

<b>Prüfbericht-Nr.:</b> <i>Test Report No.:</i>	<b>50198573-001</b>	<b>Auftrags-Nr.:</b> <i>Order No.:</i>	<b>154372555</b>	<b>Seite 1 von 17</b> <i>Page 1 of 17</i>	
<b>Kunden-Referenz-Nr.:</b> <i>Client Reference No.:</i>	<b>N/A</b>	<b>Auftragsdatum:</b> <i>Order date:</i>	<b>08/11/2018</b>		
<b>Auftraggeber:</b> <i>Client:</i>	<b>RenewSys India Pvt. Ltd.</b> Plot No. 06, Survey # 114/P, Srinagar Village, Maheshwaram Mandal Rangareddy District. Telangana-501359, India				
<b>Prüfgegenstand:</b> <i>Test item:</i>	Photovoltaic (PV) modules				
<b>Bezeichnung / Typ-Nr.:</b> <i>Identification / Type No.:</i>	DESERV3S6H-355				
<b>Auftrags-Inhalt:</b> <i>Order content:</i>	Dust and sand test for photovoltaic (PV) modules				
<b>Prüfgrundlage:</b> <i>Test specification:</i>	IEC 60068-2-68:1994 Environmental testing for electric and electronic products-Part 2: Test methods-Test L Dust and sand Refer to details on page 4.				
<b>Wareneingangsdatum:</b> <i>Date of receipt:</i>	10/12/2018	Detaillierte Fotodokumentation siehe Anlage zu diesem Bericht  <i>Detailed photo documentation see appendix to this report</i>			
<b>Prüfmuster-Nr.:</b> <i>Test sample No.:</i>	See page 4				
<b>Prüfzeitraum:</b> <i>Testing period:</i>	18/02/2019 - 08/03/2019				
<b>Ort der Prüfung:</b> <i>Place of testing:</i>	China Telecommunication Technology Labs				
<b>Prüflaboratorium:</b> <i>Testing laboratory:</i>	TÜV Rheinland (Shanghai) Co., Ltd.				
<b>Prüfergebnis*:</b> <i>Test result*:</i>	Pass				
<b>geprüft von / tested by:</b>		<b>kontrolliert von / reviewed by:</b>			
15/03/2019	Christy Zhu/ Project Engineer	15/03/2019	Stella Chen/Technical Reviewer		
<b>Datum</b> <i>Date</i>	<b>Name / Stellung</b> <i>Name / Position</i>	<b>Unterschrift</b> <i>Signature</i>	<b>Datum</b> <i>Date</i>	<b>Name / Stellung</b> <i>Name / Position</i>	<b>Unterschrift</b> <i>Signature</i>
<b>Sonstiges / Other:</b> N/A					
<b>Zustand des Prüfgegenstandes bei Anlieferung:</b> <i>Condition of the test item at delivery:</i>		Prüfmuster vollständig und unbeschädigt Test item complete and undamaged			
* Legende: 1 = sehr gut      2 = gut      3 = befriedigend      4 = ausreichend      5 = mangelhaft P(ass) = entspricht o.g. Prüfgrundlage(n)      F(ail) = entspricht nicht o.g. Prüfgrundlage(n)      N/A = nicht anwendbar      N/T = nicht getestet Legend: 1 = very good      2 = good      3 = satisfactory      4 = sufficient      5 = poor P(ass) = passed a.m. test specification(s)      F(ail) = failed a.m. test specification(s)      N/A = not applicable      N/T = not tested					
<b>Dieser Prüfbericht bezieht sich nur auf das o.g. Prüfmuster und darf ohne Genehmigung der Prüfstelle nicht auszugsweise vervielfältigt werden. Dieser Bericht berechtigt nicht zur Verwendung eines Prüfzeichens.</b> <i>This test report only relates to the a. m. test sample. Without permission of the test center this test report is not permitted to be duplicated in extracts. This test report does not entitle to carry any test mark.</i>					

**Prüfbericht-Nr.: 50198573-001**  
*Test Report No.:*

Seite 2 von 17  
Page 2 of 17

**Liste der verwendeten Prüfmittel**  
*List of used test equipment*

<b>Prüfmittel</b> <i>Test equipment</i>	<b>Prüfmittel-Nr. / ID-Nr.</b> <i>Equipment No. / ID-No.</i>	<b>Nächste Kalibrierung</b> <i>Next calibration</i>
Solar simulator	PAA0352	29/09/2019
Dielectrometer	1104101-037	13/03/2019
Infrared thermometer	08120839	19/03/2019
Power supply	62150E000390	—
Blowing sand test chamber	HJ-15-3	12/06/2019
DC clamp	130912099	13/05/2019
Steel tape	—	13/12/2019

**Prüfbericht-Nr.: 50198573-001**  
*Test Report No.:*

Seite 3 von 17  
*Page 3 of 17*

**Produktbeschreibung**  
*Product description*

**1 Zusammenfassung der Prüfergebnisse**  
*Summary of test results*

According to the inquiry, the resistance to dust and sand of photovoltaic (PV) modules should be assessed in accordance with IEC 60068-2-68:1994.

All tests were performed at China Telecommunication Technology Labs.

The relevant requirements were all fulfilled according to the pass criteria of standard IEC 61215:2005 and IEC 61730-2:2004+A1+A2. The test results are documented within this test report.

**Setting of tasks:**

According to the IEC 60068-2-68:1994 standard, following measurements shall be performed.

- Initial visual inspection according to 10.1 of IEC 61215:2005 (3 PV modules)
- Initial maximum power determination according to 10.2 of IEC 61215:2005 (3 PV modules)
- Initial measurement of insulation test according to 10.3 of IEC 61215:2005 (3 PV modules)
- Initial measurement of wet leakage current test according to 10.15 of IEC 61215:2005 (3 PV modules)
- Initial ground continuity test according to MST 13 of IEC 61730-2:2004+A1+A2 (3 PV modules)
- Initial electroluminescence measurement (3 PV modules)
- Dust and sand test according to IEC60068-2-68:1994 (2 PV modules)  
(Test condition: Method Lc2; Chamber temperature: 40°C ~ 44°C; Humidity: 4% ~ 7%; Dust/sand type: Quart, 95% SiO<sub>2</sub>; Particle size: Average 0.5mm; Speed: 20.3~21.1m/s; Dust/sand concentration: 4.8-5.3g/m<sup>3</sup>; Duration: 240 min for front side and 240min for rear side)
- Final visual inspection according to 10.1 of IEC 61215:2005 (2 PV modules)
- Final maximum power determination according to 10.2 of IEC 61215:2005 (2 PV modules)
- Final measurement of insulation test according to 10.3 of IEC 61215:2005 (2 PV modules)
- Final measurement of wet leakage current test according to 10.15 of IEC 61215:2005 (2 PV modules)
- Final ground continuity test according to MST 13 of IEC 61730-2:2004+A1+A2 (2 PV modules)
- Final bypass diode functionality test (2 PV modules)
- Final electroluminescence measurement (3 PV modules)

**Prüfbericht-Nr.: 50198573-001** Seite 4 von 17  
*Test Report No.:* *Page 4 of 17*

Absatz	<b>Photovoltaic (PV) modules</b>	Messergebnisse - Bemerkungen	Bewertung
<i>Clause</i>	<i>Anforderungen - Prüfungen / Requirements- Tests</i>	<i>Measuring results - Remarks</i>	<i>Evaluation</i>

- Reference standard are as follows:**
- IEC 60068-2-68:1994 Environmental testing for electric and electronic products-Part 2: Test methods-Test L: Dust and sand.
  - IEC 61215:2005 Crystalline silicon terrestrial photovoltaic (PV) modules – Design qualification and type approval.
  - IEC 61730-2:2004+A1+A2 Photovoltaic (PV) module safety qualification – Part 2: Requirements for testing.
  - IEC 61701:2011 Salt mist corrosion testing of PV modules.

**General information**

**Abbreviations used in the report:**

Pmpp – Maximum power	Vmpp – Maximum power voltage
Impp – Maximum power current	Voc – Open circuit voltage
Isc – Short circuit current	FF – Fill factor
STC – Standard Test Conditions	

- Possible test case verdicts:**
- test case does not apply to the test object .....: N/A
  - test object does meet the requirement .....: Pass (P)
  - test object does not meet the requirement.....: Fail (F)

**General remarks:**

The test verdicts 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.

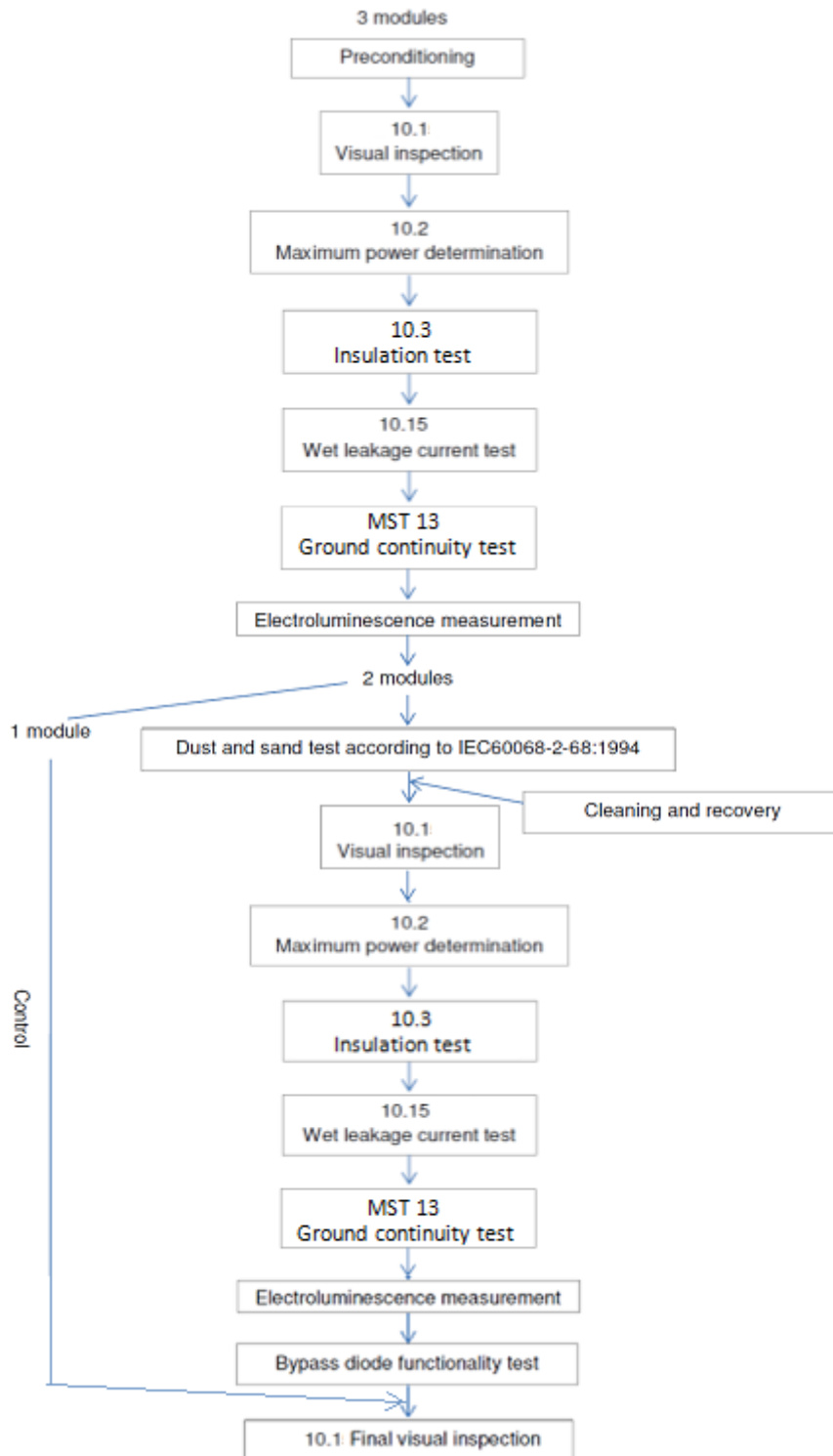
-	<b>List of test samples</b>		
Sample No.	Sample S/N	Module Type	Remarks
1	R1000040181925107	DESERV3S6H-355	6" mono c-Si module, 72pcs
2	R1000040181925112		
3	R1000040181925110		
Remarks: Sample No. 3 was selected as control panel.			

Prüfbericht-Nr.: 50198573-001  
Test Report No.:

Seite 5 von 17  
Page 5 of 17

Absatz	Photovoltaic (PV) modules	Messergebnisse - Bemerkungen	Bewertung
Clause	Anforderungen - Prüfungen / Requirements- Tests	Measuring results - Remarks	Evaluation

Test sequence and test sample requirement



**Prüfbericht-Nr.: 50198573-001**  
Test Report No.:

Seite 6 von 17  
Page 6 of 17

Absatz	<b>Photovoltaic (PV) modules</b>	Messergebnisse - Bemerkungen	Bewertung
Clause	Anforderungen - Prüfungen / Requirements- Tests	Measuring results - Remarks	Evaluation

<b>10.1</b>	<b>Visual inspection (Initial)</b>		
Test date [DD/MM/YYYY]	18/02/2019		—
Sample No.	Nature and position of initial findings		—
1	No visual defects		P
2	No visual defects		P
3	No visual defects		P
Supplementary information: N/A			

<b>10.2</b>	<b>Maximum power determination (Initial)</b>					
Test date [DD/MM/YYYY]	18/02/2019					—
Module temperature [°C].....:	Corrected to 25					—
Irradiance [W/m²].....:	1000					—
Sample No.	Pmax [W]	Vmpp [V]	Imp [A]	Voc [V]	Isc [A]	FF [%]
1	357.9	38.96	9.188	47.85	9.653	77.5
2	357.4	39.04	9.153	47.79	9.605	77.9
3	357.5	38.98	9.172	47.75	9.601	78.0
Supplementary information: N/A						

<b>10.3</b>	<b>Insulation test (Initial)</b>					
Test date [DD/MM/YYYY]	19/02/2019					—
Maximum system voltage [V <sub>DC</sub> ]	1500					
High voltage applied [V <sub>DC</sub> ]	8000					
Insulation resistance measured at [V <sub>DC</sub> ]	1500					
Sample No.	Measured	Area	Result*	Dielectric breakdown		—
	[MΩ]	[m²]	[MΩ*m²]	Yes (description)	No	
1	>9900.0	1.93	>19107.0	-	No	P
2	>9900.0	1.93	>19107.0	-	No	P
3	>9900.0	1.93	>19107.0	-	No	P

\*Minimum requirement acc. to the standard is 40MΩ\*m².

Supplementary information: Insulation tester can measure up to 9900.0 MΩ.

**Prüfbericht-Nr.: 50198573-001**  
*Test Report No.:*

Absatz	<b>Photovoltaic (PV) modules</b>	Messergebnisse - Bemerkungen	Bewertung
Clause	Anforderungen - Prüfungen / <i>Requirements- Tests</i>	<i>Measuring results - Remarks</i>	<i>Evaluation</i>

<b>10.15</b>	<b>Wet leakage current test (Initial)</b>		
Test date [DD/MM/YYYY]	19/02/2019		—
Insulation resistance measured at [V <sub>DC</sub> ]	1500		—
Solution resistivity [Ω cm]	< 3,500		P
Solution temperature [°C]	22 ± 3		P
Sample No.	Measured	Area	Result*
	[MΩ]	[m <sup>2</sup> ]	[MΩ*m <sup>2</sup> ]
1	6284.0	1.93	12128.1
2	6881.0	1.93	13280.3
3	5766.0	1.93	11128.4
*Minimum requirement acc. to the standard is 40MΩ*m <sup>2</sup> .			

<b>MST 13</b>	<b>Ground continuity test (Initial)</b>		
Test date [DD/MM/YYYY]	19/02/2019		—
Maximum over-current protection rating [A]	15		—
Current applied [A]	37.5		—
Location of designated grounding point	Grounding point of the long edge		—
Location of second contacting point	The greatest physical displacement of adjacent side		—
Sample No	Voltage [V]	Resistance [Ω]	—
1	0.072	0.0019	P
2	0.051	0.0014	P
3	0.057	0.0015	P
Supplementary information: N/A			

—	<b>EL-images (Initial)</b>		
Test date [DD/MM/YYYY]	18/02/2019		—
Forward bias current [A] .....	9.0		—
Sample No	Remarks		—
1	N/A		P
2	N/A		P
3	N/A		P
Supplementary information: Refer to annex 2: EL-images for more details.			

**Prüfbericht-Nr.: 50198573-001**  
Test Report No.:

Absatz	<b>Photovoltaic (PV) modules</b>	Messergebnisse - Bemerkungen	Bewertung
Clause	Anforderungen - Prüfungen / Requirements- Tests	Measuring results - Remarks	Evaluation

—				<b>Dust and sand test</b>			
Test Date [DD/MM/YYYY / DD/MM/YYYY] .....		01/03/2019 – 05/03/2019				—	
Sample No.....		1, 2				—	
Cell interconnection circuit.....		<input checked="" type="checkbox"/> S	<input type="checkbox"/> SP	<input type="checkbox"/> SPS			—
Chamber temperature [°C] .....		40-44				—	
Chamber relative humidity [%].....		4-7				—	
Method Lc1 or Lc2.....		Lc2				—	
Dust/sand type and composition.....		Quartz, 95% SiO <sub>2</sub>				—	
Particle size.....		Average 0.5mm				—	
Dust/sand concentration [g/m <sup>3</sup> ] .....		4.8-5.3				—	
Wind speed [m/s] .....		20.3-21.1				—	
Duration [min] .....		240 min for front side+240 min for rear side				—	
Supplementary information: N/A							

<b>10.1</b>	<b>Visual inspection (Final)</b>						
Test date [DD/MM/YYYY]		06/03/2019				—	
Sample No.	Nature and position of initial findings						—
1	No visual defects						P
2	No visual defects						P
Supplementary information: N/A							

<b>10.2</b>	<b>Maximum power determination (Final)</b>							
Test date [DD/MM/YYYY]		06/03/2019				—		
Module temperature [°C].....		Corrected to 25				—		
Irradiance [W/m <sup>2</sup> ].....		1000				—		
Sample No.	Pmax [W]	Vmpp [V]	Imp [A]	Voc [V]	Isc [A]	FF [%]	Degradation [%]	—
1	350.0	38.98	8.981	47.42	9.492	77.8	-2.20	P
2	351.4	39.03	9.002	47.62	9.527	77.5	-1.68	P
Supplementary information: N/A								



**Prüfbericht-Nr.: 50198573-001**

Seite 9 von 17

Test Report No.:

Page 9 of 17

Absatz	<b>Photovoltaic (PV) modules</b>	Messergebnisse - Bemerkungen	Bewertung
Clause	Anforderungen - Prüfungen / Requirements- Tests	Measuring results - Remarks	Evaluation

<b>10.3</b>	<b>Insulation test (Final)</b>					
Test date [DD/MM/YYYY]	06/03/2019				—	
Maximum system voltage [V <sub>DC</sub> ]	1500					
High voltage applied [V <sub>DC</sub> ]	8000					
Insulation resistance measured at [V <sub>DC</sub> ]	1500					
Sample No.	Measured	Area	Result*	Dielectric breakdown		—
	[MΩ]	[m <sup>2</sup> ]	[MΩ*m <sup>2</sup> ]	Yes (description)	No	
1	>9900.0	1.93	>19107.0	-	No	P
2	>9900.0	1.93	>19107.0	-	No	P
*Minimum requirement acc. to the standard is 40MΩ*m <sup>2</sup> .						
Supplementary information: Insulation tester can measure up to 9900.0 MΩ.						

<b>10.15</b>	<b>Wet leakage current test (Final)</b>				
Test date [DD/MM/YYYY]	06/03/2019				—
Insulation resistance measured at [V <sub>DC</sub> ]	1500				—
Solution resistivity [Ω cm]	< 3,500				P
Solution temperature [°C]	22 ± 3				P
Sample No.	Measured	Area	Result*		—
	[MΩ]	[m <sup>2</sup> ]	[MΩ*m <sup>2</sup> ]		
2	5728.0	1.93	11055.0		P
3	6135.0	1.93	11840.6		P
*Minimum requirement acc. to the standard is 40MΩ*m <sup>2</sup> .					

<b>Prüfbericht-Nr.: 50198573-001</b>			
<i>Test Report No.:</i>			
Absatz	<b>Photovoltaic (PV) modules</b>	Messergebnisse - Bemerkungen	Bewertung
<i>Clause</i>	<i>Anforderungen - Prüfungen / Requirements- Tests</i>	<i>Measuring results - Remarks</i>	<i>Evaluation</i>

<b>MST 13</b>	<b>Ground continuity test (Final)</b>		
Test date [DD/MM/YYYY]	06/03/2019		—
Maximum over-current protection rating [A]	15		—
Current applied [A]	37.5		—
Location of designated grounding point	Grounding point of the long edge		—
Location of second contacting point	The greatest physical displacement of adjacent side		—
Sample No	Voltage [V]	Resistance [ $\Omega$ ]	—
1	0.085	0.0023	P
2	0.055	0.0015	P
Supplementary information: N/A			

—	<b>Bypass diode functional test (Final)</b>			
Test Date [DD/MM/YYYY]	06/03/2019			—
Number of diodes in junction box	3			
Diode manufacturer	—			
Diode type designation	—			
Max. permissible junction temperature $T_{jmax}$ [°C] (according to diode datasheet)	—			
Sample No.	Diode 1	Diode 2	Diode 3	—
1	Functional	Functional	Functional	P
2	Functional	Functional	Functional	P
Supplementary information: N/A				

—	<b>EL-images (Final)</b>		
Test date [DD/MM/YYYY]	06/03/2019		—
Forward bias current [A]..... :	9.0		—
Sample No	Remarks		—
1	N/A		P
2	N/A		P
3	N/A		P
Supplementary information: Refer to annex 2: EL-images for more details.			

**Prüfbericht-Nr.: 50198573-001**  
*Test Report No.:*

Absatz	<b>Photovoltaic (PV) modules</b>	Messergebnisse - Bemerkungen	Bewertung
Clause	Anforderungen - Prüfungen / <i>Requirements- Tests</i>	<i>Measuring results - Remarks</i>	<i>Evaluation</i>

**Annex 1: Photos of module**

**Model type: DESERV3S6H-355**



Fig. 1: front view of test module

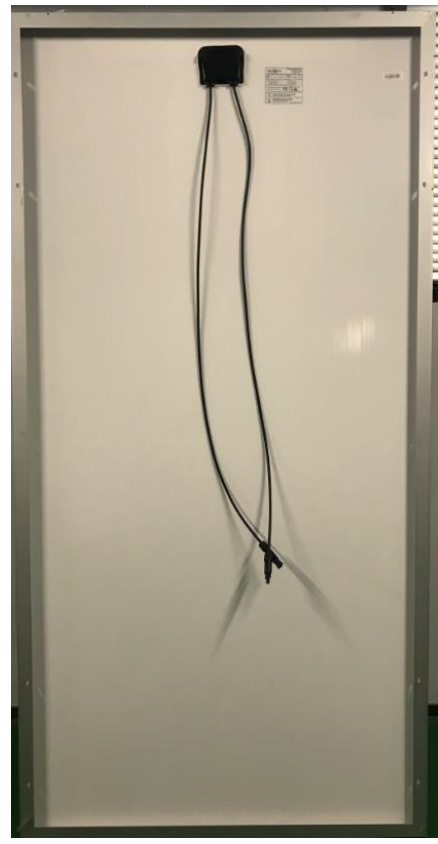


Fig. 2: rear view of test module



Fig. 3: rating label of test module



Fig. 4: junction box of test module

**Prüfbericht-Nr.: 50198573-001**  
*Test Report No.:*

Seite 12 von 17  
Page 12 of 17

Absatz	Photovoltaic (PV) modules	Messergebnisse - Bemerkungen	Bewertung
<i>Clause</i>	<i>Anforderungen - Prüfungen / Requirements- Tests</i>	<i>Measuring results - Remarks</i>	<i>Evaluation</i>

**Annex 2: EL-images**

**Model type: DESERV3S6H-355**

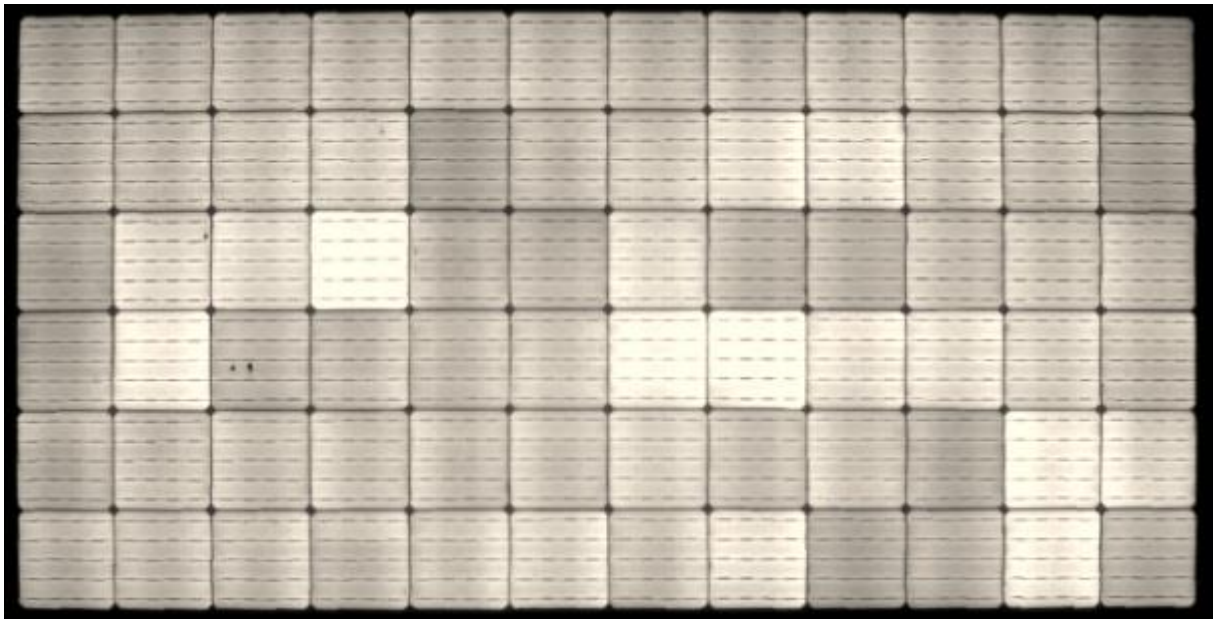


Fig. 5: EL-image of sample R1000040181925107 (initial)

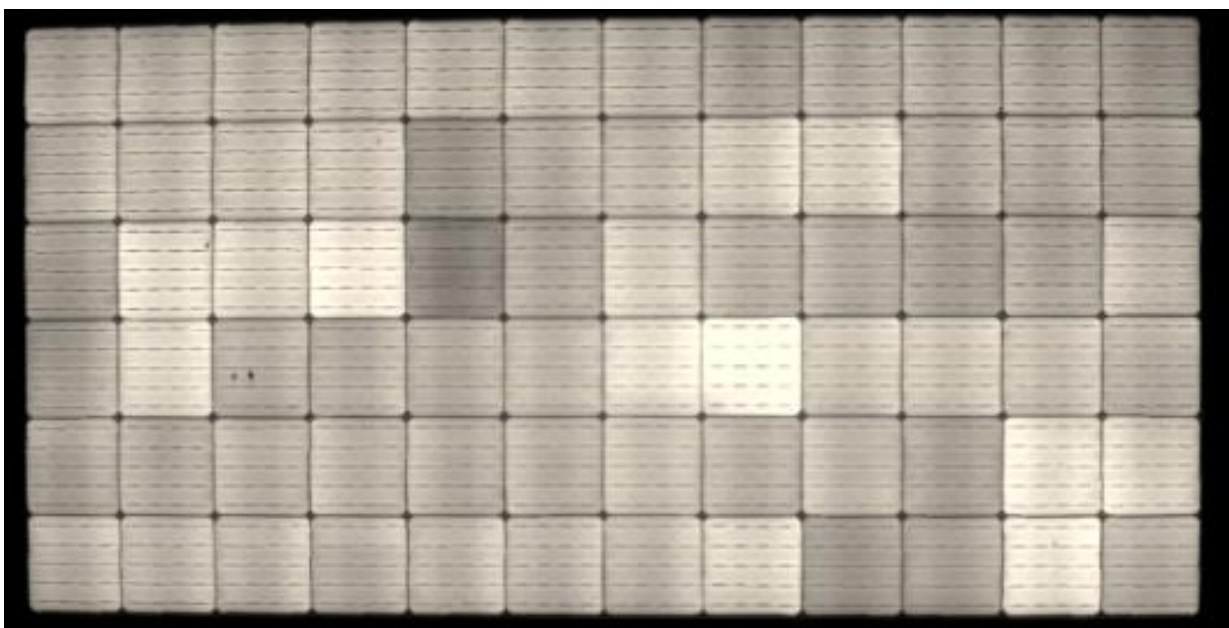


Fig. 6: EL-image of sample R1000040181925107 (final)

**Prüfbericht-Nr.: 50198573-001**  
*Test Report No.:*

Seite 13 von 17  
*Page 13 of 17*

Absatz	<b>Photovoltaic (PV) modules</b>	Messergebnisse - Bemerkungen	Bewertung
<i>Clause</i>	<i>Anforderungen - Prüfungen / Requirements- Tests</i>	<i>Measuring results - Remarks</i>	<i>Evaluation</i>

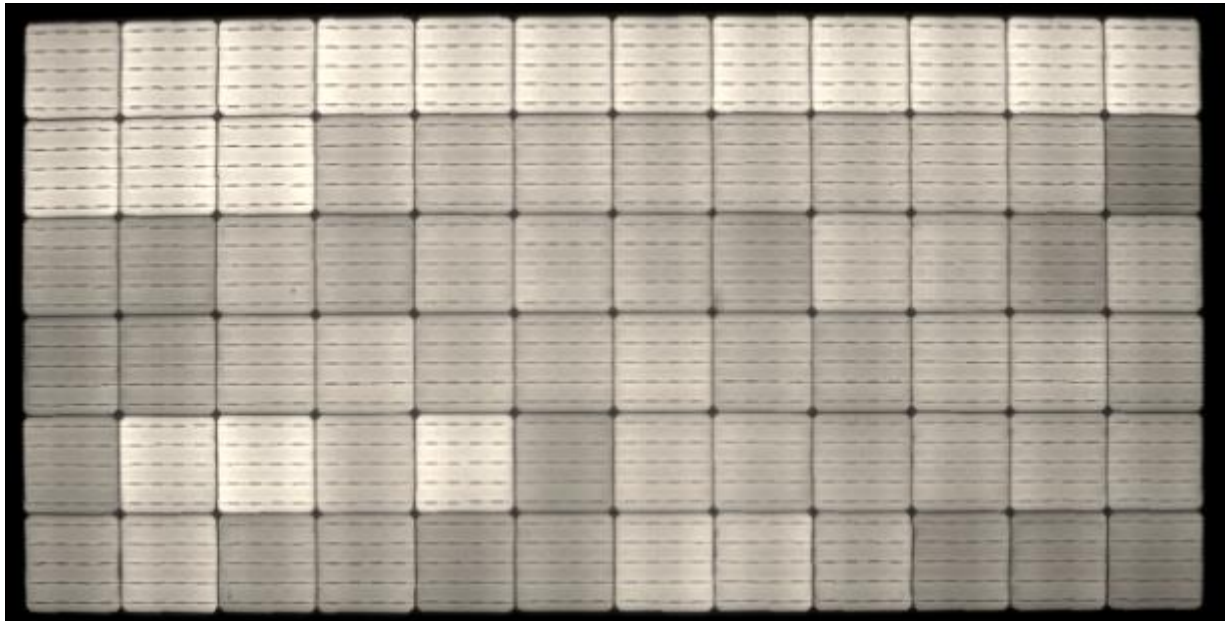


Fig. 7: EL-image of sample R1000040181925112 (initial)

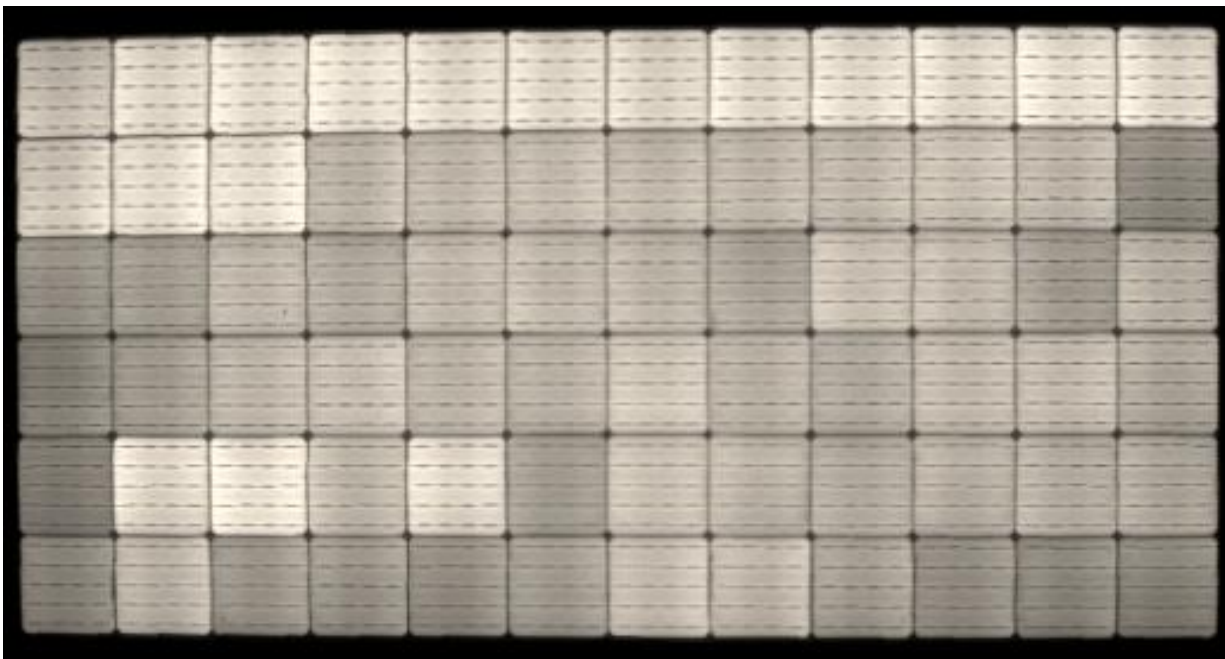


Fig. 8: EL-image of sample R1000040181925112 (final)

**Prüfbericht-Nr.: 50198573-001**  
*Test Report No.:*

Seite 14 von 17  
Page 14 of 17

Absatz <i>Clause</i>	<b>Photovoltaic (PV) modules</b> <i>Anforderungen - Prüfungen / Requirements- Tests</i>	Messergebnisse - Bemerkungen <i>Measuring results - Remarks</i>	Bewertung <i>Evaluation</i>
-------------------------	--	--	--------------------------------

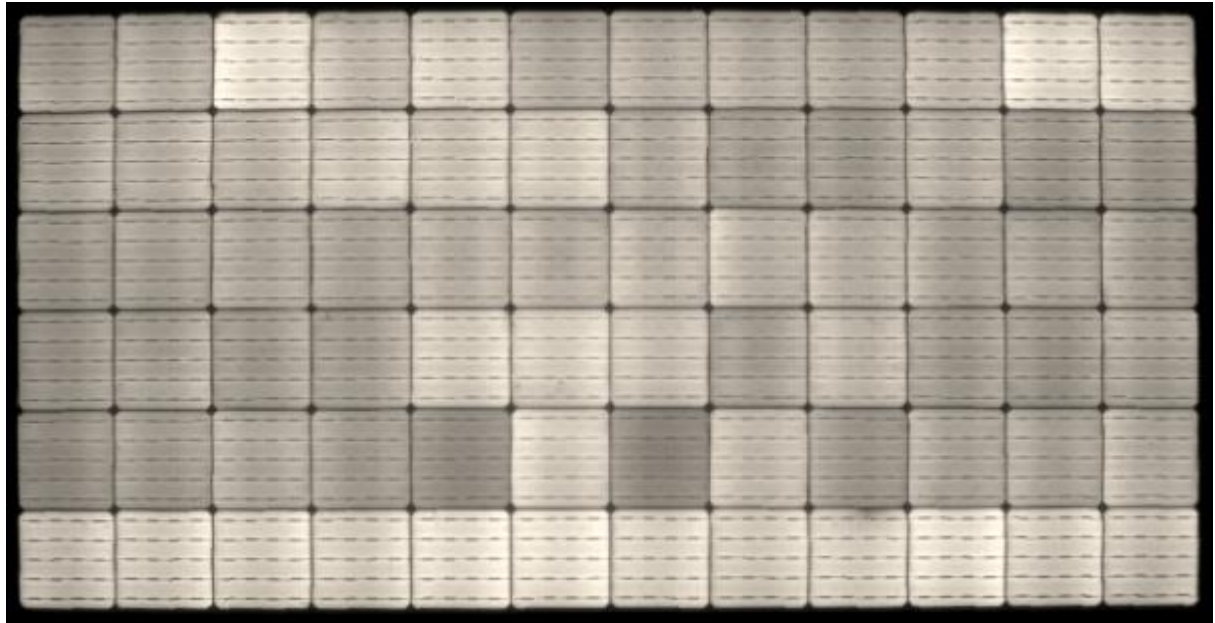


Fig. 9: EL-image of sample R1000040181925110 (initial)

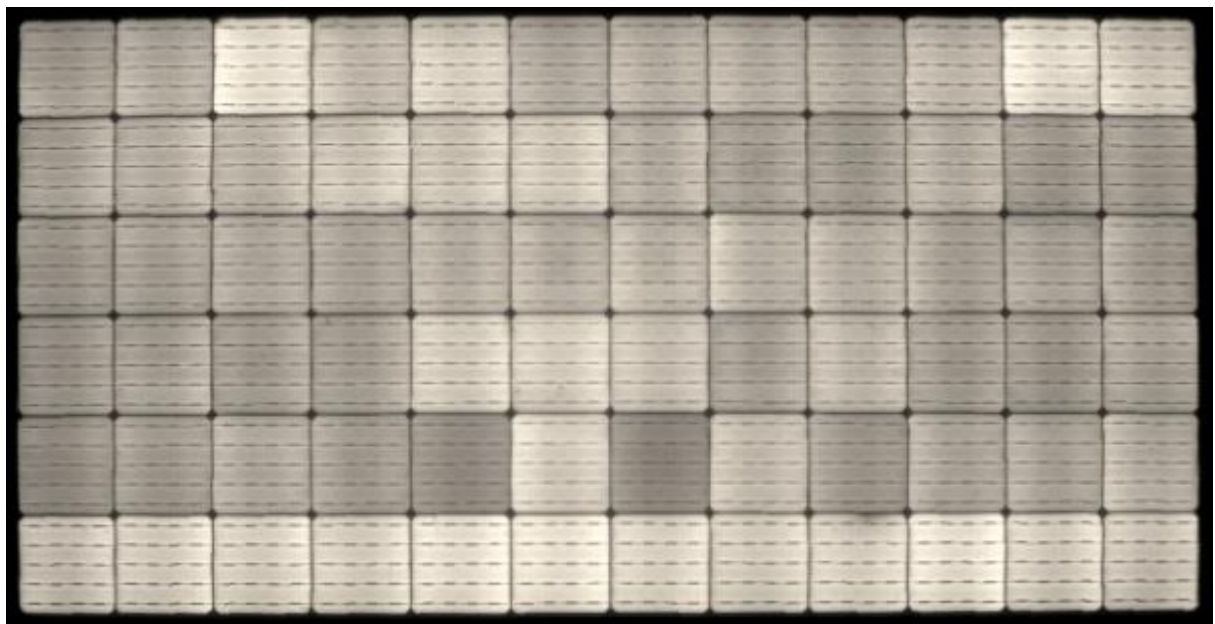


Fig. 10: EL-image of sample R1000040181925110 (final)

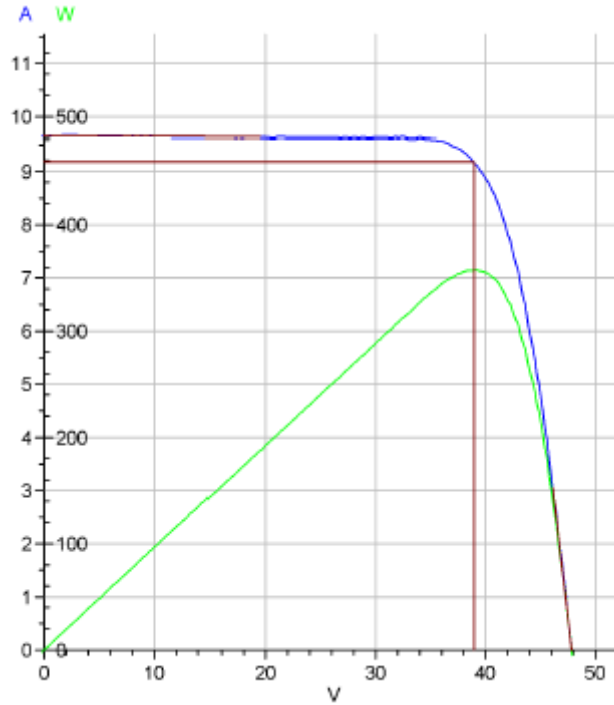
Prüfbericht-Nr.: 50198573-001  
Test Report No.:

Absatz	Photovoltaic (PV) modules	Messergebnisse - Bemerkungen	Bewertung
Clause	Anforderungen - Prüfungen / Requirements- Tests	Measuring results - Remarks	Evaluation

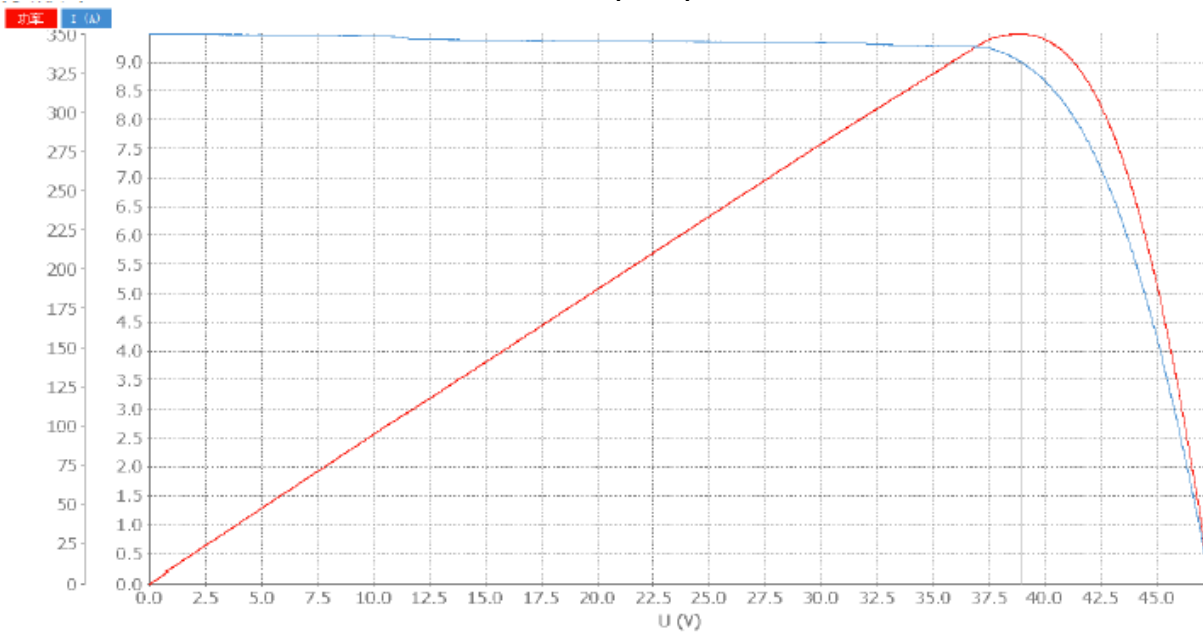
Annex 4: Measurement reports

Model type: DESERV3S6H-355

I-V curve for serial number R1000040181925107 (initial):



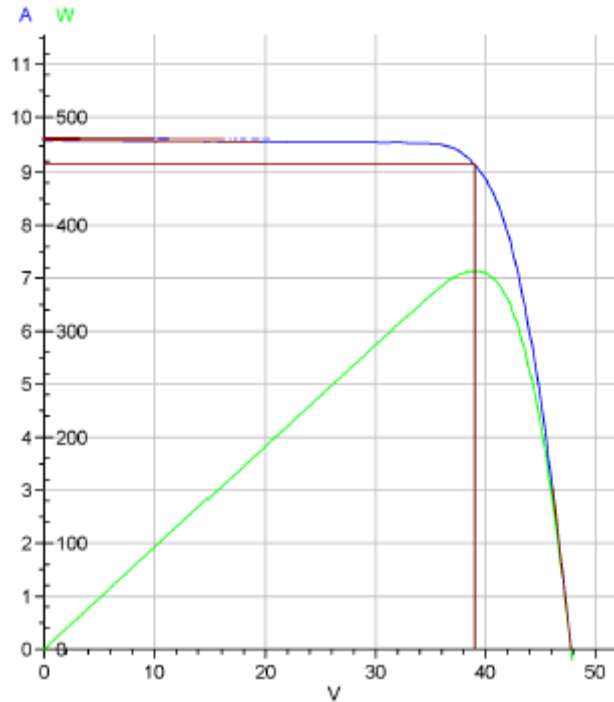
I-V curve for serial number R1000040181925107 (Final):



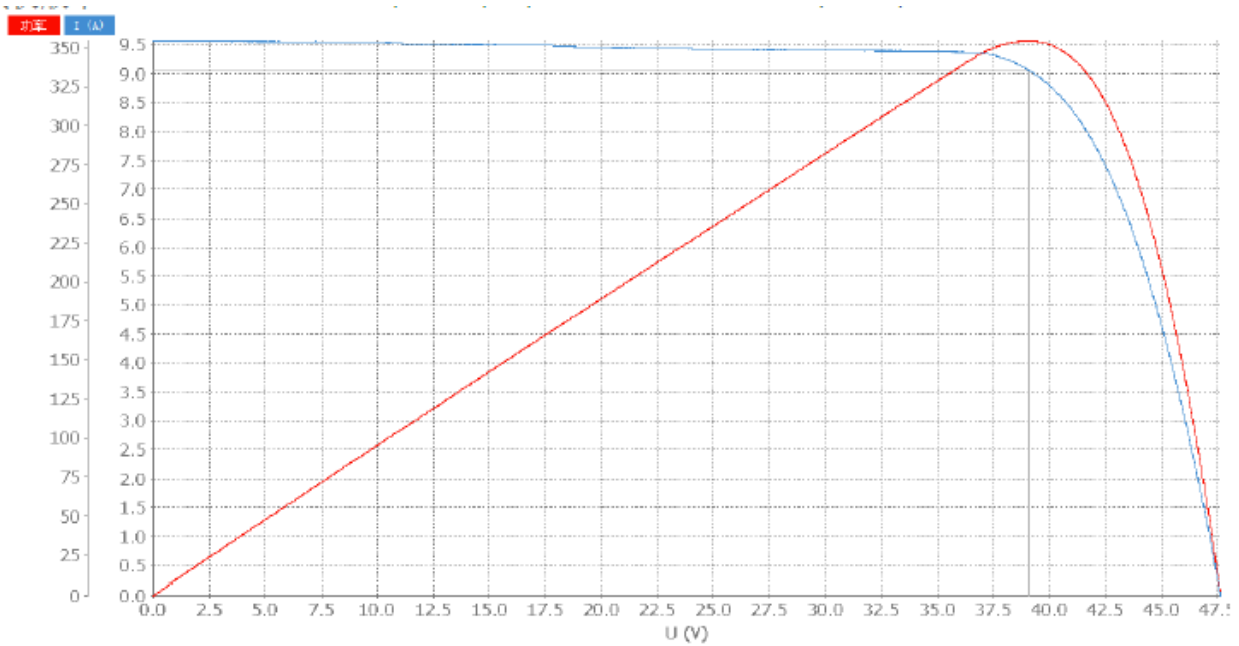
Prüfbericht-Nr.: 50198573-001  
Test Report No.:

Absatz	Photovoltaic (PV) modules	Messergebnisse - Bemerkungen	Bewertung
Clause	Anforderungen - Prüfungen / Requirements- Tests	Measuring results - Remarks	Evaluation

I-V curve for serial number R1000040181925112 (initial):



I-V curve for serial number R1000040181925112 (Final):

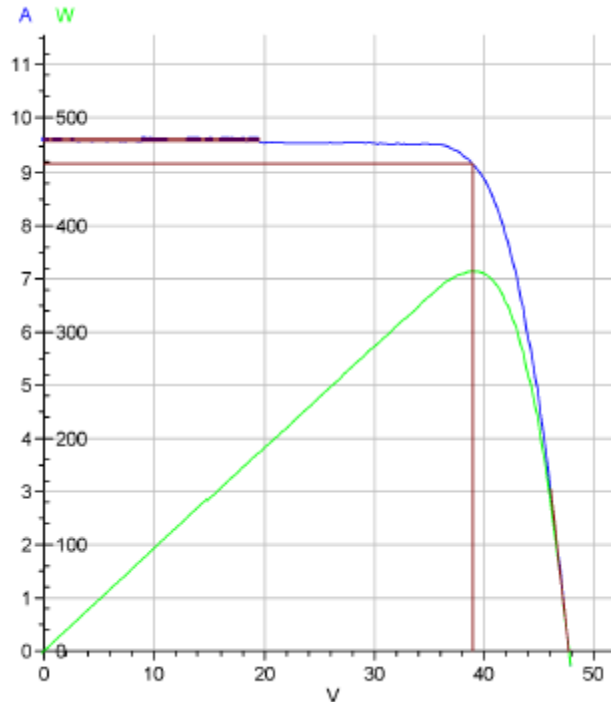




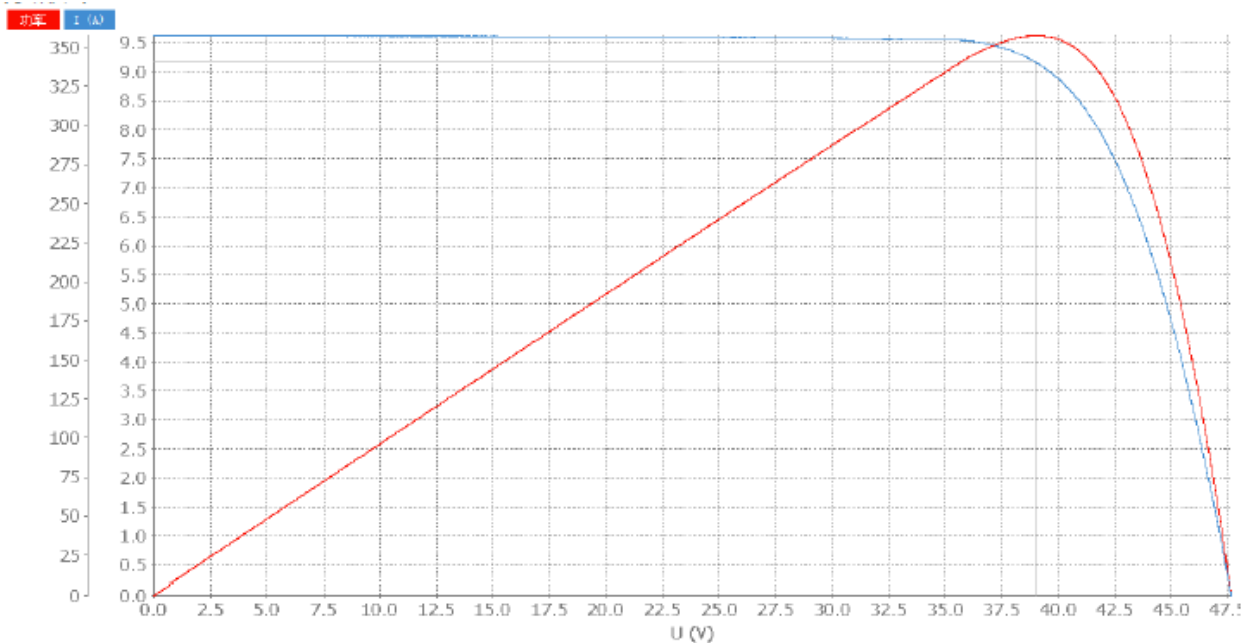
**Prüfbericht-Nr.: 50198573-001**  
Test Report No.:

Absatz	Photovoltaic (PV) modules	Messergebnisse - Bemerkungen	Bewertung
Clause	Anforderungen - Prüfungen / Requirements- Tests	Measuring results - Remarks	Evaluation

I-V curve for serial number R100040181925110 (initial):



I-V curve for serial number R100040181925110 (Final):



**End of Test Report**