Test Report

Application No.	:	TB-LVD161374
Applicant	:	Shenzhen JuGuangNeng Science and Technology Co., Ltd.
Equipment Under Test (EUT)		
EUT Name	:	Solar Panel
Model No.	:	JGN300W
Serial No.	:	See page 4
Brand Name	:	JGN
Receipt Date	:	2018-07-31
Test Date	:	2018-07-31 To 2018-08-06
Issue Date	:	2018-08-07
Standards	:	IEC 61215 : 2005 Crystalline silicon terrestrial photovoltaic (PV) modules – Design qualification and type approval This report shows that the product technically complies with the Council LVD Directive 2014/35/EU requirements.
Report by (Tiger chen)	:	tiger. chen.
Checked by (Benny Xu)	:	Benny
Approved by (Justin Zhang)	:	Justin zhang

This test report is valid for above tested sample only and shall not be reproduced in part without written approval of the laboratory.

Revision History

Report No.	Version	Description	Issued Date
TB-LVD161374	Rev.01	Initial issue of report	2018-08-07

IEC 61215: 2005 Crystalline silicon terrestrial photovoltaic (PV) modules – Design qualification and type approval	
Testing laboratory----------	Shenzhen Toby Technology Co., Ltd.
Address----------	1A/F., Bldg.6, Yusheng Industrial Zone, The National Road No.107 Xixiang Section 467, Xixiang, Bao'an Shenzhen, Guangdong, China
Testing location----------	Shenzhen Toby Technology Co., Ltd.
Applicant----------	Shenzhen JuGuangNeng Science and Technology Co., Ltd.
Address----------	6/F, Building A, Shuangjinhui industrial park, Fuyong, Bao'an, Shenzhen city, Guangdong, China 518103
Standard----------	IEC 61215: 2005
Test result----------	Compliance with the requirements.
Procedure deviation----------	N.A.
Non-standard test method---	N.A.
Trademark----------	JGN
Type of test object----------	Solar Panel
Models/Type reference-------	JGN300W
Rating----------	DC36V, 8.33A
Factory----------	Shenzhen JuGuangNeng Science and Technology Co., Ltd.
Address----------	6/F, Building A, Shuangjinhui industrial park, Fuyong, Bao'an, Shenzhen city, Guangdong, China 518103

Possible test case verdicts:
Test case does not apply to the object----------: N
Test object does meet the requirement ----------: P
Test object does not meet the requirement----------: F

General product information:
Unless otherwise specified, actually illumination when testing: Temperature: 25 °C Relative Humidity: 58%.

General remarks:
1.”（see remark #）” refers to a remark appended to the report.

2. Throughout this report a point is used as the decimal separator.

3. The test results presented in this report relate only to the object tested.

4. All models are the same except model name and frame color.

5. This report shall not be reproduced except in full without the written approval of the Shenzhen TOBY.

6. If client has any objection to the testing results, please advise us within 15 working days after publish, otherwise claims will not be accepted.

Artwork of Marking Label

Remark: 1. Model Type of label can be JGN350W, JGN340W, JGN330W, JGN320W, JGN310W, JGN300W, JGN290W, JGN280W, JGN270W, JGN260W, JGN240W, JGN200W, JGN180W, JGN160W, JGN150W, JGN120W, JGN110W, JGN100W, JGN90W, JGN80W, JGN70W, JGN60W, JGN50W, JGN40W, JGN30W, JGN28W, JGN25W, JGN20W, JGN16W, JGN15W, JGN14W, JGN12W, JGN10W, JGN9W, JGN7W, JGN6W, JGN5W, JGN4W, JGN3W, JGN2W, JGN1W

2. Name of label can be Shenzhen JuGuangNeng Science and Technology Co., Ltd.

IEC 61215 : 2005			
CL.	Requirement of the test	Result--Remark	Verdict
1	**Scope and object**		**P**
	Requirements for the design qualification and type approval of terrestrial photovoltaic modules suitable for long-term operation in general openair climates		P
	The object of this test sequence is to determine the electrical and thermal characteristics of the module and to show, as far as is possible within reasonable constraints of cost and time, that the module is capable of withstanding prolonged exposure in climates described in the scope.		P
2	**Normative references**		**P**
3	**Sampling**		P
	Eight modules for qualification testing (plus spares as desired) shall be taken at random from a production batch or batches, in accordance with the procedure given in IEC 60410.		P
4	**Marking**		P
	Each module shall carry the following clear and indelible markings:		P
	name, monogram or symbol of manufacturer;	See the marking	P
	type or model number;	See the marking	P
	serial number;	See the marking	P
	polarity of terminals or leads (colour coding is permissible);	terminals with polarity + and -	P
	maximum system voltage for which the module is suitable.	DC 1000V	P
	The date and place of manufacture shall be marked on the module or be traceable from the serial number.		P
5	**Testing**		**P**
	Before beginning the testing, all modules, including the control, shall be exposed to sunlight (either real or simulated) to an irradiation level of 5 kWh m^{-2} to 5,5 kWh m^{-2} while open circuited.		P
	In carrying out the tests, the tester shall strictly observe the manufacturer's handling, mounting and connection instructions.		P
6	**Pass criteria**		**P**
	A module design shall be judged to have passed the qualification tests, if each test sample meets all the following criteria:		P

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CL.	Requirement of the test	Result--Remark	Verdict
	a) the degradation of maximum output power does not exceed the prescribed limit after each test nor 8 % after each test sequence;		P
	b) no sample has exhibited any open circuit during the tests;		P
	c) there is no visual evidence of a major defect, as defined in Clause 7;		P
	d) the insulation test requirements are met after the tests;		P
	e) the wet leakage current test requirements are met at the beginning and the end of each sequence and after the damp heat test;		P
	f) specific requirements of the individual tests are met.		P
	If two or more modules do not meet these test criteria, the design shall be deemed not to have met the qualification requirements.		N
	Should one module fail any test, another two modules meeting the requirements of Clause 3 shall be subjected to the whole of the relevant test sequence from the beginning.		P
7	**Major visual defects**		**N**
	For the purposes of design qualification and type approval, the following are considered to be major visual defects:		N
	a) broken, cracked, or torn external surfaces, including superstrates, substrates, frames and junction boxes;		N
	b) bent or misaligned external surfaces, including superstrates, substrates, frames and junction boxes to the extent that the installation and/or operation of the module would be impaired.		N
	c) a crack in a cell the propagation of which could remove more than 10 % of that cell's area from the electrical circuit of the module;		N
	d) bubbles or delaminations forming a continuous path between any part of the electrical circuit and the edge of the module;		N
	e) loss of mechanical integrity, to the extent that the installation and/or operation of the module would be impaired.		N
8	**Report**		**P**
	Each certificate or test report shall include at least the following information:		P
	a) a title;		P
	b) name and address of the test laboratory and location where the tests were carried out;		P
	c) unique identification of the certification or report and of each page;		P

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CL.	Requirement of the test	Result--Remark	Verdict
	d) name and address of client, where appropriate;		P
	e) description and identification of the item tested;		P
	f) characterization and condition of the test item;		P
	g) date of receipt of test item and date(s) of test, where appropriate;		P
	h) identification of test method used;		P
	i) reference to sampling procedure, where relevant;		P
	j) any deviations from, additions to or exclusions from the test method, and any other information relevant to a specific tests, such as environmental conditions;		P
	k) measurements, examinations and derived results supported by tables, graphs, sketches and photographs as appropriate including temperature coefficients of short-circuit current, open-circuit voltage and peak power, NOCT, power at NOCT, STC and low irradiance, spectrum of the lamp used for the UV pre-screening test, maximum power loss observed after all of the tests, and any failures observed;		P
	l) a statement of the estimated uncertainty of the test results (where relevant);		P
	m) a signature and title, or equivalent identification of the person(s) accepting responsibility for the content of the certificate or report, and the date of issue;		P
	n) where relevant, a statement to the effect that the results relate only to the items tested;		P
	o) a statement that the certificate or report shall not be reproduced except in full, without the written approval of the laboratory.		P
9	**Modifications**		**P**
	Any change in the design, materials, components or processing of the module may require a repetition of some or all of the qualification tests to maintain type approval.		P
10	**Test procedures**		**P**
10.1	Visual inspection		P
10.1.1	Purpose		P
	To detect any visual defects in the module.		P
10.1.2	Procedure		P

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CL.	Requirement of the test	Result--Remark	Verdict
	Carefully inspect each module under an illumination of not less than 1 000 W/m^2 for the following conditions:		P
	cracked, bent, misaligned or torn external surfaces;		N
	broken cells;		N
	cracked cells;		N
	faulty interconnections or joints;		N
	cells touching one another or the frame;		N
	failure of adhesive bonds;		N
	bubbles or delaminations forming a continuous path between a cell and the edge of the module;		N
	tacky surfaces of plastic materials;		N
	faulty terminations, exposed live electrical parts;		N
	any other conditions which may affect performance.		N
10.1.3	Requirements		P
	Visual conditions other than the major visual defects listed in Clause 7 are acceptable for the purposes of type approval.		P
10.2	Maximum power determination	See appended test data	P
10.2.1	Purpose		P
	To determine the maximum power of the module before and after the various environmental tests.		P
10.2.2	Apparatus		P
	a) A radiant source (natural sunlight or a solar simulator class B or better).		P
	b) A PV reference device		P
	c) A suitable mount for supporting the test specimen and the reference device in a plane normal to the radiant beam.		P
	d) A means for monitoring the temperature of the test specimen and the reference device to an accuracy of ±1 °C and repeatability of ±0,5 °C.		P
	e) Equipment for measuring the current of the test specimen and reference device to an accuracy of ±0,2 % of the reading;		P
	f) Equipment for measuring the voltage of the test specimen and reference device to an accuracy of 0,2 % of the reading.		P
10.2.3	Procedure		

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CL.	Requirement of the test	Result--Remark	Verdict
	Determine the current-voltage characteristic of the module in accordance with IEC 60904-1 at a specific set of irradiance and temperature conditions (a recommended range is a cell temperature between 25 °C and 50 °C and an irradiance between 700 W m–2 and 1100 W m–2) using natural sunlight or a class B or better		P
10.3	Insulation test	See appended test data	P
10.3.1	Purpose		P
	The purpose is to determine whether or not the module is sufficiently well-insulated between current-carrying parts and the frame or the outside world.		P
10.3.2	Apparatus		P
	a) DC voltage source, with current limitation, capable of applying 500 V or 1 000 V plus twice the maximum system voltage of the module according to 10.3.4 c).		N
	b) An instrument to measure the insulation resistance.		P
10.3.3	Test conditions		P
	The test shall be made on modules at ambient temperature of the surrounding atmosphere and in a relative humidity not exceeding 75 %.		P
	a) Connect the shorted output terminals of the module to the positive terminal of a d.c. insulation tester with a current limitation.		P
	b) Connect the exposed metal parts of the module to the negative terminal of the tester.		P
	c) Increase the voltage applied by the tester at a rate not exceeding 500 V s–1 to a maximum equal to 1 000 V plus twice the maximum system voltage, If the maximum system voltage does not exceed 50 V, the applied voltage shall be 500 V. Maintain.		P
	d) Reduce the applied voltage to zero and short-circuit the terminals of the test equipment to discharge the voltage build-up in the module.		P
	e) Remove the short circuit.		P
	f) Increase the voltage applied by the test equipment at a rate not to exceed 500 V s–1 to 500 V or the maximum system voltage for the module, whichever is greater.		P
	g) Reduce the applied voltage to zero and short-circuit the terminals of the test equipment to discharge the voltage build-up in the module.		P
	h) Remove the short circuit and disconnect the test equipment from the module.		P
10.3.5	Test requirements		P

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CL.	Requirement of the test	Result--Remark	Verdict
	The following requirements are necessary:		P
	no dielectric breakdown or surface tracking during step c);		P
	for modules with an area of less than 0,1 m^2 the insulation resistance shall be not less than 400 MΩ;		N
	for modules with an area larger than 0,1 m^2 the measured insulation resistance times the area of the module shall be not less than 40 $M\Omega m^2$.		P
10.4	Measurement of temperature coefficients	See appended test data	P
10.4.1	Purpose		P
	The purpose is to determine the temperature coefficients of current (α), voltage (β) and peak power (δ) from module measurements.		P
10.4.2	Apparatus		P
	The following apparatus is required to control and measure the test conditions:		P
	a) a radiant source (natural sunlight or solar simulator, class B or better		P
	b) a PV reference device having a known short-circuit current versus irradiance characteristic determined by calibrating against an absolute radiometer		P
	c) any equipment necessary to change the temperature of the test specimen over the range of interest;		P
	d) a suitable mount for supporting the test specimen and the reference device in the same plane normal to the radiant beam;		P
	e) a means for monitoring the temperature of the test specimen and reference device to an accuracy of ±1 °C, and repeatability of ±0,5 °C;		P
	f) equipment for measuring the current of the test specimen and reference device to an accuracy of ±0,2 % of the reading;		P
	g) equipment for measuring the voltage of the test specimen and reference device to an accuracy of ±0,2 % of the reading;		P
10.4.3	Procedure		P
	There are two acceptable procedures for measuring the temperature coefficients.		P
10.4.3.1	Procedure in natural sunlight		P
	a) Measurement in natural sunlight shall only be made when:		P
	the total irradiance is at least as high as the upper limit of the range of interest;		P

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CL.	Requirement of the test	Result--Remark	Verdict
	the irradiance variation caused by short-term oscillations (clouds, haze, or smoke) is less than ±2 % of the total irradiance as measured by the reference device		P
	the wind speed is less than 2 m s–1.		P
	b) Mount the reference device co-planar with the test module so that both are normal to the direct solar beam within ±5°.		P
	c) If the test module and reference device are equipped with temperature controls, set the controls at the desired level.		N
	d) If temperature controls are not used, shade the specimen and the reference device from the sun and wind until its temperature is uniform within ±1 °C of the ambient air temperature, or allow the test specimen to equilibrate to its stabilized temperature, or cool the test specimen to a point below the required test temperature and then let the module warm up naturally.		P
	e) Record the current-voltage characteristic and temperature of the specimen concurrently with recording the short-circuit current and temperature of the reference device at the desired temperatures.		P
	f) The irradiance Go shall be calculated in accordance with IEC 60891 from the measured current (Isc) of the PV reference device, and its calibration value at STC (Irc).		P
	g) Adjust the temperature by means of a controller or alternately exposing and shading the test module as required to achieve and maintain the desired temperature.		P
	h) Ensure that the test module and reference device temperature are stabilized and remain constant within ±1 °C and that the irradiance as measured by the reference device remains constant within ±1 % during the recording period for each data set.		P
	i) Repeat steps d) through h). Module temperatures shall be such that the range of interest is at least 30 °C and that it is spanned in at least four approximately equal increments.		P
10.4.3.2	Procedure with a solar simulator		N
	a) Determine the short-circuit current of the module at the desired irradiance at room temperature		N
	b) Mount the test module in the equipment used to change the temperature.		N
	c) Set the irradiance so that the test module produces the short-circuit current determined in item a).		N

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CL.	Requirement of the test	Result--Remark	Verdict
	d) Heat or cool the module to a temperature of interest.		N
10.4.3.3	Calculation of temperature coefficients		P
	a) Plot the values of Isc, Voc and Pmax as functions of temperature and construct a least squares-fit curve through each set of data.		P
	b) From the slopes of the least squares fit straight lines for current, voltage and Pmax, calculate α, the temperature coefficient of short circuit current, β , the temperature coefficient of open-circuit voltage, and δ , the temperature coefficient of Pmax, for the module.		P
10.5	Measurement of nominal operating cell temperature	See appended test data	P
10.5.1	Purpose		P
	To determine the NOCT of the module.		P
10.5.2	Introduction		P
	NOCT is defined as the equilibrium mean solar cell junction temperature within an open- rack mounted module in the following standard reference environment (SRE):		P
10.5.3	Primary method		P
10.5.3.1	Principle		P
10.5.3.2	Apparatus		P
10.5.3.3	Test module mounting		P
10.5.3.4	Procedure		P
10.5.4	Reference-plate method		
10.5.4.1	Principle		N
10.5.4.2	Reference plate		N
10.5.4.3	Test site		N
10.5.4.4	Apparatus		N
10.5.4.5	Procedure		N
10.6	Performance at STC and NOCT	See appended test data	P
10.6.1	Purpose		P
10.6.2	Apparatus		P
10.6.3	Procedure		P
10.6.3.1	STC		P
10.6.3.2	NOCT		P
10.7	Performance at low irradiance	See appended test data	P
10.7.1	Purpose		P

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CL.	Requirement of the test	Result--Remark	Verdict
10.7.2	Apparatus		P
10.7.3	Procedure		P
10.8	Outdoor exposure test	See appended test data	P
10.8.1	Purpose		P
	To make a preliminary assessment of the ability of the module to withstand exposure to outdoor conditions and to reveal any synergistic degradation effects which may not be detected by laboratory tests.		P
10.8.2	Apparatus		P
	a) A device capable of measuring solar irradiation, with an uncertainty of less than ±5 %.		P
	b) Means to mount the module, as recommended by the manufacturer, co-planar with the irradiation measuring device.		P
	c) A load sized such that at STC the module will operate near the maximum power point.		P
10.8.3	Procedure		P
	a) Attach the resistive load to the module and mount it outdoors, as recommended by the manufacturer, co-planar with the irradiation monitor.		P
	b) Subject the module to an irradiation totaling 60 kWh m–2, as measured by the monitor, under conditions conforming to general open-air climates		P
10.8.4	Final measurements		P
	Repeat the tests of 10.1, 10.2 and 10.3.		P
10.8.5	Requirements		P
	The requirements are as follows:		P
	no evidence of major visual defects, as defined in Clause 7;		P
	the degradation of maximum output power shall not exceed 5 % of the value measured before the test;		P
	insulation resistance shall meet the same requirements as for the initial measurements.		P
10.9	Hot-spot endurance test	See appended test data	P
10.9.1	Purpose		P
	The purpose of this test is to determine the ability of the module to withstand hot-spot heating effects, for example solder melting or deterioration of the encapsulation.		P
10.9.2	Hot-spot effect		P

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CL.	Requirement of the test	Result--Remark	Verdict
	Hot-spot heating occurs in a module when its operating current exceeds the reduced short circuit current of a shadowed or faulty cell or group of cells within it.		P
10.9.3	Classification of cell interconnection		P
10.9.4	Apparatus		P
10.9.5	Procedure		P
	Any hot-spot protective devices recommended by the manufacturer shall be installed before the module is tested.		P
10.9.6	Final measurements		P
	Repeat the tests of 10.1, 10.2 and 10.3.		P
10.9.7	Requirements		P
	The requirements are as follows:		P
	no evidence of major visual defects, as defined in Clause 7. If there is evidence of serious damage that does not qualify as a major visual defect, repeat the test on 2 additional cells. If there is no visual damage around either of these two cells the module type passes the hot spot test;		P
	the degradation of maximum output power shall not exceed 5 % of the value measured before the test;		P
	insulation resistance shall meet the same requirements as for the initial measurements.		P
10.10	UV preconditioning test	See appended test data	P
10.10.1	Purpose		P
	To precondition the module with ultra-violet (UV) radiation before the thermal cycle/humidity freeze tests to identify those materials and adhesive bonds that are susceptible to UV degradation.		P
10.10.2	Apparatus		P
10.10.3	Procedure		P
10.10.4	Final measurements		P
	Repeat the tests of 10.1, 10.2 and 10.3.		P
10.10.5	Requirements		P
	The requirements are as follows:		P
	no evidence of major visual defects, as defined in Clause 7;		P
	the degradation of maximum output power shall not exceed 5 % of the value measured before the test;		P
	insulation resistance shall meet the same requirements as for the initial measurements.		P

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CL.	Requirement of the test	Result--Remark	Verdict
10.11	Thermal cycling test	See appended test data	P
10.11.1	Purpose		P
	To determine the ability of the module to withstand thermal mismatch, fatigue and other stresses caused by repeated changes of temperature.		P
10.11.2	Apparatus		P
10.11.3	Procedure		P
10.11.4	Final measurements		P
	After a minimum recovery time of 1 h, repeat the tests of 10.1, 10.2 and 10.3.		P
10.11.5	Requirements		P
	The requirements are as follows:		P
	no interruption of current flow during the test;		P
	no evidence of major visual defects, as defined in Clause 7;		P
	the degradation of maximum output power shall not exceed 5 % of the value measured before the test;		P
	insulation resistance shall meet the same requirements as for the initial measurements.		P
10.12	Humidity-freeze test	See appended test data	P
10.12.1	Purpose		P
	The purpose of this test is to determine the ability of the module to withstand the effects of high temperature and humidity followed by sub-zero temperatures.		P
10.12.2	Apparatus		P
10.12.3	Procedure		P
10.12.4	Final measurements		P
	After a recovery time between 2 h and 4 h, repeat the test of 10.3. Repeat the tests of 10.1 and 10.2.		P
10.12.5	Requirements		P
	The requirements are as follows:		P
	no evidence of major visual defects, as defined in Clause 7;		P
	the degradation of maximum output power shall not exceed 5 % of the value measured before the test;		P
	insulation resistance shall meet the same requirements as for the initial measurements.		P
10.13	Damp-heat test	See appended test data	P
10.13.1	Purpose		P

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CL.	Requirement of the test	Result--Remark	Verdict
	To determine the ability of the module to withstand the effects of long-term penetration of humidity.		P
10.13.2	Procedure		P
10.13.3	Final measurements		P
	After a recovery time between 2 h and 4 h, repeat the tests of 10.3 and 10.15. Repeat the tests of 10.1 and 10.2.		P
10.13.4	Requirements		P
	The requirements are as follows:		P
	no evidence of major visual defects, as defined in Clause 7;		P
	the degradation of maximum output power shall not exceed 5 % of the value measured before the test;		P
	the insulation test and the wet leakage current test shall meet the same requirements as for the initial measurements.		P
10.14	Robustness of terminations test	See appended test data	P
10.14.1	Purpose		P
	To determine that the terminations and the attachment of the terminations to the body of the module will withstand such stresses as are likely to be applied during normal assembly or handling operations.		P
10.14.2	Types of terminations		P
	Three types of module terminations are considered:		P
	type A: wire or flying lead;		N
	type B: tags, threaded studs, screws, etc.;		P
	type C: connector.		N
10.14.3	Procedure		P
	Preconditioning: 1 h at standard atmospheric conditions for measurement and test.		P
10.14.3.1	Type A terminations		N
10.14.3.2	Type B terminations		P
10.14.3.3	Type C terminations		N
10.14.4	Final measurements		P
	Repeat the tests of 10.1, 10.2 and 10.3.		P
10.14.5	Requirements		P
	The requirements are as follows:		P
	no evidence of mechanical damage;		P

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CL.	Requirement of the test	Result--Remark	Verdict
	the degradation of maximum output power shall not exceed 5 % of the value measured before the test;		P
	insulation resistance shall meet the same requirements as for the initial measurements.		P
10.15	Wet leakage current test	See appended test data	P
10.15.1	Purpose		P
	To evaluate the insulation of the module under wet operating conditions and verify that moisture from rain, fog, dew or melted snow does not enter the active parts of the module circuitry, where it might cause corrosion, a ground fault or a safety hazard.		P
10.15.2	Apparatus		P
10.15.3	Procedure		P
	For modules with an area of less than 0,1 m2 the insulation resistance shall be not less than 400 MΩ.		N
	For modules with an area larger than 0,1 m2 the measured insulation resistance times the area of the module shall be not less than 40 MΩ m^2.		P
10.16	Mechanical load test		P
10.16.1	Purpose		P
	The purpose of this test is to determine the ability of the module to withstand wind, snow, static or ice loads.		P
10.16.2	Apparatus		P
10.16.3	Procedure		P
10.16.4	Final measurements		P
	Repeat the tests of 10.1, 10.2 and 10.3.		P
10.16.5	Requirements		P
	The requirements are as follows:		P
	no intermittent open-circuit fault detected during the test;		P
	no evidence of major visual defects, as defined in Clause 7;		P
	the degradation of maximum output power shall not exceed 5 % of the value measured before the test;		P
	insulation resistance shall meet the same requirements as for the initial measurements.		P
10.17	Hail test	See appended test data	P
10.17.1	Purpose		P
	To verify that the module is capable of withstanding the impact of hailstones.		P
10.17.2	Apparatus		P

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CL.	Requirement of the test	Result--Remark	Verdict
10.17.3	Procedure		P
10.17.4	Final measurements		P
	Repeat the tests of 10.1, 10.2 and 10.3.		P
10.17.5	Requirements		P
	The requirements are as follows:		P
	no evidence of major visual defects, as defined in Clause 7;		P
	the degradation of maximum output power shall not exceed 5 % of the value measured before the test;		P
	insulation resistance shall meet the same requirements as for the initial measurements.		P
10.18	Bypass diode thermal test		N
10.18.1	Purpose		N
	To assess the adequacy of the thermal design and relative long-term reliability of the by-pass diodes used to limit the detrimental effects of module hot-spot susceptibility.		N
10.18.2	Apparatus		N
10.18.3	Procedure		N
10.18.4	Final measurements		N
	Repeat the tests of 10.1, 10.2 and 10.3.		N
10.18.5	Requirements		N
	The requirements are as follows:		N
	the diode junction temperature as determined in 10.18.3.e) shall not exceed the diode manufacturer's maximum junction temperature rating;		N
	no evidence of major visual defects, as defined in Clause 7;		N
	the degradation of maximum output power shall not exceed 5 % of the value measured before the test;		N
	insulation resistance shall meet the same requirements as for the initial measurements;		N
	the diode shall still function as a diode after the conclusion of the test.		N

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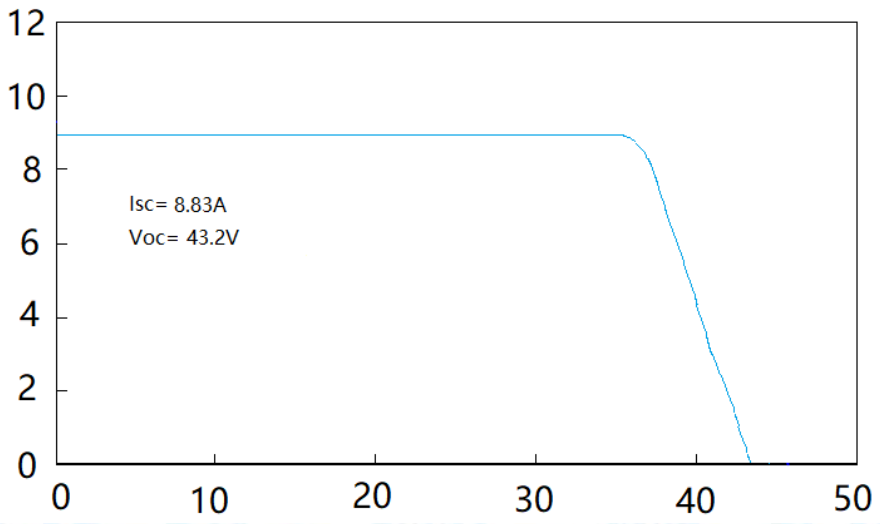
CL.	Requirement of the test	Result--Remark	Verdict

Maximum power determination

Temperature: 25°C Relative Humidity : 50% irradiance : 1000W.m-2
Instrument used : Solar beam simulator, I-V test system
Tested data
I-V Characteristic



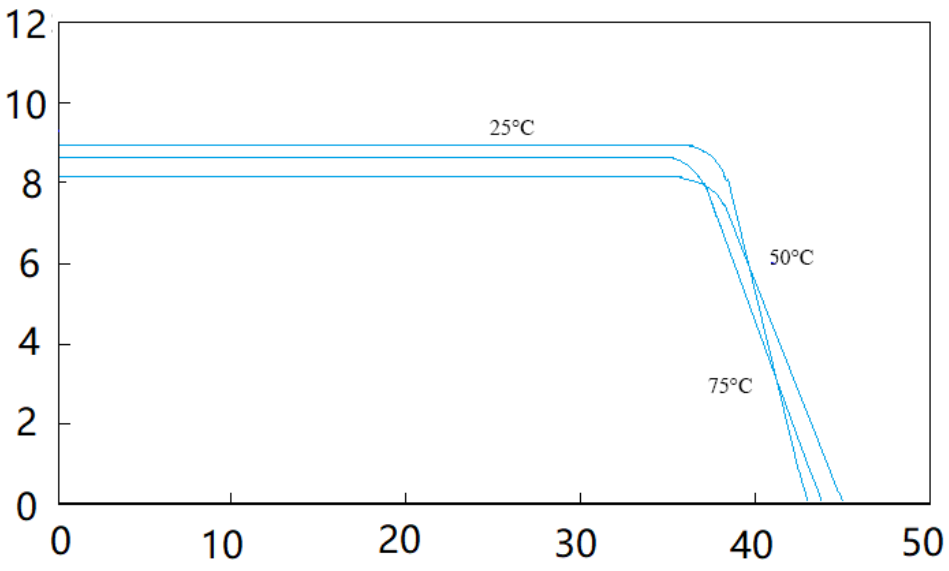
Insulation Test

Instrument used : d.c. insulation tester, leakage current meter
No dielectric breakdown or surface cracking during step (c),
leakage current less than : 45μA
insulation resistor > 100MΩ.

IEC 61215 : 2005			
CL.	Requirement of the test	Result--Remark	Verdict

Temperature coefficient test

Current coefficient α = + 0.58/°C
Voltage Coefficient β = - 68mV/°C



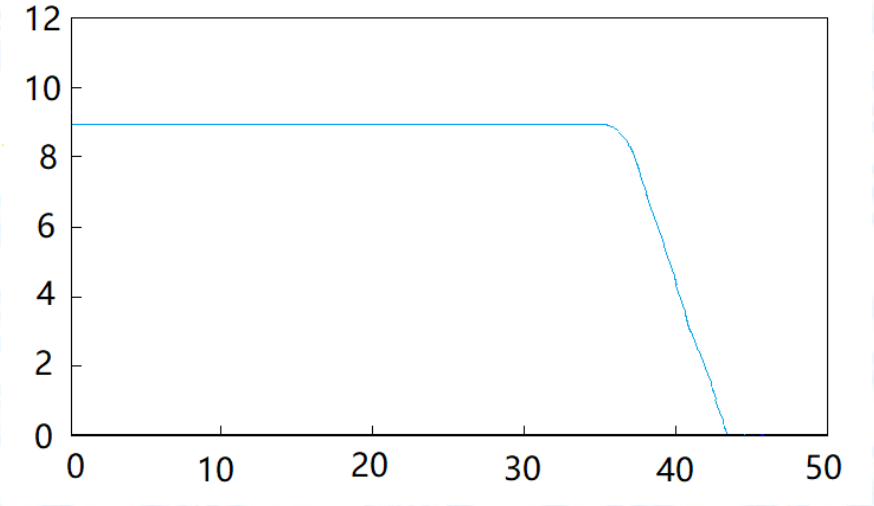
NOCT

First module
Ambient temperature while testing: 21.4°C, Wind speed while testing: 0.74.s-1
Tamb at 800W.m-2: 53.0°C, Tj-Tamb: 31.6
Preliminary NOCT value 51.6C, Correction factor according to figure 2 -2°C
NOCT after correction 49.6C
Second module
Ambient temperature while testing: 20.8°C, Wind speed while testing: 0.71.s-1
Tamb at 800W.m-2: 52.5C, Tj-Tamb: 31.7
Preliminary NOCT value: 51.7C, Correction factor according to figure 2 -2°C
NOCT after correction: 49.7C,
Final NOCT value = 49.7C

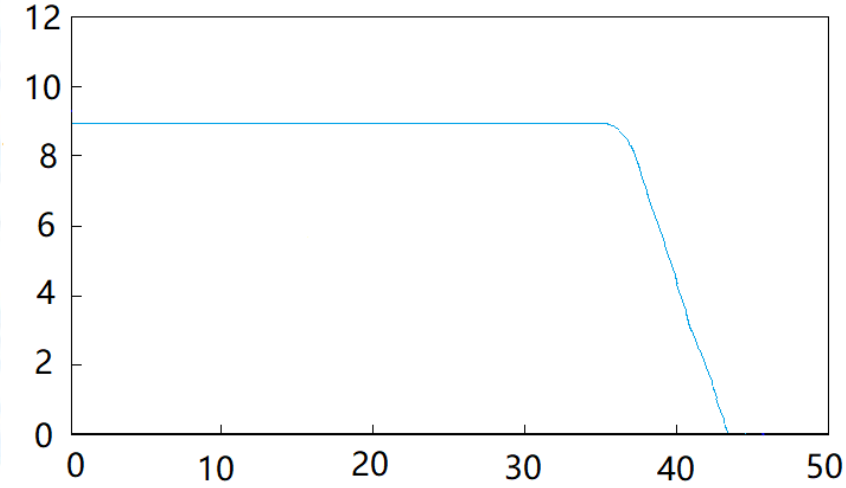
IEC 61215 : 2005			
CL.	Requirement of the test	Result--Remark	Verdict

Performance at STC and NOCT

Current-Voltage characteristic at NOCT, irradiance of 1000W.m-2



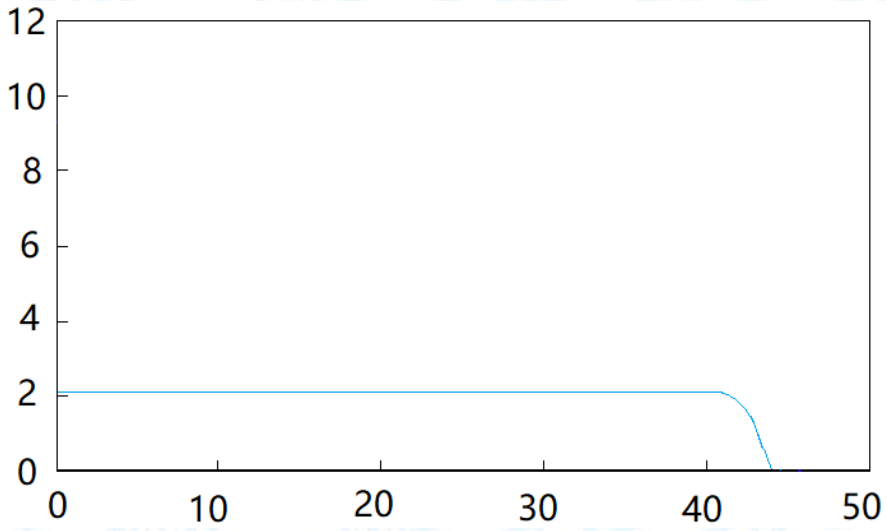
Current-Voltage characteristic at NOCT, irradiance of 800W.m-2



IEC 61215 : 2005			
CL.	Requirement of the test	Result--Remark	Verdict

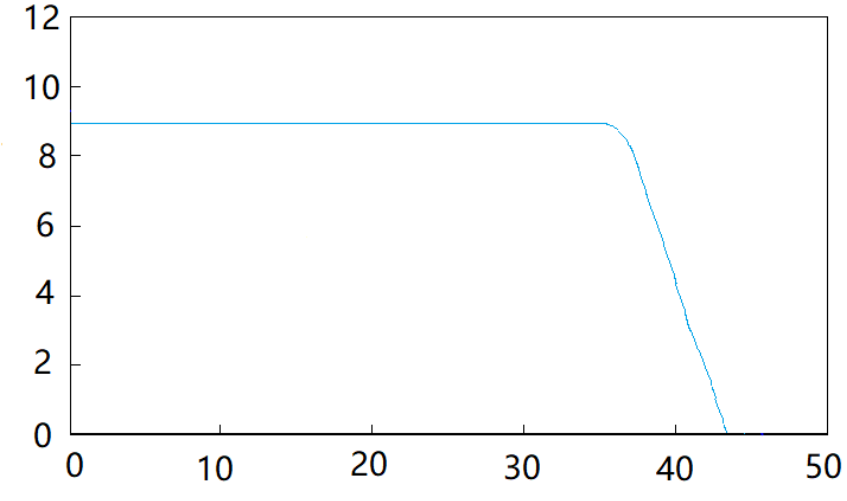
Performance at low irradiance

Temperature while testing : 25.5°C
Irradiance 200W.m-2



Outdoor exposure test

Visual inspection OK
Insulation resistor: >100MΩ, leakage current <45μA
STC figure



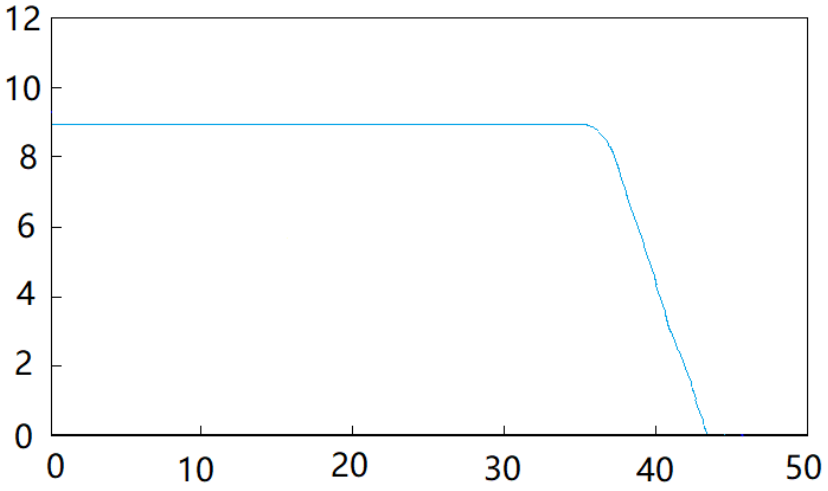
IEC 61215 : 2005			
CL.	Requirement of the test	Result--Remark	Verdict

Hot-spot test

Under worst conditions (PV cell enveloped), no abnormal operation observed.

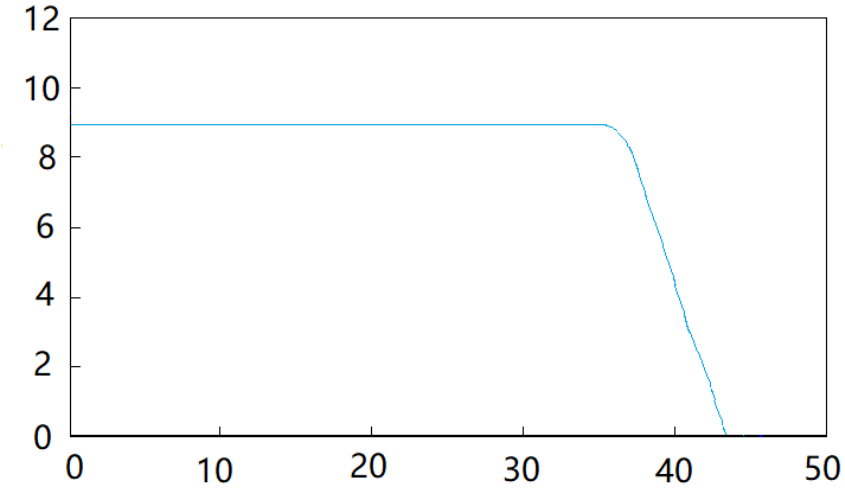
Thermal cycling test

Test result: Visual inspection : OK,
Insulation resistor: >100MΩ, leakage current less than 45μA
STC check figure



Humidity freezer test

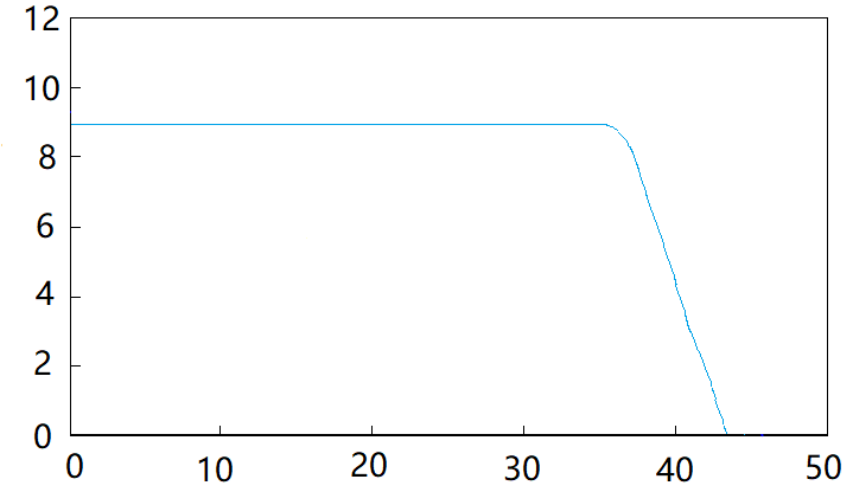
Test result: Visual inspection : OK,
Insulation resistor: >100MΩ, leakage current less than 45μA
STC check figure



IEC 61215 : 2005			
CL.	Requirement of the test	Result--Remark	Verdict

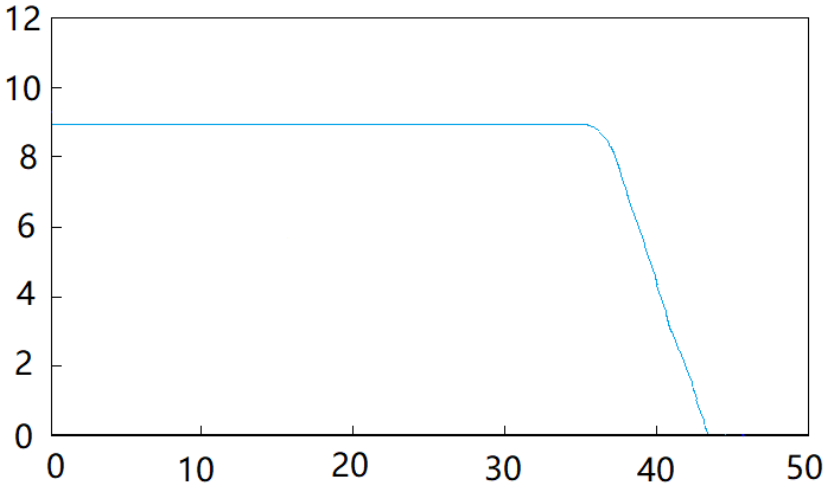
Damp heat test

Test result: Visual inspection : OK,
Insulation resistor: >100MΩ, leakage current less than 45μA
STC check figure



Robustness of terminations test

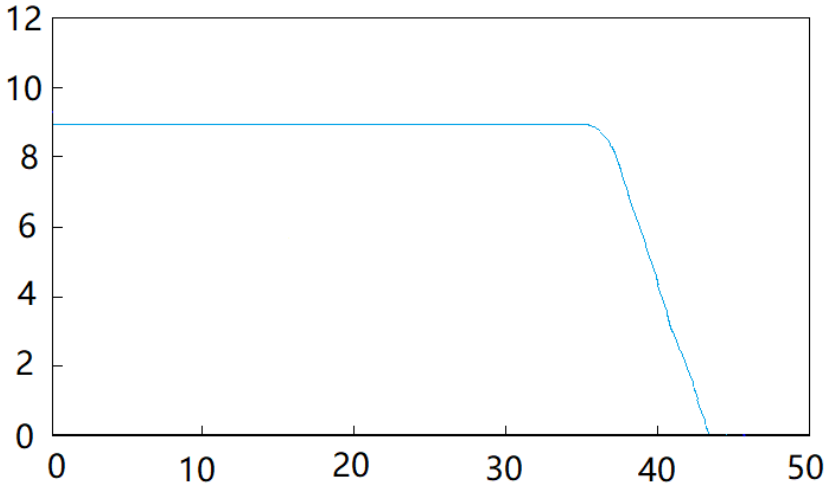
Test was conducted on the wire fixed screws by extend power output lead and fixed on the simulation instrument.
Visual inspection : OK, no observance mechanical damage
Insulation resistor: >100MΩ, leakage current less than 45μA
STC check figure:



IEC 61215 : 2005			
CL.	Requirement of the test	Result--Remark	Verdict

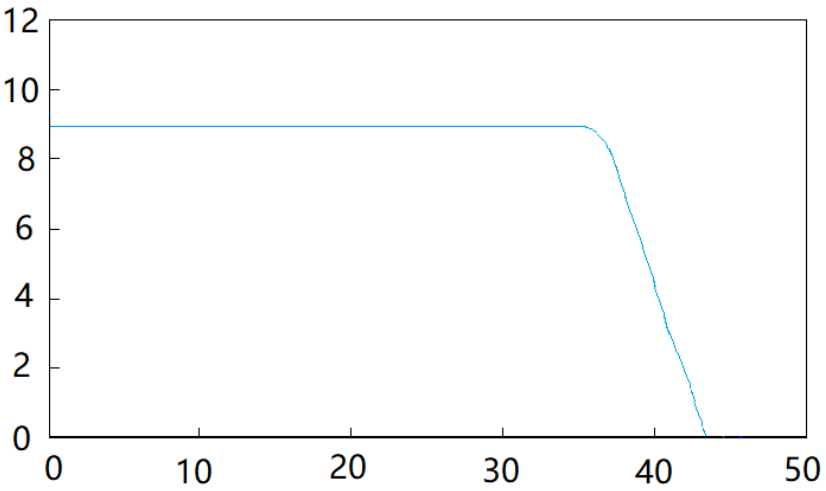
Wet Leakage Current Test

Visual inspection : OK, no observance mechanical damage
Insulation resistor: >100MΩ, leakage current less than 45μA
STC check figure



Mechanical load test

Visual inspection : OK, no observance mechanical damage
Insulation resistor: >100MΩ, leakage current less than 45μA
STC check figure



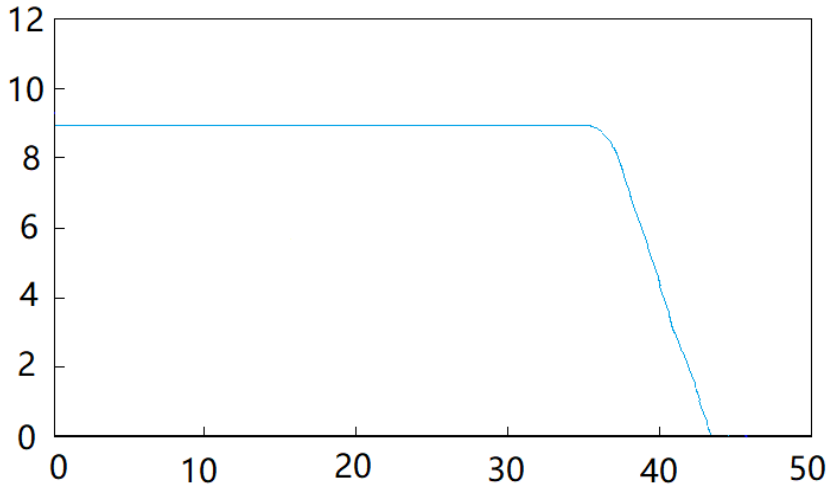
IEC 61215 : 2005			
CL.	Requirement of the test	Result--Remark	Verdict

Hail test

Visual inspection : OK, no observance mechanical damage

Insulation resistor: >100MΩ, leakage current less than 45μA

STC check figure



EUT Photos

Photo 1 View of EUT

Photo 2 View of EUT

END OF REPORT