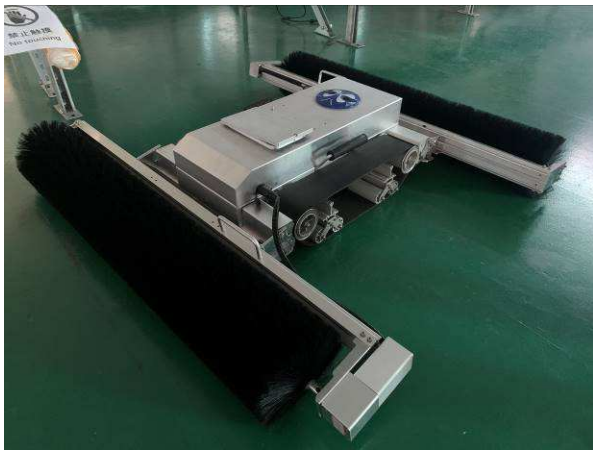






Photovoltaic module Cleaning Robot Verification Test

To:	ShenZhen Kwunphi Robot Co., LTD		
Address:	2nd floor, Galaxy Lingchuangtianxia II, Nankeng Community, Bantian Street, Longgang District, Shenzhen, Guangdong, China.		
Factory name:	ShenZhen Kwunphi Robot Co., LTD		
Location:	2nd floor, Galaxy Lingchuangtianxia II, Nankeng Community, Bantian Street, Longgang District, Shenzhen, Guangdong, China.		
	Sample No:	--	
	Start date:	October 26, 2022	
	Finish date:	November 10, 2022	
	Standards used: (Date):	According client's requirement	
	Clauses examined:	Null	
	Re-testing:	Null	
Photovoltaic module Cleaning Robot <Model: Kwun-B30 >		Remark / Note:	Null
Test requirement:			
<ul style="list-style-type: none"> - Visual inspection Photovoltaic module. - EL testing of Photovoltaic module. 			
Test purpose:			
<ul style="list-style-type: none"> - To check if any AR glass defect of the PV module cleaned by Photovoltaic Module Cleaning robot after 2000 times, 4000 times, 6000 times, 8000 times, 10000 times, 12000 times, 14000 times cleaning. - To check if any cell micro crack defect of the PV module cleaned by Photovoltaic Module Cleaning robot. 			
Test result:			
<ul style="list-style-type: none"> - No AR glass visual defect after 14000 times cleaning. - No cell micro crack after 10000 times cleaning, but the cell occur micro crack after 12000 times cleaning. 			
Complied by:		Approved by:	
			
Engineer: Chris Feng		Senior Engineer: Jetter Yang	
Date: November 16, 2022		Date: November 16, 2022	
<p>This report is governed by, and incorporates by reference, the Conditions of Testing as posted at the date of issuance of this report at http://www.bureauveritas.com/home/about-us/our-business/cps/about-us/terms-conditions/ and is intended 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. Measurement uncertainty is only provided upon request for accredited tests. Statements of conformity are based on simple acceptance criteria without taking measurement uncertainty into account, unless otherwise requested in writing. You have 60 days from date of issuance of this report to notify us of any material error or omission caused by our negligence or if you require measurement uncertainty; 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</p>			



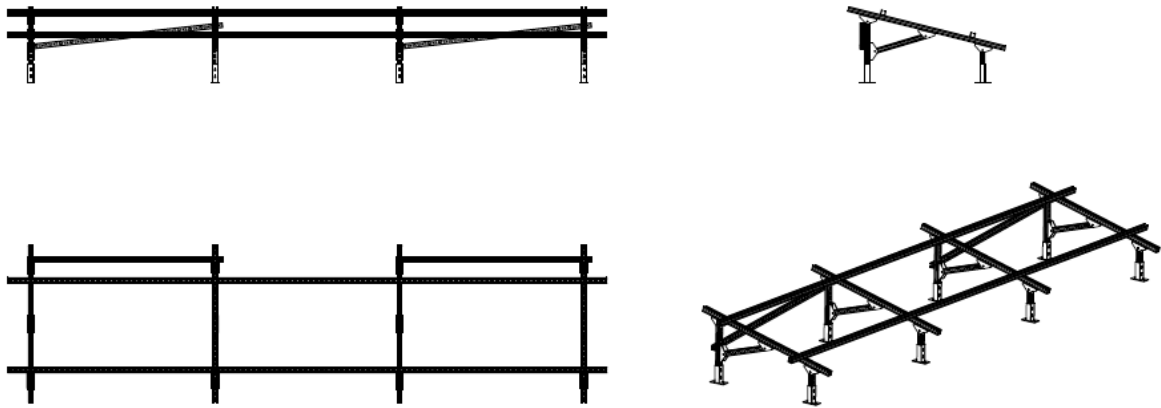
1. Product information:

Brush Parameter	
Size	Ø170mm, length:1320mm
Material	PBT
Weight	7.6kg
Product Parameter	
Grade ability	≤ 20° for dry brushing, ≤ 15° for washing
Operating ambient temperature range	-20 to +45°C
Allowable humidity range	0-100% RH
Shell material	Aluminum alloy / Stainless steel
Weight	26.3kg
Size	654mm×507mm×232mm
Ingress protection	IP65
Speed	13.2m/min
Obstacle crossing ability	< 3cm
Photovoltaic panel spacing	< 4cm
Protect function	Overcurrent protection, Over temp protection, Low-voltage protection, Drop protection
Operating mode	Automatic / Semi-automatic with Remote control
Fall prevention	Yes
Remote_upgrade	Yes
System voltage	25.2V
Rated power	360W
Equipment power	Replaceable lithium battery (15.3Ah, 25.2V)
Communication mode	4G communication
Monitoring	APP / Background
Control mode	APP / Remote control(opt.)
Rated power of Driving motor	100W



Rated power of brush rolling motor	90W
Battery charger Power supply	
Battery charger rated input	100-240Vac, 50/60Hz, 1.5A
Battery charger rated output	29.4Vdc, 5A

2. Supporting Structure Drawing



3. PV module Sample

Sample No.	Manufacture	Module type	S/N
1	ASTRONERGY	CHSM6610P-275	6630137284504565
2	ASTRONERGY	CHSM6610P-275	6630137284504544
3	ASTRONERGY	CHSM6610P-275	6630137284504510

4. Test result

4.1 Visual inspection

TABLE: Visual inspection (After 2000 times cleaning)	
Test Date [MM/DD/YYYY]:	10/28/2022
Sample No.	Result
1	No glass scratch, no visual AR coating damage
2	No glass scratch, no visual AR coating damage
3	No glass scratch, no visual AR coating damage



TABLE: Visual inspection (After 4000 times cleaning)

Test Date [MM/DD/YYYY]:	10/31/2022
Sample No.	Result
1	No glass scratch, no visual AR coating damage
2	No glass scratch, no visual AR coating damage
3	No glass scratch, no visual AR coating damage

TABLE: Visual inspection (After 6000 times cleaning)

Test Date [MM/DD/YYYY]:	11/2/2022
Sample No.	Result
1	No glass scratch, no visual AR coating damage
2	No glass scratch, no visual AR coating damage
3	No glass scratch, no visual AR coating damage

TABLE: Visual inspection (After 8000 times cleaning)

Test Date [MM/DD/YYYY]:	11/4/2022
Sample No.	Result
1	No glass scratch, no visual AR coating damage
2	No glass scratch, no visual AR coating damage
3	No glass scratch, no visual AR coating damage

TABLE: Visual inspection (After 10000 times cleaning)

Test Date [MM/DD/YYYY]:	11/6/2022
Sample No.	Result
1	No glass scratch, no visual AR coating damage
2	No glass scratch, no visual AR coating damage
3	No glass scratch, no visual AR coating damage

TABLE: Visual inspection (After 12000 times cleaning)

Test Date [MM/DD/YYYY]:	11/8/2022
Sample No.	Result
1	No glass scratch, no visual AR coating damage



**BUREAU
VERITAS**

TEST REPORT No.: BV2210WDG0169

2	No glass scratch, no visual AR coating damage
3	No glass scratch, no visual AR coating damage

TABLE: Visual inspection (After 14000 times cleaning)

Test Date [MM/DD/YYYY]:	11/10/2022
Sample No.	Result
1	No glass scratch, no visual AR coating damage
2	No glass scratch, no visual AR coating damage
3	No glass scratch, no visual AR coating damage



4.2 Visual inspection

TABLE: Electroluminescence measurement (EL micro crack test) (After 2000 times cleaning)	
Test Date [MM/DD/YYYY]:	10/28/2022
Current applied [A].....:	10.0
Exposure [s]	3
Sample No.	Result
1	No cell micro crack
2	No cell micro crack
3	No cell micro crack

TABLE: Electroluminescence measurement (EL micro crack test) (After 4000 times cleaning)	
Test Date [MM/DD/YYYY]:	10/31/2022
Current applied [A].....:	10.0
Exposure [s]	3
Sample No.	Result
1	No cell micro crack
2	No cell micro crack
3	No cell micro crack

TABLE: Electroluminescence measurement (EL micro crack test) (After 6000 times cleaning)	
Test Date [MM/DD/YYYY]:	11/2/2022
Current applied [A].....:	10.0
Exposure [s]	3
Sample No.	Result
1	No cell micro crack
2	No cell micro crack
3	No cell micro crack

TABLE: Electroluminescence measurement (EL micro crack test) (After 8000 times cleaning)	
Test Date [MM/DD/YYYY]:	11/4/2022
Current applied [A].....:	10.0



Exposure [s]	3
Sample No.	Result
1	No cell micro crack
2	No cell micro crack
3	No cell micro crack

TABLE: Electroluminescence measurement (EL micro crack test) (After 10000 times cleaning)	
Test Date [MM/DD/YYYY]:	11/6/2022
Current applied [A].....	10.0
Exposure [s]	3
Sample No.	Result
1	No cell micro crack
2	No cell micro crack
3	No cell micro crack

TABLE: Electroluminescence measurement (EL micro crack test) (After 12000 times cleaning)	
Test Date [MM/DD/YYYY]:	11/8/2022
Current applied [A].....	10.0
Exposure [s]	3
Sample No.	Result
1	Cell occur micro crack.
2	Cell occur micro crack.
3	Cell occur micro crack.

TABLE: Electroluminescence measurement (EL micro crack test) (After 14000 times cleaning)	
Test Date [MM/DD/YYYY]:	11/10/2022
Current applied [A].....	10.0
Exposure [s]	3
Sample No.	Result
1	Cell occur micro crack.
2	Cell occur micro crack.
3	Cell occur micro crack.

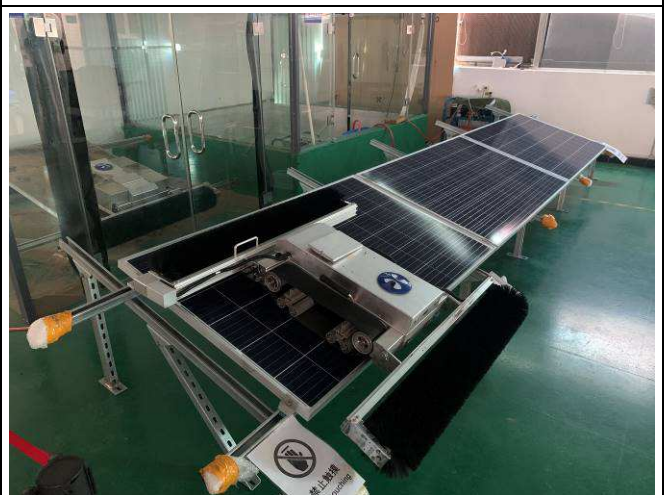
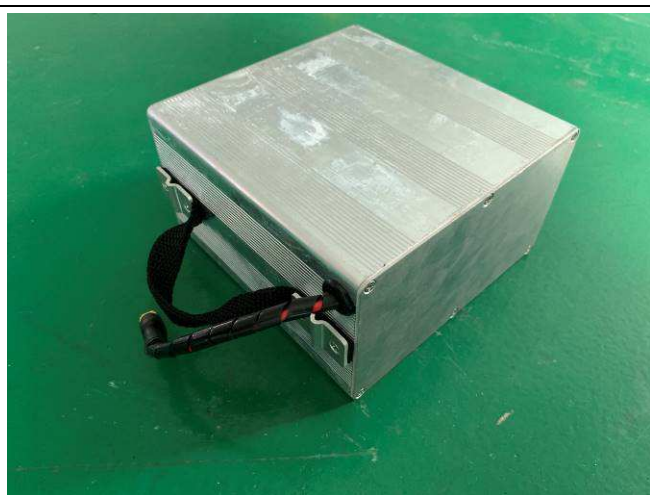
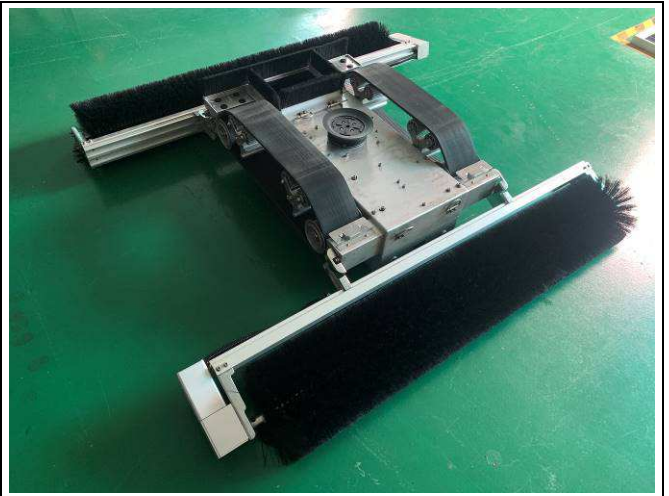
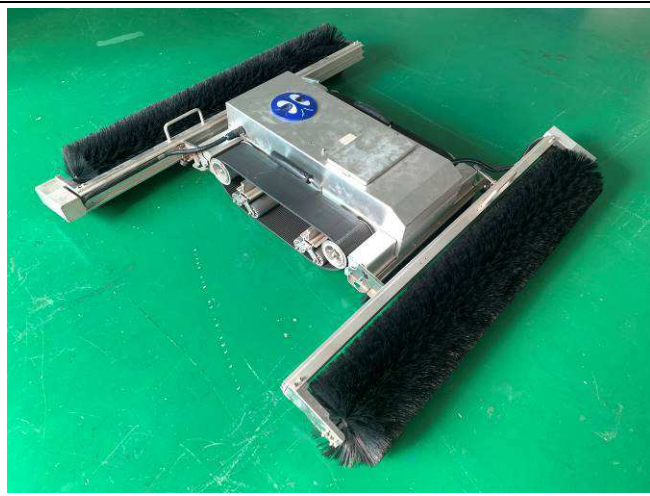


5. Summary of test result

After 14000 times cleaned by Photovoltaic Module Cleaning robot, no AR glass visual defect; no cell micro crack after 10000 times, but the cell occur micro crack after 12000 times.

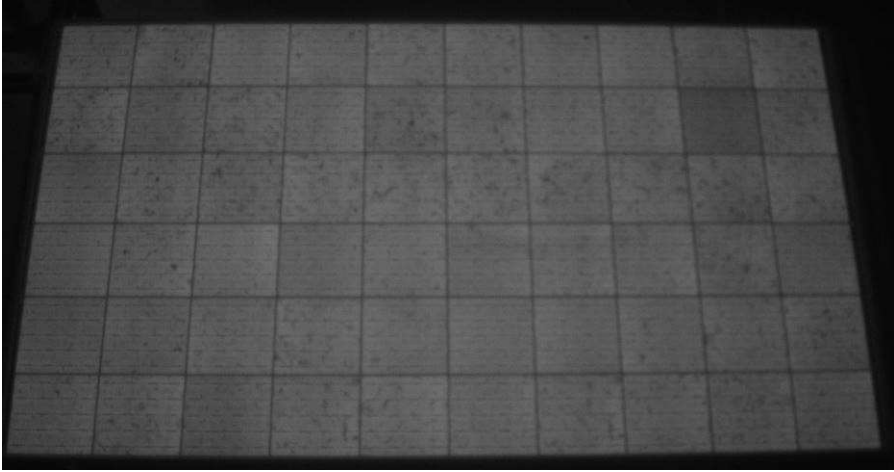
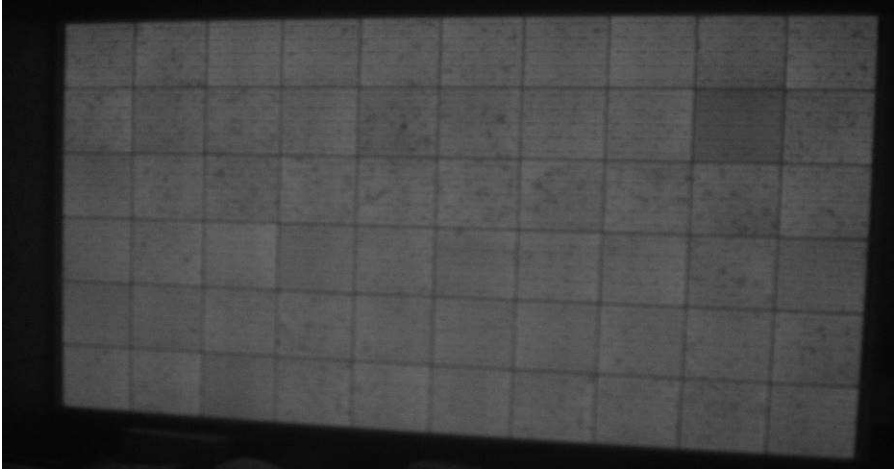


Annex 1: Picture of Samples/Products Tested

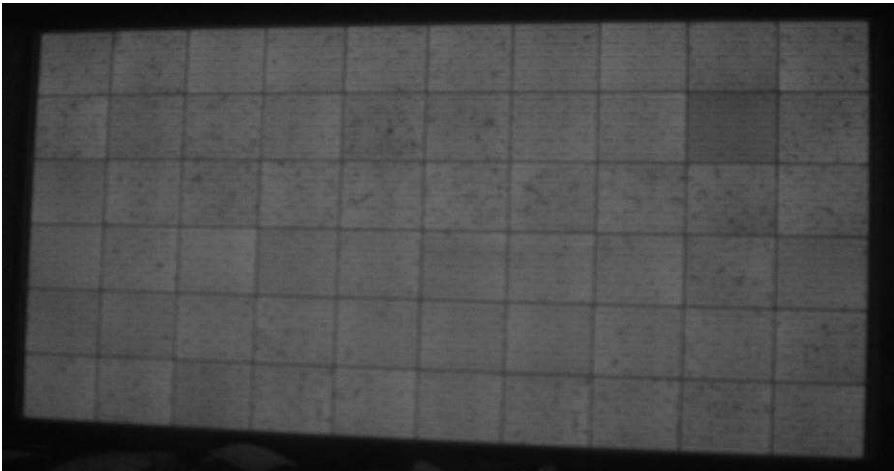
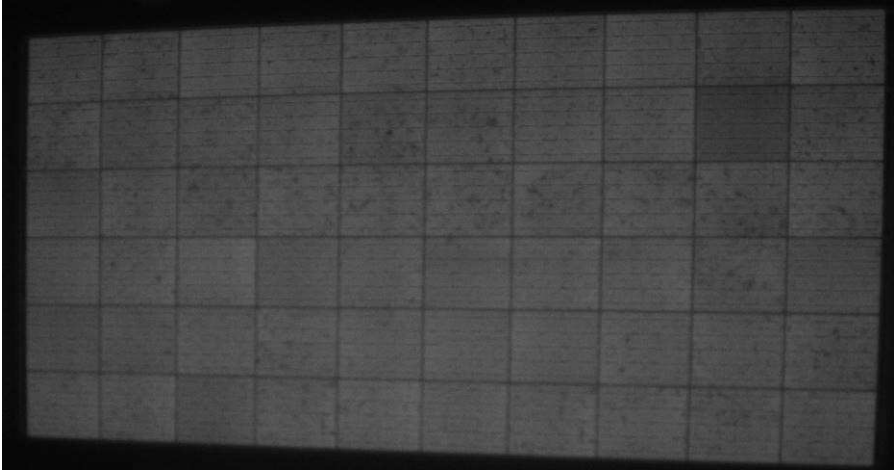




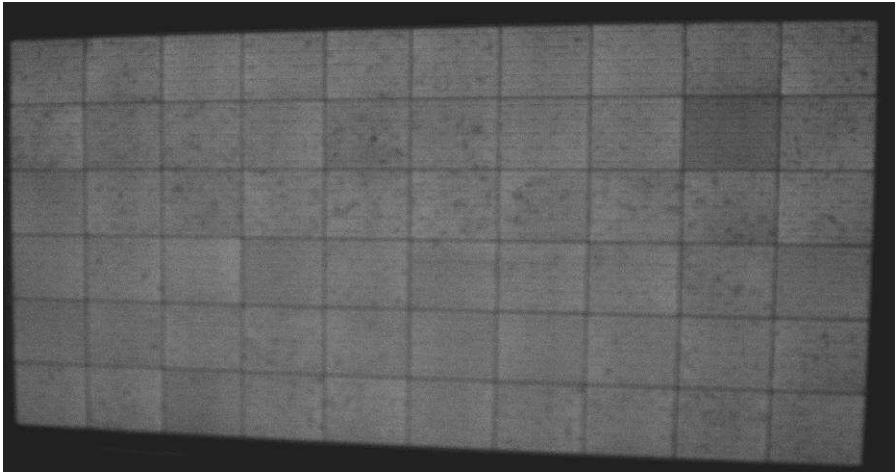
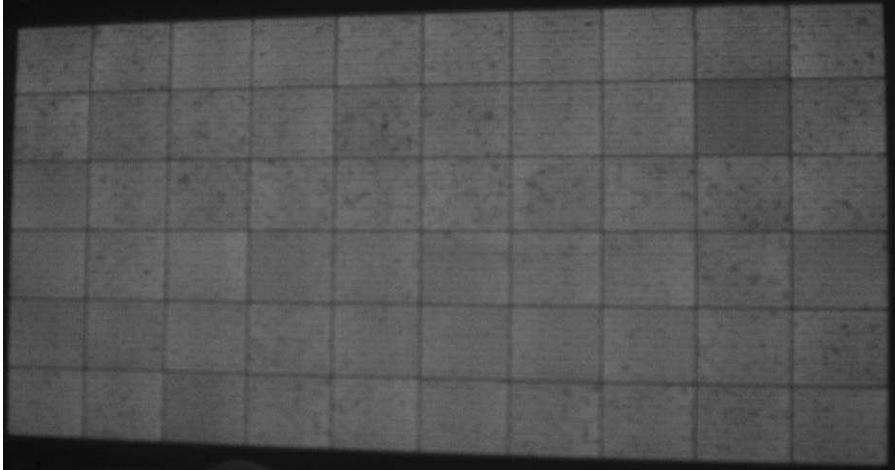
Annex 2: EL images

EL Picture		
Sample #	Status	Picture
Note	N/A	
1	Initial	
	2000 times	

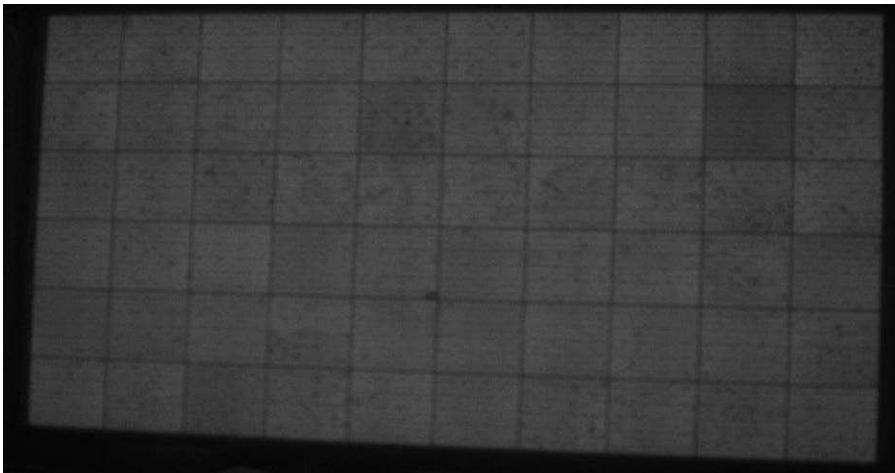
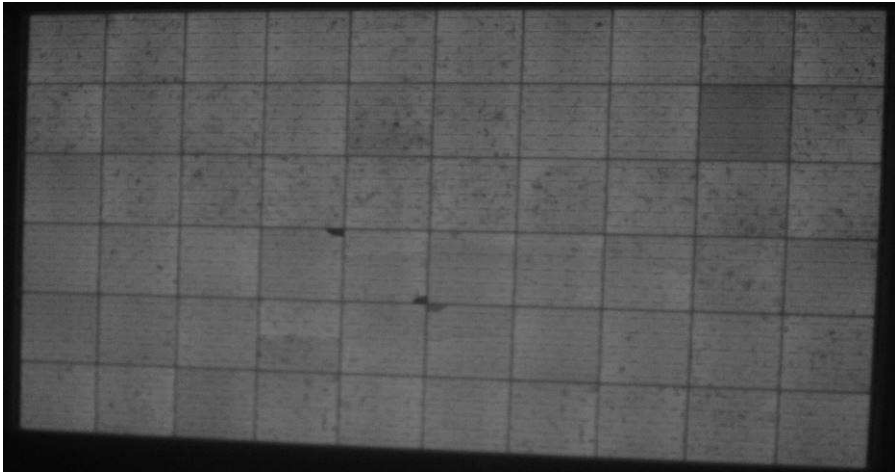


EL Picture		
Sample #	Status	Picture
Note		N/A
1	4000 times	
	6000 times	

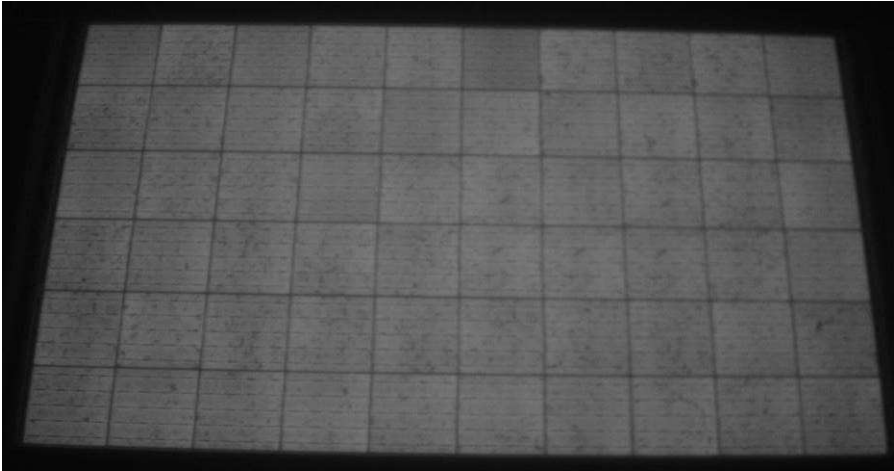
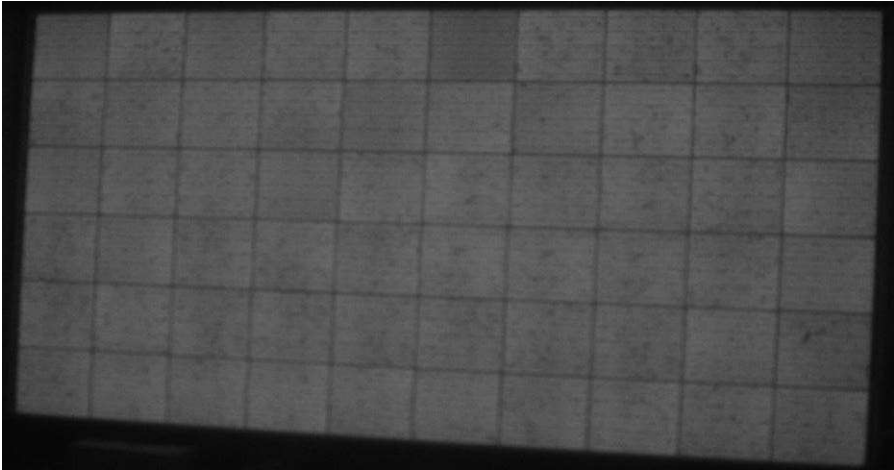


EL Picture		
Sample #	Status	Picture
Note		N/A
1	8000 times	
	10000 times	

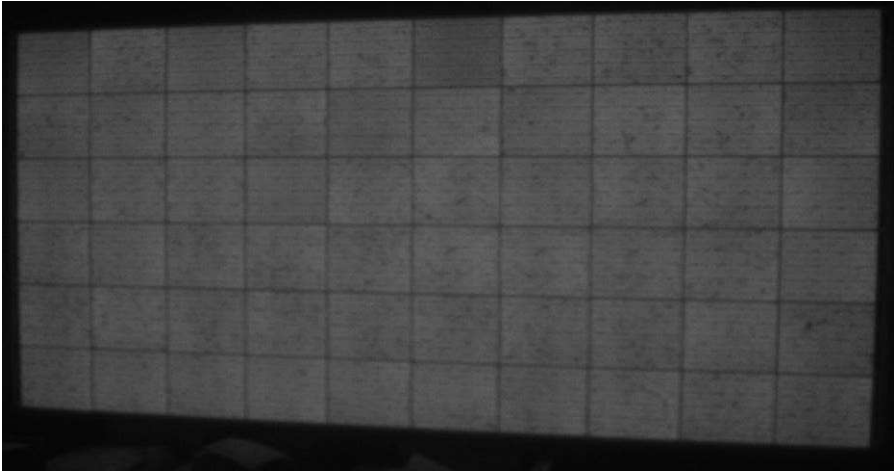
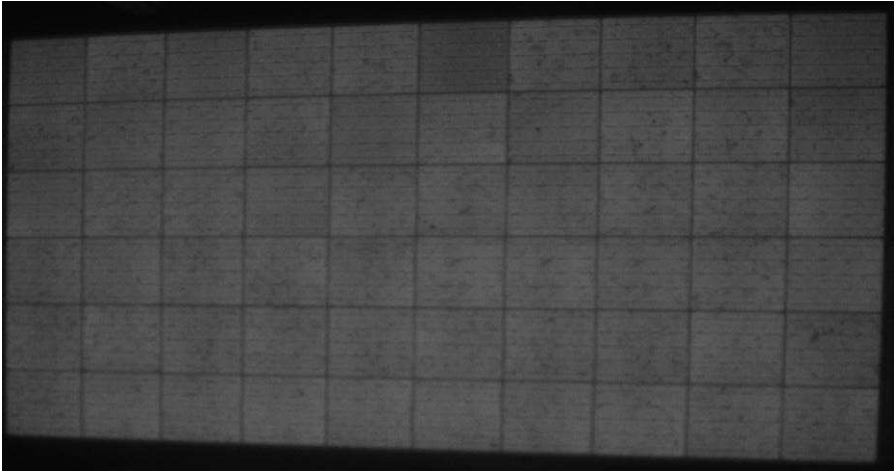


1	12000 times	
	14000 times	

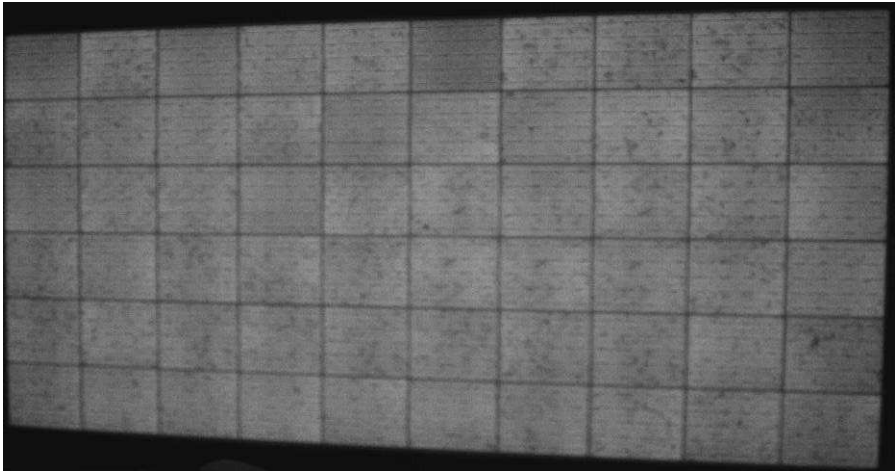
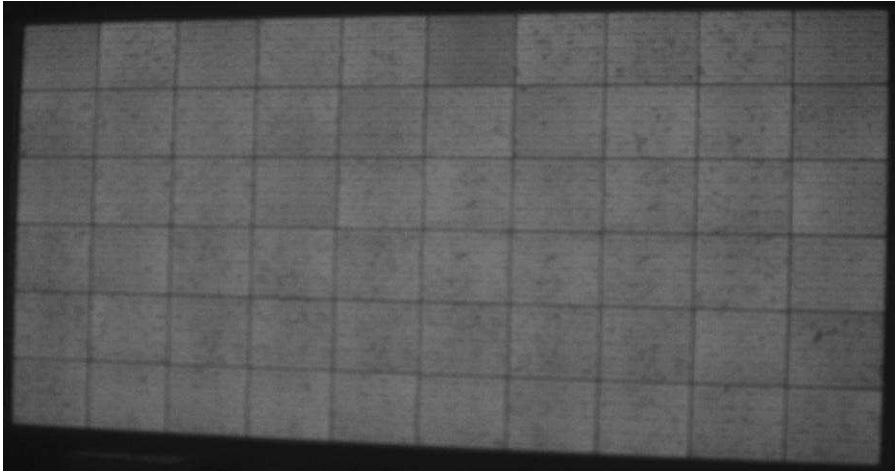


EL Picture		
Sample #	Status	Picture
Note		N/A
2	Initial	
	2000 times	

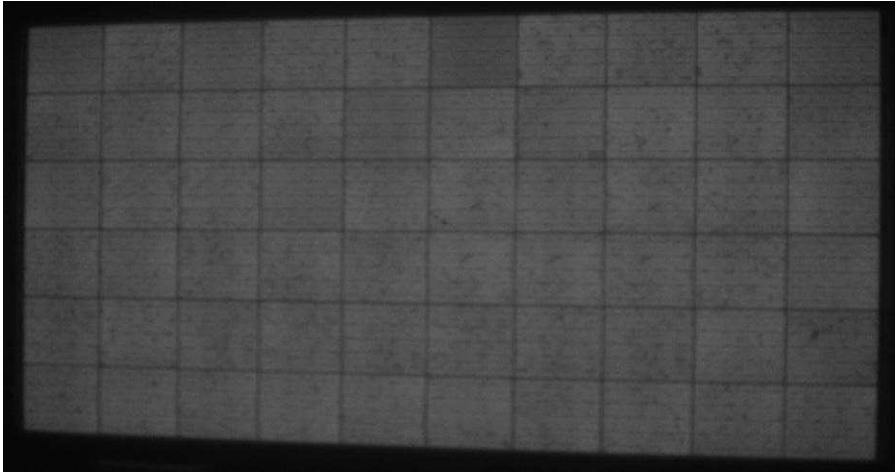
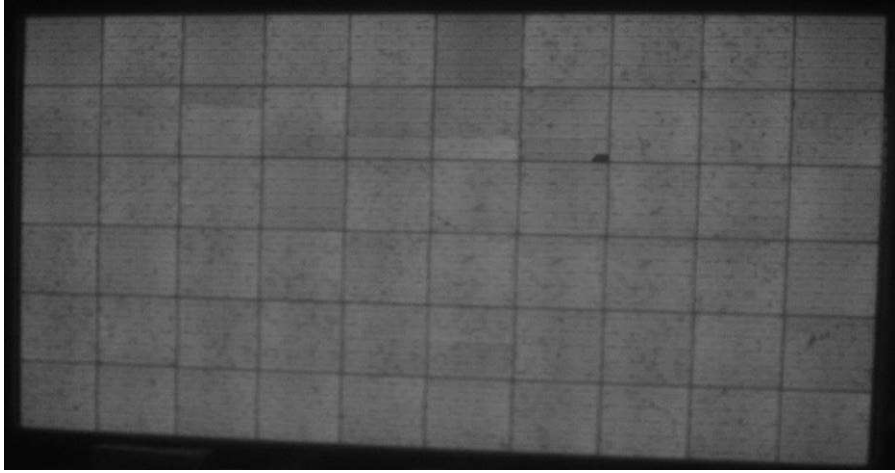


EL Picture		
Sample #	Status	Picture
Note		N/A
2	4000 times	
	6000 times	

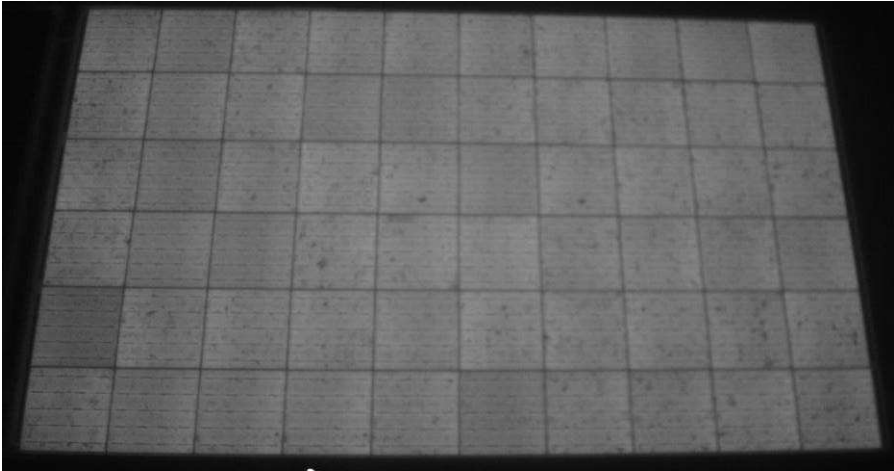
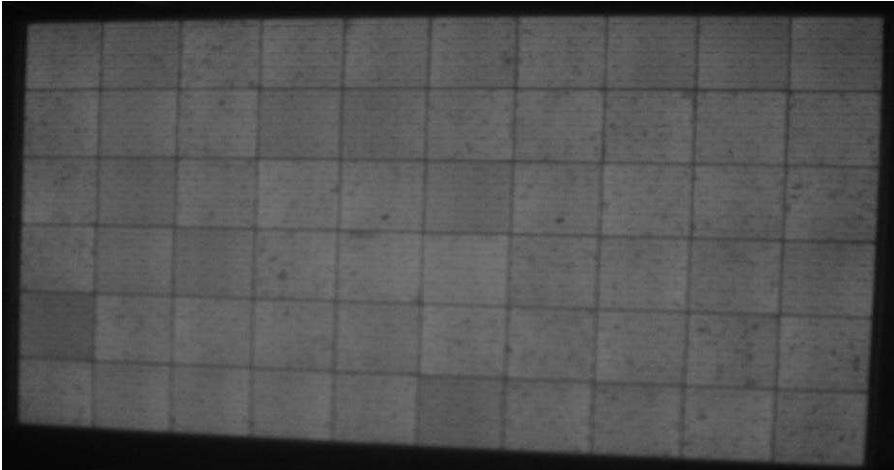


EL Picture		
Sample #	Status	Picture
Note		N/A
2	8000 times	
	10000 times	

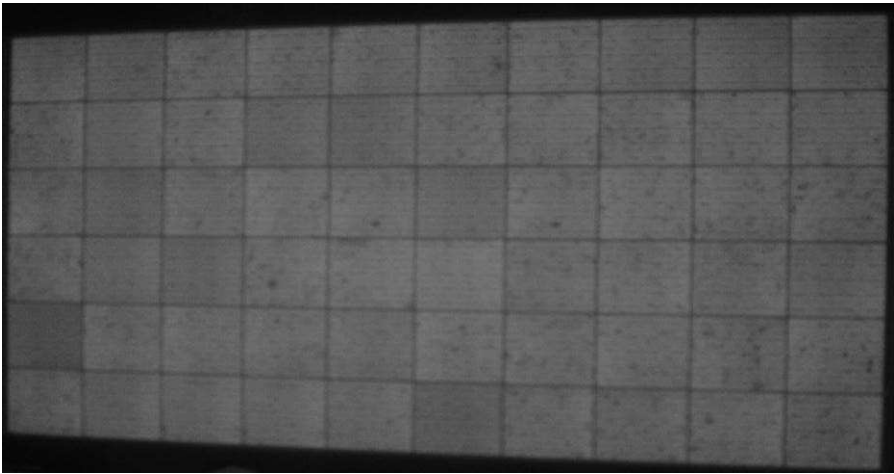
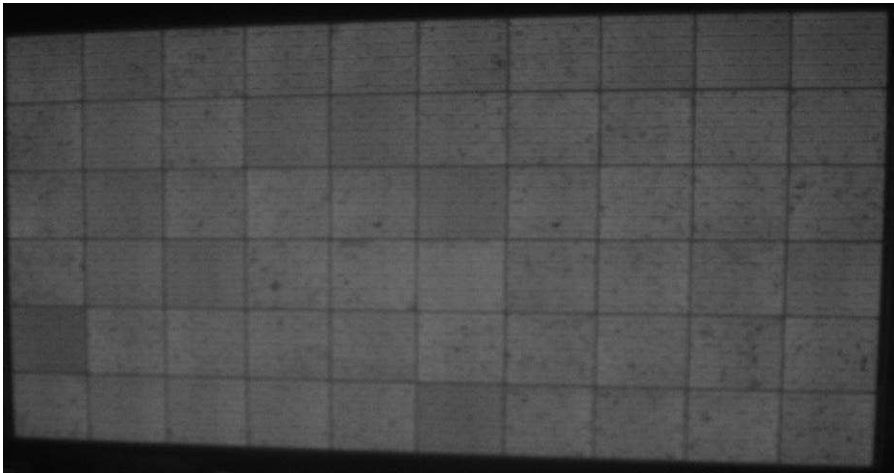


2	12000 times	
	14000 times	

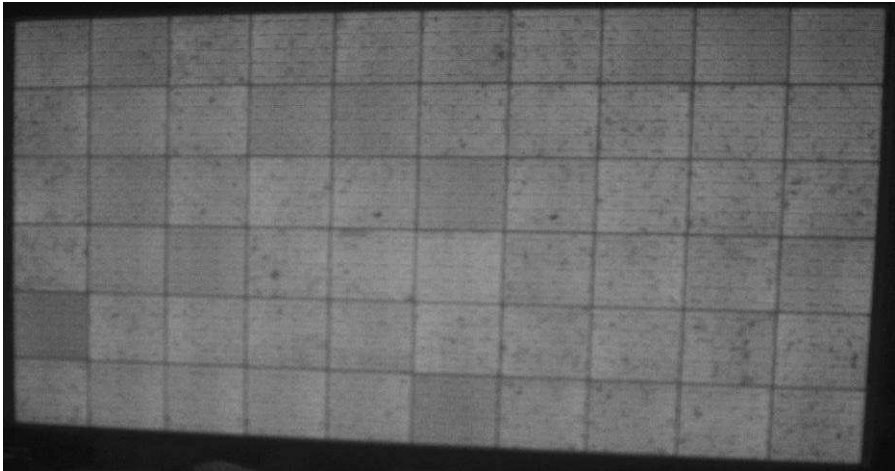
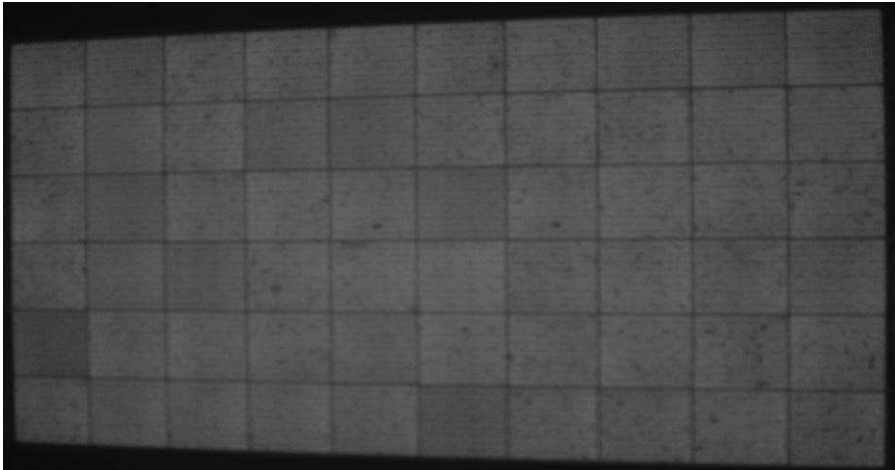


EL Picture		
Sample #	Status	Picture
Note		N/A
3	Initial	
	2000 times	

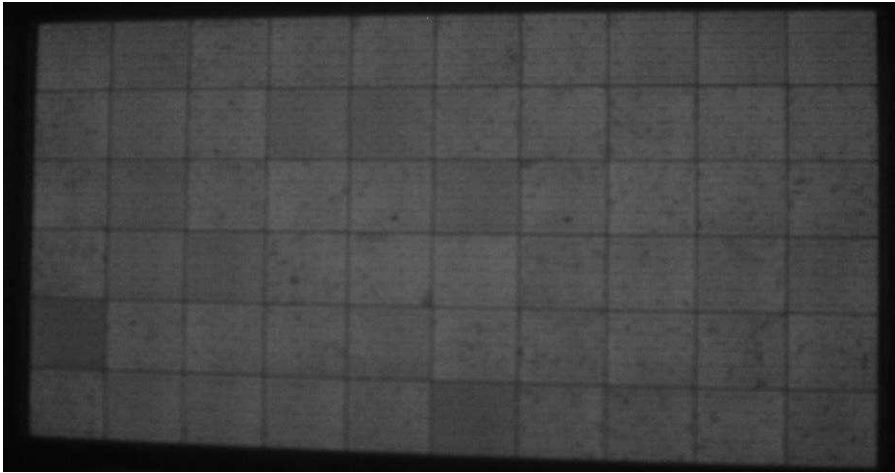
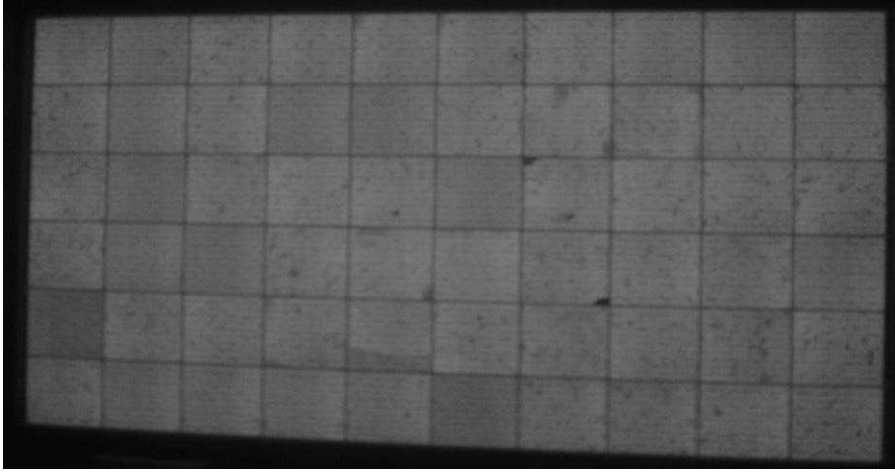


EL Picture		
Sample #	Status	Picture
Note		N/A
3	4000 times	
	6000 times	



EL Picture		
Sample #	Status	Picture
Note		N/A
3	8000 times	
	10000 times	



3	12000 times	
	14000 times	

End of report
