ATTESTATION OF CONFORMITY

Issued to:	NINGBO AUSTA SOLAR TECH CO., LTD. No.136 1-1, Haichuan Rd, Jiangbei District, Ningbo, China
For the product:	Hybrid inverter
Trade name:	Austa
Type/Model:	AU-1P1K3G-LE-1, AU-1P1.5K3G-LE-1, AU-1P2K3G-LE-1, AU-1P2.5K3G-LE-1, AU-1P3K3G-LE-1, AU-1P3.6K3G-LE-1, AU-1P3K3G-LE, AU-1P3.6K3G-LE
Ratings:	See Annex
Manufactured by:	NINGBO AUSTA SOLAR TECH CO., LTD. No.136 1-1, Haichuan Rd, Jiangbei District, Ningbo, China
Requirements:	Engineering Recommendation G98 Issue 1 – Amendment 7:2022 (G98/1-7:2022)

This Attestation is granted on account of an examination by DEKRA, the results of which are laid down in a confidential file no. 6169274.50

The examination has been carried out on one single specimen or several specimens of the product, submitted by the manufacturer. The Attestation does not include an assessment of the manufacturer's production. Conformity of his production with the specimen tested by DEKRA is not the responsibility of DEKRA.

Arnhem, 19 September 2023 Number: 6169274.01AOC

DEKRA Testing and Certification (Shanghai) Ltd.

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Document no. : 6169274.01AOC

Ratings of the test product:

Specifications table						
Model	AU-1P1K3G-LE-1	AU-1P1.5K3G-LE-1	AU-1P2K3G-LE-1	AU-1P2.5K3G-LE-1	AU-1P3K3G-LE-1	AU-1P3.6K3G-LE-1
Input						
PV Max (W)	1500	2300	3000	3800	4500	5400
Vmax PV (V)	550	550	550	550	550	550
Isc PV (absolute Max.) (A)	26	26	26	26	26	26
Number of MPP trackers	1	1	1	1	1	1
Number of input strings	1	1	1	1	1	1
Max. PV input range (A)	18.5	18.5	18.5	18.5	18.5	18.5
MPPT Voltage Range (V)	80-500	80-500	80-500	80-500	80-500	80-500
Vdc range @ full power (V)	80-500	90-500	120-500	150-500	170-500	210-500
Battery (charge/discharge***)***						
Battery type	Li-ion/Lead-acid etc.					
Battery Nominal Voltage (V)	51.2					
Battery Voltage Range (V)	40-60					
Max charge/discharge Current(A)	25	40	50	63	80	80
Max charge/discharge Power(W)	1000	1500	2000	2500	3000	3600
AC Grid (input and output)						
Normal AC Voltage (VAC)	L/N/PE, 220Vac, 230Vac					
Frequency (Hz)	50 / 60					
Max. cont. Current (A)	5	7	10	12	14	17
Nominal Power (VA)	1000	1500	2000	2500	3000	3600
Max. Power (W)	1000	1500	2000	2500	3000	3600
Max. apparent Power (VA)	1000	1500	2000	2500	3000	3600
Power factor(adjustable)	1.0(-0.8~ +0.8)					
AC Load output						
Normal Voltage (VAC)	L/N/PE, 220Vac, 230Vac					
Frequency (Hz)	50 / 60					
Max. cont. Current (A)	5	7	10	12	14	17
Nominal Output Power (W)	1000	1500	2000	2500	3000	3600
Max. output Power (W)	1000	1500	2000	2500	3000	3600
Max. apparent Power (VA)	1000	1500	2000	2500	3000	3600
Power factor	1.0					
Others						
Ingress protection (IP)	IP65					
Protective class	Class I					
Temperature (℃)	-25°C to +60°C (Derating 45°C)					
Inverter Isolation	Non-isolated (PV-AC-BAT)					
Overvoltage category	OVC III (AC Main), OVC II (PV)					

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Specifications table						
Model	AU-1P1K3G-LE-1	AU-1P1.5K3G-LE-1	AU-1P2K3G-LE-1	AU-1P2.5K3G-LE-1	AU-1P3K3G-LE-1	AU-1P3.6K3G-LE-1

Specifications table		
Model	AU-1P3K3G-LE	AU-1P3.6K3G-LE
Input		
PV Max (W)	4500	5400
Vmax PV (V)	550	550
Isc PV (absolute Max.) (A)	26 x 2	26 x 2
Number of MPP trackers	2	2
Number of input strings	1/1	1/1
Max. PV input range (A)	18.5 x 2	18.5 x 2
MPPT Voltage Range (V)	80-500	80-500
Vdc range @ full power (V)	90-500	110-500
Battery (charge/discharge***)***		
Battery type	Li-ion/Lead-acid etc.	
Battery Nominal Voltage (V)	51.2	
Battery Voltage Range (V)	40-60	
Max charge/discharge Current(A)	80	80
Max charge/discharge Power(W)	3000	3600
AC Grid (input and output)		
Normal AC Voltage (VAC)	L/N/PE, 220Vac, 230Vac	
Frequency (Hz)	50 / 60	
Max. cont. Current (A)	14	17
Nominal Power (VA)	3000	3600
Max. Power (W)	3000	3600
Max. apparent Power (VA)	3000	3600
Power factor(adjustable)	1.0(-0.8~ +0.8)	
AC Load output		
Normal Voltage (VAC)	L/N/PE, 220Vac, 230Vac	
Frequency (Hz)	50 / 60	
Max. cont. Current (A)	14	17
Nominal Output Power (W)	3000	3600
Max. output Power (W)	3000	3600
Max. apparent Power (VA)	3000	3600
Power factor	1.0	
Others		
Ingress protection (IP)	IP65	
Protective class	Class I	
Temperature (℃)	-25°C to +60°C (Derating 45°C)	
Inverter Isolation	Non-isolated (PV-AC-BAT)	
Overvoltage category	OVC III (AC Main), OVC II (PV)	

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G98/1-7 Form C: Type Test Verification Report	
Extract form test report number.:	**6169274.50**

1. Operating Range:				**P**
This test should be carried out as specified in A.1.2.10. Pass or failure of the test should be indicated in the fields below (right hand side), for example with the statement “Pass”, “No disconnection occurs”, etc. Graphical evidence is preferred.				
Model: AU-1P3K3G-LE				**P**
Test 1:				
Measured Voltage (V)	Measured Frequency (Hz)	Measured Power (W)	Measured Power factor	Test Time (seconds)
195.56	47.00	2729.63	0.9995	31
Test 2:				
Measured Voltage (V)	Measured Frequency (Hz)	Measured Power (W)	Measured Power factor	Test Time (Minutes)
195.49	47.50	2728.50	0.9995	92
Test 3:				
Measured Voltage (V)	Measured Frequency (Hz)	Measured Power (W)	Measured Power factor	Test Time (Minutes)
253.37	51.50	3006.00	0.9996	93
Test 4:				
Measured Voltage (V)	Measured Frequency (Hz)	Measured Power (W)	Measured Power factor	Test Time (Minutes)
252.99	52.00	3005.50	0.9995	16
Test 5:				
Measured Voltage (V)	Measured Frequency (Hz)	Measured Power (W)	Measured Power factor	Test Time (Minutes)
230.10	50.00	3002.49	0.9989	93
Test 6:				
Measured Voltage (V)	Ramp range	Test frequency ramp	Test Duration	Confirm no trip
195.5	47.0 Hz to 52.0 Hz	+1 Hzs^{-1}	5.0s	No trip
253.0	52.0 Hz to 49.0 Hz	-1 Hzs^{-1}	3.0s	No trip

2. Power Quality – Harmonics:	**P**
These tests should be carried out as specified in BS EN 61000-3-2. The chosen test should be undertaken with a fixed source of energy at two power levels a) between 45 and 55% and b) at 100% of **Registered Capacity**. The test requirements are specified in Annex A1 A.1.3.1 (**Inverter** connected) or Annex A2 A.2.3.1 (Synchronous).	
Model: AU-1P1K3G-LE-1	
Micro-generator tested to BS EN 61000-3-2	
Micro-generator rating per phase (rpp)	1 kW
For 3-phase **Micro-generator**s, tick this box if harmonic measurements are identical for all three phases. If the harmonics are not identical for each phase, please replicate this section with the results for each phase.	Single phase PV inverter

Harmonic	At 45-55% of **Registered Capacity**		100% of **Registered Capacity**			
	Measured Value MV in Amps	Normalised Value (NV) in Amps	Measured Value MV in Amps	Normalised Value (NV) in Amps	Limit in BS EN 61000-3-2 in Amps	Higher limit for odd harmonics 21 and above
2	0.0067	0.025	0.0125	0.046	1.080	
3	0.0209	0.077	0.0662	0.243	2.300	
4	0.0020	0.007	0.0019	0.007	0.430	
5	0.0078	0.029	0.0255	0.094	1.140	
6	0.0018	0.006	0.0018	0.007	0.300	
7	0.0045	0.017	0.0132	0.049	0.770	
8	0.0016	0.006	0.0019	0.007	0.230	
9	0.0041	0.015	0.0091	0.033	0.400	
10	0.0015	0.005	0.0017	0.006	0.184	
11	0.0021	0.008	0.0049	0.018	0.330	
12	0.0015	0.006	0.0017	0.006	0.153	
13	0.0017	0.006	0.0046	0.017	0.210	
14	0.0015	0.005	0.0017	0.006	0.131	
15	0.0016	0.006	0.0027	0.010	0.150	
16	0.0015	0.005	0.0017	0.006	0.115	
17	0.0016	0.006	0.0024	0.009	0.132	
18	0.0014	0.005	0.0016	0.006	0.102	
19	0.0014	0.005	0.0020	0.007	0.118	
20	0.0016	0.006	0.0017	0.006	0.092	
21	0.0014	0.005	0.0020	0.007	0.107	0.160

22	0.0014	0.005	0.0017	0.006	0.084	
23	0.0014	0.005	0.0019	0.007	0.098	0.147
24	0.0014	0.005	0.0015	0.006	0.077	
25	0.0013	0.005	0.0017	0.006	0.090	0.135
26	0.0013	0.005	0.0016	0.006	0.071	
27	0.0014	0.005	0.0017	0.006	0.083	0.124
28	0.0013	0.005	0.0016	0.006	0.066	
29	0.0013	0.005	0.0018	0.006	0.078	0.117
30	0.0012	0.005	0.0015	0.006	0.061	
31	0.0013	0.005	0.0017	0.006	0.073	0.109
32	0.0012	0.005	0.0016	0.006	0.058	
33	0.0012	0.005	0.0016	0.006	0.068	0.102
34	0.0012	0.004	0.0016	0.006	0.054	
35	0.0013	0.005	0.0018	0.007	0.064	0.096
36	0.0011	0.004	0.0015	0.006	0.051	
37	0.0012	0.004	0.0016	0.006	0.061	0.091
38	0.0011	0.004	0.0015	0.006	0.048	
39	0.0012	0.004	0.0016	0.006	0.058	0.087
40	0.0012	0.004	0.0016	0.006	0.046	

Note the higher limits for odd harmonics 21 and above are only allowable under certain conditions, if these higher limits are utilised please state the exemption used as detailed in part 6.2.3.4 of BS EN 61000-3-2 in the box below.

2. Power Quality – Harmonics:	**P**
These tests should be carried out as specified in BS EN 61000-3-2. The chosen test should be undertaken with a fixed source of energy at two power levels a) between 45 and 55% and b) at 100% of **Registered Capacity**. The test requirements are specified in Annex A1 A.1.3.1 (**Inverter** connected) or Annex A2 A.2.3.1 (Synchronous).	
Model: AU-1P3K3G-LE	
Micro-generator tested to BS EN 61000-3-2	
Micro-generator rating per phase (rpp)	3.0 kW
For 3-phase **Micro-generator**s, tick this box if harmonic measurements are identical for all three phases. If the harmonics are not identical for each phase, please replicate this section with the results for each phase.	Single phase PV inverter

Harmonic	At 45-55% of **Registered Capacity**		100% of **Registered Capacity**			
	Measured Value MV in Amps	Normalised Value (NV) in Amps	Measured Value MV in Amps	Normalised Value (NV) in Amps	Limit in BS EN 61000-3-2 in Amps	Higher limit for odd harmonics 21 and above
2	0.0189	0.023	0.0141	0.017	1.080	
3	0.1428	0.175	0.2810	0.345	2.300	
4	0.0043	0.005	0.0171	0.021	0.430	
5	0.0926	0.114	0.1895	0.232	1.140	
6	0.0091	0.011	0.0106	0.013	0.300	
7	0.0629	0.077	0.1325	0.163	0.770	
8	0.0068	0.008	0.0124	0.015	0.230	
9	0.0509	0.062	0.1017	0.125	0.400	
10	0.0068	0.008	0.0020	0.002	0.184	
11	0.0384	0.047	0.0871	0.107	0.330	
12	0.0058	0.007	0.0055	0.007	0.153	
13	0.0348	0.043	0.0683	0.084	0.210	
14	0.0074	0.009	0.0050	0.006	0.131	
15	0.0201	0.025	0.0523	0.064	0.150	
16	0.0066	0.008	0.0037	0.005	0.115	
17	0.0156	0.019	0.0404	0.050	0.132	
18	0.0066	0.008	0.0037	0.005	0.102	
19	0.0109	0.013	0.0308	0.038	0.118	
20	0.0087	0.011	0.0079	0.010	0.092	
21	0.0119	0.015	0.0267	0.033	0.107	0.160

22	0.0072	0.009	0.0067	0.008	0.084	
23	0.0075	0.009	0.0224	0.027	0.098	0.147
24	0.0067	0.008	0.0092	0.011	0.077	
25	0.0060	0.007	0.0184	0.023	0.090	0.135
26	0.0047	0.006	0.0055	0.007	0.071	
27	0.0063	0.008	0.0154	0.019	0.083	0.124
28	0.0073	0.009	0.0113	0.014	0.066	
29	0.0037	0.005	0.0142	0.017	0.078	0.117
30	0.0050	0.006	0.0096	0.012	0.061	
31	0.0049	0.006	0.0132	0.016	0.073	0.109
32	0.0049	0.006	0.0061	0.007	0.058	
33	0.0071	0.009	0.0132	0.016	0.068	0.102
34	0.0058	0.007	0.0068	0.008	0.054	
35	0.0059	0.007	0.0087	0.011	0.064	0.096
36	0.0041	0.005	0.0033	0.004	0.051	
37	0.0065	0.008	0.0090	0.011	0.061	0.091
38	0.0031	0.004	0.0050	0.006	0.048	
39	0.0137	0.017	0.0137	0.017	0.058	0.087
40	0.0027	0.003	0.0039	0.005	0.046	

Note the higher limits for odd harmonics 21 and above are only allowable under certain conditions, if these higher limits are utilised please state the exemption used as detailed in part 6.2.3.4 of BS EN 61000-3-2 in the box below.

3. Power Quality – Voltage fluctuations and Flicker:	**P**

These tests should be undertaken in accordance with EREC G98 Annex A1 A.1.3.3 (**Inverter** connected) or Annex A2 A.2.3.3 (Synchronous).
The standard test impedance is 0.4 Ω for a single phase **Micro-generating Plant** (and for a two phase unit in a three phase system) and 0.24 Ω for a three phase **Micro-generating Plant** (and for a two phase unit in a split phase system). Please ensure that both test and standard impedance are completed on this form. If the test impedance (or the measured impedance) is different to the standard impedance, it must be normalised to the standard impedance as follows (where the **Power Factor** of the generation output is 0.98 or above):
d max normalised value = (Standard impedance / Measured impedance) x Measured value.
Where the **Power Factor** of the output is under 0.98 then the X to R ratio of the test impedance should be close to that of the standard impedance.
The stopping test should be a trip from full load operation.
The duration of these tests needs to comply with the particular requirements set out in the testing notes for the technology under test.
The test date and location must be declared.

Test start date	2023-01-10	Test end date	2023-01-10
Test location	No.99, Hongye Road, Suzhou Industrial Park, Suzhou, Jiangsu, P.R. China		
Model:	AU-1P3K3G-LE		

	Starting			Stopping			Running	
	d(max)	d(c)	d(t)	d(max)	d(c)	d(t)	P_{st}	P_{lt} 2 hours
Measured Values at test impedance	0.56	0.27	0	1.43	0.27	0	0.22	0.19
Normalised to standard impedance	0.56	0.27	0	1.43	0.27	0	0.22	0.19
Normalised to required maximum impedance	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Limits set under BS EN 61000-3-11	4%	3.3%	3.3%	4%	3.3%	3.3%	1.0	0.65

Test Impedance	R	0.4	Ω	Xl	0.25	Ω
Standard Impedance	R	0.24 * 0.4 ^	Ω	Xl	0.15 * 0.25 ^	Ω
Maximum Impedance	R	N/A #	Ω	Xl	N/A #	Ω

* Applies to three phase and split single phase **Micro-generators**. Delete as appropriate.

^ Applies to single phase **Micro-generators** and **Micro-generators** using two phases on a three phase system. Delete as appropriate.

4. Power quality – DC injection:				**P**
This test should be carried out in accordance with A 1.3.4 as applicable. The % **DC** injection ("as % of rated AC current" below) is calculated as follows: % **DC** injection = Recorded **DC** value in Amps / base current where the base current is the **Registered Capacity** (W) / 230 V. The % **DC** injection should not be greater than 0.25%.				
Model: AU-1P1K3G-LE-1				
Test power level	20%	50%	75%	100%
Recorded DC injection value in Amps	-0.003 A	0.005 A	0.005 A	0.005 A
as % of rated AC current	-0.07%	0.12%	0.11%	0.12%
Limit	0.25%	0.25%	0.25%	0.25%
Model: AU-1P3K3G-LE				
Test power level	20%	50%	75%	100%
Recorded DC injection value in Amps	0.014 A	0.016 A	0.018 A	0.020 A
as % of rated AC current	0.11%	0.12%	0.14%	0.15%
Limit	0.25%	0.25%	0.25%	0.25%

5. Power Factor:			**P**
This test shall be carried out in accordance with A.1.3.2 and A.2.3.2 at three voltage levels and at **Registered Capacity** and the measured **Power Factor** must be greater than 0.95 to pass. Voltage to be maintained within ±1.5% of the stated level during the test.			
Model: AU-1P1K3G-LE-1			
Voltage	0.94 pu (216.2 V)	1.0 pu (230 V)	1.1 pu (253 V)
Measured value	0.9995	0.9996	0.9989
Power Factor Limit	>0.95	>0.95	>0.95
Model: AU-1P3K3G-LE-1			
Voltage	0.94 pu (216.2 V)	1.0 pu (230 V)	1.1 pu (253 V)
Measured value	0.9993	09996	0.9996
Power Factor Limit	>0.95	>0.95	>0.95

6. Protection – Frequency tests:						**P**
These tests should be carried out in accordance with Annex A1 A.1.2.3 (**Inverter** connected) or Annex A2 A.2.2.3 (Synchronous). For trip tests, frequency and time delay should be stated. For “no trip tests”, “no trip” can be stated.						
Model: AU-1P3K3G-LE						
Function	Setting		Trip test		“No trip tests”	
	Frequency	Time delay	Frequency	Time delay	Frequency / time	Confirm no trip
U/F stage 1	47.5 Hz	20 s	47.50 Hz	20.1s	47.7 Hz 30 s	No trip
U/F stage 2	47.0 Hz	0.5 s	46.99 Hz	0.546s	47.2 Hz 19.5 s	No trip
					46.8 Hz 0.45 s	No trip
O/F	52.0 Hz	0.5 s	52.00 Hz	0.543s	51.8 Hz 120.0 s	No trip
					52.2 Hz 0.45 s	No trip
Note: For frequency trip tests the frequency required to trip is the setting ± 0.1 Hz. In order to measure the time delay a larger deviation than the minimum required to operate the projection can be used. The “No trip tests” need to be carried out at the setting ± 0.2 Hz and for the relevant times as shown in the table above to ensure that the protection will not trip in error.						

7. Protection – Voltage tests:						**P**
These tests should be carried out in accordance with Annex A1 A.1.2.2 (**Inverter** connected) or Annex A2 A.2.2.2 (Synchronous). For trip tests, voltage and time delay should be stated. For “no trip tests”, “no trip” can be stated.						
Model: AU-1P3K3G-LE						
Function	Setting		Trip test		“No trip tests”	
	Voltage	Time delay	Voltage	Time delay	Voltage / time	Confirm no trip
U/V	0.8 pu (184 V)	2.5 s	181.1 V	2.512 s	188 V 5.0 s	No trip
					180 V 2.45 s	No trip
O/V stage 1	1.14 pu (262.2 V)	1.0 s	265.5 V	1.068 s	258.2 V 5.0 s	No trip
O/V stage 2	1.19 pu (273.7 V)	0.5 s	275.6 V	0.514 s	269.7 V 0.95 s	No trip
					277.7 V 0.45 s	No trip
Note: For Voltage tests the Voltage required to trip is the setting ±3.45 V. The time delay can be measured at a larger deviation than the minimum required to operate the protection. The No trip tests need to be carried out at the setting ±4 V and for the relevant times as shown in the table above to ensure that the protection will not trip in error.						

8. Protection – Loss of Mains test:						**P**
For PV **Inverter**s shall be tested in accordance with BS EN 62116. Other **Micro-generator**s should be tested in accordance with A.2.2.4 at 10%, 55% and 100% of rated power. For test condition A, EUT output = 100 % P_n, test condition B, EUT output = 50 % to 66 % P_n, and test condition C, EUT output = 25 % to 33 % P_n.						
Model: AU-1P3K3G-LE						
For **Inverter**s tested to BS EN 62116 the following sub set of tests should be recorded in the following table.						
Test Power and imbalance	33% -5% Q Test 22	66% -5% Q Test 12	100% -5% P Test 5	33% +5% Q Test 31	66% +5% Q Test 21	100% +5% P Test 10
Trip time. **Limit is 0.5s**	0.091s	0.081s	0.079s	0.075s	0.082s	0.073s

8. Protection – Frequency change, Vector Shift Stability test:			**P**
This test should be carried out in accordance with EREC G98 Annex A1 A.1.2.6 (**Inverter** connected) or Annex A2 A.2.2.6 (Synchronous). Confirmation is required that the **Micro-generating Plant** does not trip under positive / negative vector shift.			
Model: AU-1P3K3G-LE			
	Start Frequency	Change	Confirm no trip
Positive Vector Shift	49.0 Hz	+50 degrees	No trip
Negative Vector Shift	50.0 Hz	-50 degrees	No trip
8. Protection – Frequency change, RoCoF Stability test:			**P**
The requirement is specified in section 11.3, test procedure in Annex A.1.2.6 (**Inverter** connected) or Annex A2 A.2.2.6 (Synchronous). Confirmation is required that the **Micro-generating Plant** does not trip for the duration of the ramp up and ramp down test.			
Model: AU-1P3K3G-LE			
Ramp range	Test frequency ramp:	Test Duration	Confirm no trip
49.0 Hz to 51.0 Hz	+0.95 Hzs^{-1}	2.1 s	No trip
51.0 Hz to 49.0 Hz	-0.95 Hzs^{-1}	2.1 s	No trip

9. Limited Frequency Sensitive Mode – Over frequency test:					**P**
This test should be carried out in accordance with A.1.2.9. The test should be carried out using the specific threshold frequency of 50.4 Hz and **Droop** of 10%. The measurement tolerances are contained in A.1.2.9.					
Model: AU-1P3K3G-LE					
Alternatively, simulation results should be noted below:					
Test sequence at **Registered Capacity** >80%	Measured **Active Power** Output (W)	Frequency (Hz)	Calculated droop (%)	Primary Power Source	**Active Power** Gradient
Step a) 50.00 Hz ±0.01 Hz	3000.00	50.00	-	Photovoltaic array simulator	-
Step b) 50.45 Hz ±0.05 Hz	2969.01	50.45	9.65		-
Step c) 50.70 Hz ±0.10 Hz	2810.32	50.70	9.48		-
Step d) 51.15 Hz ±0.05 Hz	2529.46	51.15	9.56		-
Step e) 50.70 Hz ±0.10 Hz	2811.96	50.70	9.56		-
Step f) 50.45 Hz ±0.05 Hz	2968.37	50.45	9.45		-
Step g) 50.00 Hz ±0.01 Hz	3000.22	50.00	-		-
Test sequence at **Registered Capacity** 40-60%	Measured **Active Power** Output (W)	Frequency (Hz)	Calculated droop (%)	Primary Power Source	**Active Power** Gradient
Step a) 50.00 Hz ±0.01 Hz	1500.00	50.00	-	Photovoltaic array simulator	-
Step b) 50.45 Hz ±0.05 Hz	1469.98	50.45	9.95		-
Step c) 50.70 Hz ±0.10 Hz	1310.80	50.70	9.51		-
Step d) 51.15 Hz ±0.05 Hz	1020.84	51.15	9.39		-
Step e) 50.70 Hz ±0.10 Hz	1308.33	50.70	9.38		-
Step f) 50.45 Hz ±0.05 Hz	1469.29	50.45	9.70		-
Step g) 50.00 Hz ±0.01 Hz	1499.80	50.00	-		-
The frequency at each step should be maintained for at least one minute and the Active Power reduction in the form of a gradient determined and assessed for compliance with paragraph 11.2.3. The Droop should be determined from the measurements between 50.4 Hz and 51.15 Hz. The allowed tolerance for the frequency measurement shall be ± 0.05 Hz. The allowed tolerance for Active Power output measurement shall be ±10% of the required change in Active Power. The resulting overall tolerance range for a nominal 10% Droop is +2.8% and – 1.5%, ie a Droop less than 12.8% and greater than 8.5%.					

10. Power output with falling frequency test (For PV Inverter):			**P**
This test should be carried out in accordance with A.1.2.7.			
Model: AU-1P3K3G-LE			
Test sequence	Measured **Active Power** Output (W)	Frequency (Hz)	Primary power source
Test a) 50 Hz ± 0.01 Hz	3005.95	50.00	Photovoltaic array simulator
Test b) Point between 49.5 Hz and 49.6 Hz	3006.08	49.55	Photovoltaic array simulator
Test c) Point between 47.5 Hz and 47.6 Hz	3006.10	47.55	Photovoltaic array simulator

NOTE:
The operating point in Test (b) and (c) shall be maintained for at least 5 minutes

The test is regarded as passed if:
• the Micro-generator does not disconnect from the network at the operating points a) to c) when the network frequency is changed and
• the Micro-generator does not reduce output energy at point b) and
• the power reduction at point c) is less than or equal to the allowed power reduction according to paragraph 9.4.2 (Figure 3).

The following data shall be documented:
• variation of the network frequency with time;
• the measured Active Power with time.

11. Power output with falling frequency test (For Electricity Storage Device)				**P**
This test should be carried out in accordance with clause A.1.2.8				
Model: AU-1P3K3G-LE				
Test 1: 50 Hz to 49.0 Hz, from **100%** $P_{rated\text{-}import}$				
Test sequence (Hz)	Measured **Active Power** Output (W)	Steady frequency (Hz)	Calculated droop (%)	Primary power source
50.0	-2980.27	50.00	-	AC grid / Storage Battery
49.5	-2975.57	49.50	-	AC grid / Storage Battery
49.2	-1248.88	49.20	1.04%	AC grid / Storage Battery
49.0	-75.30	49.00	1.03%	AC grid / Storage Battery
Test 2: 50 Hz to 48.8 Hz, from **100%** $P_{rated\text{-}import}$				
Test sequence (Hz)	Measured **Active Power** Output (W)	Steady frequency (Hz)	Calculated droop (%)	Primary power source
50.0	-2930.37	50.00	-	AC grid / Storage Battery
49.5	-2980.06	49.50	-	AC grid / Storage Battery
49.2	-1254.71	49.20	1.04%	AC grid / Storage Battery
49.0	-66.68	49.00	1.03%	AC grid / Storage Battery
48.9	573.38	48.90	1.01%	AC grid / Storage Battery
48.8	1190.61	48.80	1.01%	AC grid / Storage Battery
Test 3: 50 Hz to 49.0 Hz, from **40%** $P_{rated\text{-}import}$				
Test sequence (Hz)	Measured **Active Power** Output (W)	Steady frequency (Hz)	Calculated droop (%)	Primary power source

50.0	-1156.95	50.00	-	AC grid / Storage Battery
49.5	-1204.34	49.50	-	AC grid / Storage Battery
49.2	540.67	49.20	1.03%	AC grid / Storage Battery
49.0	1842.61	49.00	0.98%	AC grid / Storage Battery
Test 4: 50 Hz to 48.8 Hz, from **40%** $P_{rated\text{-}import}$				
Test sequence (Hz)	Measured **Active Power** Output (W)	Steady frequency (Hz)	Calculated droop (%)	Primary power source
50.0	-1128.60	50.00	-	AC grid / Storage Battery
49.5	-1197.52	49.50	-	AC grid / Storage Battery
49.2	542.33	49.20	1.03%	AC grid / Storage Battery
49.0	1847.71	49.00	0.99%	AC grid / Storage Battery
48.9	2460.83	48.90	0.98%	AC grid / Storage Battery
48.8	3063.27	48.80	0.99%	AC grid / Storage Battery
NOTE: This paragraph provides a method for demonstrating compliance with the optional performance characteristic as discussed in the foreword. The tests shall be carried out to demonstrate how the Power Park Module Active Power when acting as a load (ie replenishing its energy store) responds to changes in system frequency. In general four tests are proposed, one set of two at rated import capacity, and one set of two at 40% of rated import capacity. In both cases the test is to reduce frequency from 50 Hz at rate of 2 Hz/s. In the first case the lower frequency reached will be 49.0 Hz and the second case the lower frequency will be 48.8 Hz. In all cases the response shall meet the requirements of 11.2.3.3.				

12. Re-connection timer					**P**
Model: AU-1P3K3G-LE					
Test should prove that the reconnection sequence starts after a minimum delay of 20 s for restoration of voltage and frequency to within the stage 1 settings of Table 2. Both the time delay setting and the measured delay should be provided in this form; both should be greater than 20 s to pass. Confirmation should be provided that the **Micro-generating Plant** does not reconnect at the voltage and frequency settings below; a statement of "no reconnection" can be made.					
Time delay setting	Measured delay	Checks on no reconnection when voltage or frequency is brought to just outside stage 1 limits of Table 10.1.			
30 s	32 s	At 1.16 pu (266.2 V)	At 0.78 pu (180.0 V)	At 47.4 Hz	At 52.1 Hz
Confirmation that the **Micro-generator** does not re-connect.		No Reconnection	No Reconnection	No Reconnection	No Reconnection
Recover to normal operation range after confirmation of no reconnection		Yes	Yes	Yes	Yes
Confirmation that the **Power Generating Module** shall reconnect		Reconnection after 32.0 s	Reconnection after 30.8 s	Reconnection after 31.6 s	Reconnection after 31.6 s

13. Fault level contribution:					**P**
These tests shall be carried out in accordance with EREC G98 Annex A1 A.1.3.5 (**Inverter** connected) and Annex A2 A.2.3.4 (Synchronous). Please complete each entry, even if the fault contribution is zero.					
Model: AU-1P3K3G-LE					
For machines with electro-magnetic output			For **Inverter** output		
Parameter	Symbol	Value	Time after fault	Volts	Amps
Peak Short Circuit current	i_p	N/A	20ms	187.7V	9.806A
Initial Value of aperiodic current	A	N/A	100ms	0.899 V	8.758A
Initial symmetrical short-circuit current*	I_k	N/A	250ms	0	0
Decaying (aperiodic) component of short circuit current*	i_{DC}	N/A	500ms	0	0
Reactance/Resistance Ratio of source*	$^X/_R$	N/A	Time to trip	117 ms	In seconds
For rotating machines and linear piston machines the test should produce a 0 s – 2 s plot of the short circuit current as seen at the **Micro-generator** terminals. * Values for these parameters should be provided where the short circuit duration is sufficiently long to enable interpolation of the plot.					

14. Logic interface (input port)	
Confirm that an input port is provided and can be used to reduce the **Active Power** output to zero	Yes
Provide high level description of logic interface, e.g. details in 9.4.3 such as AC or **DC** signal (the additional comments box below can be used)	Yes
15. Self-Monitoring solid state switching: No specified test requirements. Refer to EREC G98 Annex A1 A.1.3.6 (**Inverter** connected).	
It has been verified that in the event of the solid state switching device failing to disconnect the **Micro-generator**, the voltage on the output side of the switching device is reduced to a value below 50 V within 0.5 s.	N/A
16. Cyber security	
Confirm that the **Manufacturer** or **Installer** of the **Micro-generator** has provided a statement describing how the **Micro-generator** has been designed to comply with cyber security requirements, as detailed in 9.7.	Yes Manufacturer's declaration provided.
Additional comments.	
To short or open pin1 and pin5 of logic interface port (Com 1) to control the inverter to normal or shutdown active power of output. A logic interface is provided that can be operated by an external switch or contactor. Users can install by themselves. Users install the switch connected to pin1 and pin5 of Com1 and just need control the switch signal causing the switch to open or short. When the switch is closed, the inverter will operate normally. When the switch is opened, the inverter will cease to export active power within 5 seconds. The signal from the inverter that is being switched is DC (maximum value 3.3V).	

End