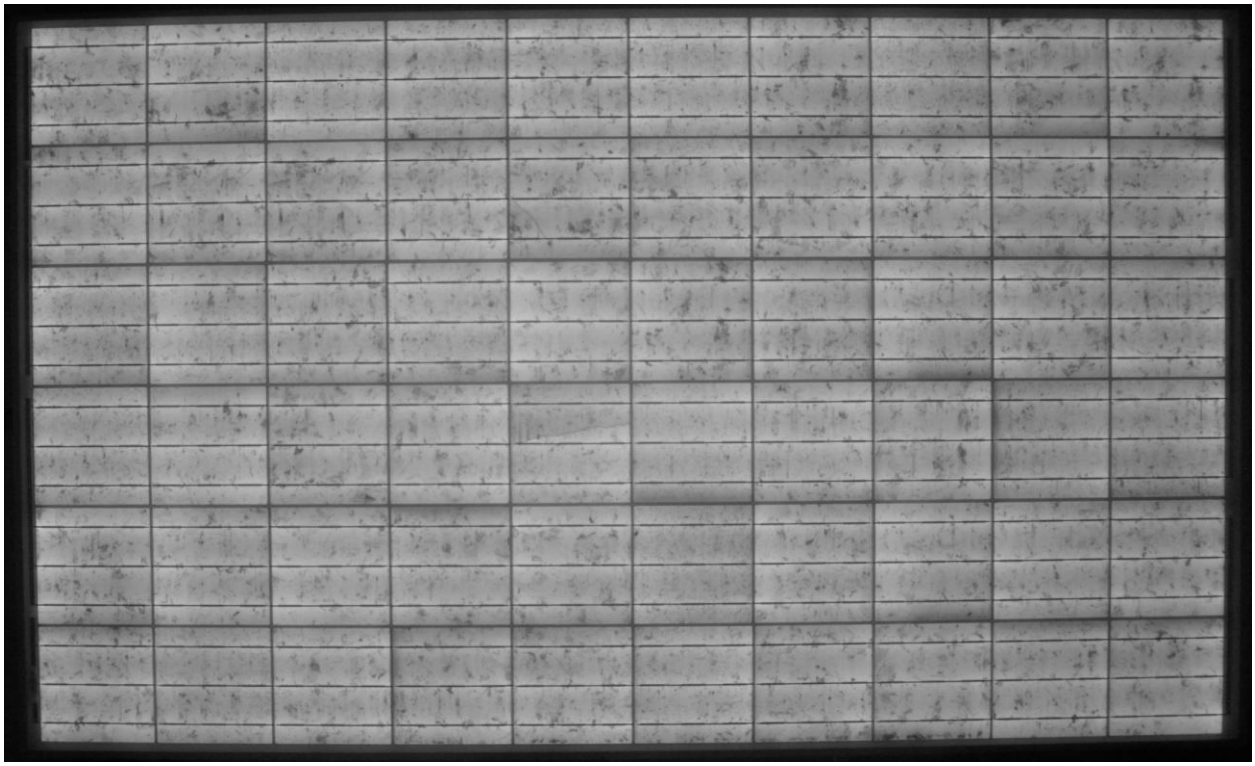

Fig. 8 - Electroluminescence photos for sample #4 (Final)

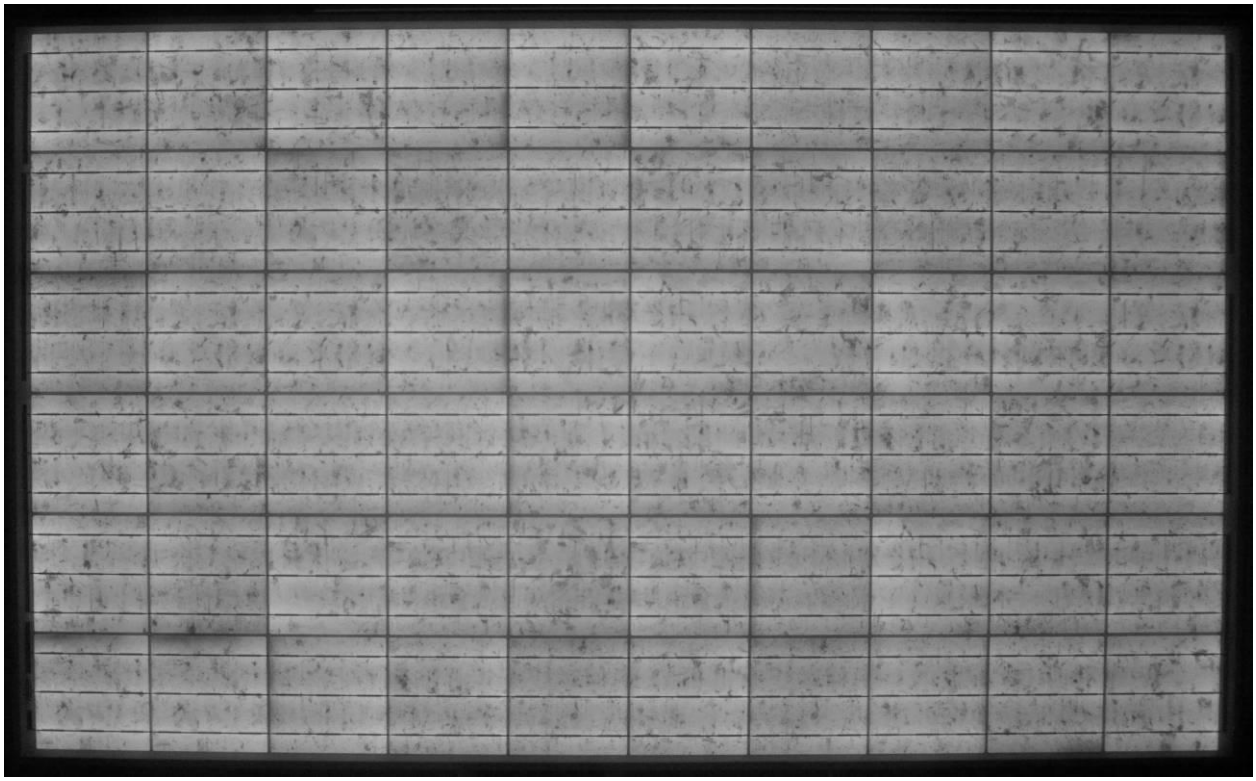

Fig. 9 - Electroluminescence photos for sample #5 (Initial)

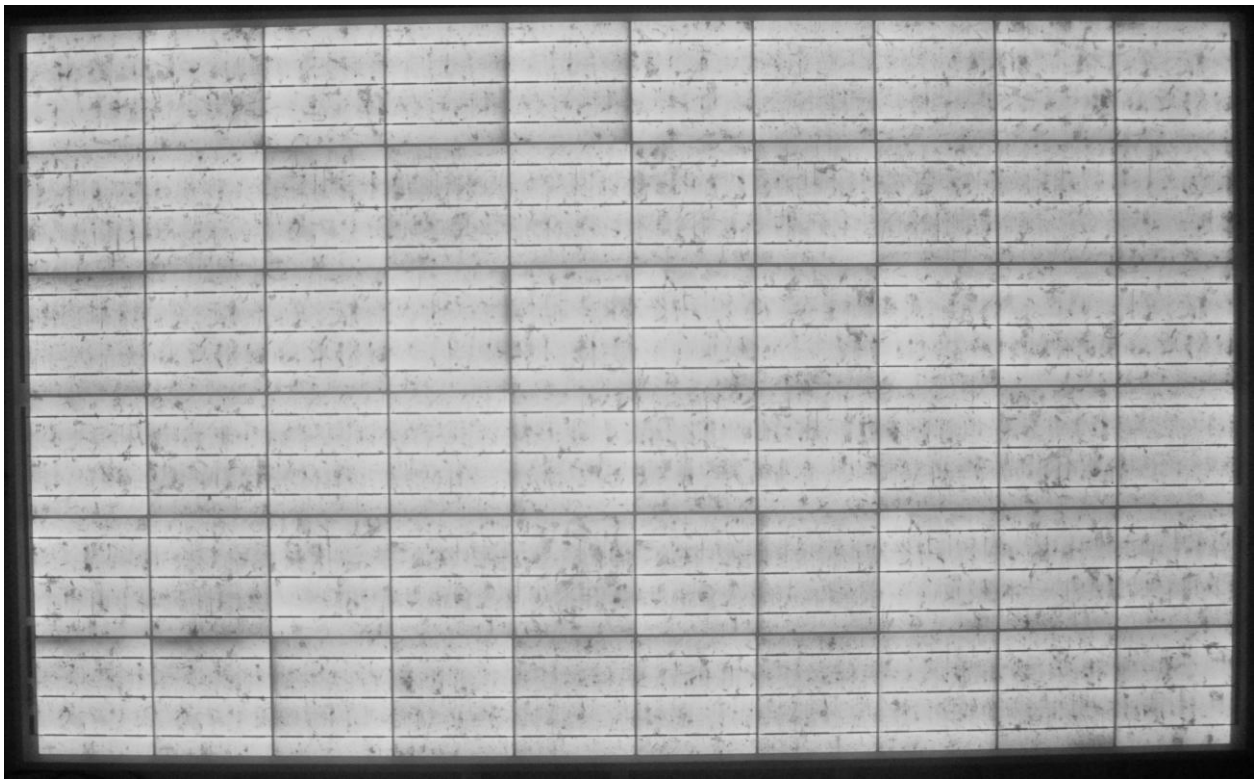

Fig. 10 - Electroluminescence photos for sample #5 (Final)

END OF REPORT