Form A2-3: Compliance Verification Report for Type A Inverter Connected Power Generating Modules

This form should be used by the **Manufacturer** to demonstrate and declare compliance with the requirements of EREC G99.The form can be used in a variety of ways as detailed below:

1. To obtain **Fully Type Tested** status (≤ 50 kW)

   The Manufacturer can use this form to obtain **Fully Type Tested** status for a **Power Generating Module** by registering this completed form with the Energy Networks Association (ENA) Type Test Verification Report Register. Tests 1 – 15 must all be completed and compliant for the **Power Generating Module** to be classified as **Fully Type Tested**.

2. To obtain **Type Tested** status for a product

   This form can be used by the **Manufacturer** to obtain **Type Tested** status for a product which is used in a **Power Generating Module** by registering this form with the relevant parts completed with the Energy Networks Association (ENA) Type Test Verification Report Register.
   Where the **Manufacturer** is seeking to obtain **Type Tested** status for an **Interface Protection** device the appropriate section of Form A2-4 should be used.

3. One-off Installation

   This form can be used by the **Manufacturer** or **Installer** to confirm that the **Power Generating Module** has been tested to satisfy all or part of the requirements of this EREC G99.This form must be submitted to the **DNO** as part of the application.

A combination of (2) and (3) can be used as required, together with Form A2-4 where compliance of the **Interface Protection** is to be demonstrated on site.

Note:

Within this Form A2-3 the term **Power Park Module** will be used but its meaning can be interpreted within Form A2-3 to mean **Power Park Module**, **Generating Unit or Inverter** as appropriate for the context. However, note that compliance must be demonstrated at the **Power Park Module** level.

If the **Power Generating Module** is **Fully Type Tested** and registered with the Energy Networks Association (ENA) Type Test Verification Report Register, the Installation Document (Form A3-1 or A3-2) should include the **Manufacturer's** reference number (the system reference), and this form does not need to be submitted.

Where the **Power Generating Module** is not registered with the ENA Type Test Verification Report Register or is not **Fully Type Tested** this form (all or in parts as applicable) needs to be completed and provided to the **DNO**, to confirm that the **Power Generating Module** has been tested to satisfy all or part of the requirements of this EREC G99.

PGM technology		S5-EH1P3K-L,S5-EH1P3.6K-L, S5-EH1P4.6K-L, S5-EH1P5K-L,S5-EH1P6K-L	
Manufacturer name		Ginlong Technologies Co., Ltd.	
Address		No. 57 Jintong Road, Seafront (Binhai) Industrial Park, Xiangshan, Ningbo, Zhejiang,315712,P.R.China	
Tel	(+86) 574 6580 3377	Web site	www.ginlong.com
E:mail	Ruyi.Pan@ginlong.com		
Registered Capacity		3.0/3.6/4.6/5.0/6.0 kW	

Energy storage capacity for **Electricity Storage** devices	N/A kWh

There are four options for Testing: (1) **Fully Type Tested**(≤ 50 kW), (2) **Type Tested** product, (3) one-off installation, (4) tested on site at time of commissioning. The check box below indicates which tests in this Form have been completed for each of the options. With the exception of **Fully Type Tested PGMs** tests may be carried out at the time of commissioning (Form A4). **Type Tested** status is suitable for devices > 50 kW where the power quality aspects need consideration on a site by site basis in accordance with EREC G5 and EREC P28.

Insert Document reference(s) for **Manufacturers' Information**

Tested option:	**1. Fully Type Tested**	**2. Type Tested product**	**3. One-off Manufacturers' Info.**	**4. Tested on Site at time of Commission-ing**
0. **Fully Type Tested**- all tests detailed below completed and evidence attached to this submission	**Yes**	**N/A**	**N/A**	**N/A**
1. Operating Range				
2. PQ – Harmonics				
3. PQ – Voltage Fluctuation and Flicker				
4. PQ – DC Injection (**Power Park Modules** only)				
5. **Power Factor** (PF)				
6. Frequency protection trip and ride through tests				
7. Voltage protection trip and ride through tests				
8. Protection – Loss of Mains Test, Vector Shift and RoCoF Stability Test	**N/A**			
9.**LFSM-O** Test				
10. Protection – Reconnection Timer				
11. Fault Level Contribution				
12. Self-monitoring Solid State Switch				
13. Wiring functional tests if required by para 15.2.1 (attach relevant schedule of tests)				
14. Logic Interface (input port)				
15. Cyber security				

Manufacturer compliance declaration. - I certify that all products supplied by the company with the above **Type Tested Manufacturer**'s reference number will be manufactured and tested to ensure that they perform as stated in this document, prior to shipment to site and that no site **Modifications** are required to ensure that the product meets all the requirements of EREC G99.

Signed	12.Apr.2022	On behalf of	GinLong Technologies Co., Ltd.

锦浪科技股份有限公司
GINLONG TECHNOLOGIES CO.,LTD.

Note that testing can be done by the **Manufacturer** of an individual component or by an external test house.

Where parts of the testing are carried out by persons or organisations other than the **Manufacturer** then that person or organisation shall keep copies of all test records and results supplied to them to verify that the testing has been carried out by people with sufficient technical competency to carry out the tests.

A2-3 Compliance Verification Report –Tests for Type A Inverter Connected Power Generating Modules – test record	
1. Operating Range: Tests should be carried with the **Power Generating Module** operating at **Registered Capacity** and connected to a suitable test supply or grid simulation set. The power supplied by the primary source shall be kept stable within ± 5 % of the apparent power value set for the entire duration of each test sequence. Frequency, voltage and **Active Power** measurements at the output terminals of the **Power Generating Module** shall be recorded every second. The tests will verify that the **Power Generating Module** can operate within the required ranges for the specified period of time. The **Interface Protection** shall be disabled during the tests. In case of a PV **Power Park Module** the PV primary source may be replaced by a DC source. In case of a full converter **Power Park Module** (e.g. wind) the primary source and the prime mover **Inverter**/rectifier may be replaced by a DC source. 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. Note that the value of voltage stated in brackets assumes a **LV** connection. This should be adjusted for **HV** as required.	
Test 1 Voltage = 85% of nominal (195.5 V), Frequency = 47 Hz, **Power Factor** = 1, Period of test 20s	No disconnection occurs. Pass.
Test 2 Voltage = 85% of nominal (195.5 V), Frequency = 47.5 Hz, **Power Factor** = 1, Period of test 90 minutes	No disconnection occurs. Pass.
Test 3 Voltage = 110% of nominal (253 V)., Frequency = 51.5 Hz, **Power Factor** = 1, Period of test 90 minutes	No disconnection occurs. Pass.
Test 4 Voltage = 110% of nominal (253 V), Frequency = 52.0 Hz, **Power Factor** = 1, Period of test 15 minutes	No disconnection occurs. Pass.
Test 5 Voltage = 100% of nominal (230 V), Frequency = 50.0 Hz, Power Factor = 1,	No disconnection occurs. Pass.

Period of test = 90 minutes	
Test 6 RoCoF withstand Confirm that the **Power Generating Module** is capable of staying connected to the **Distribution Network** and operate at rates of change of frequency up to 1 Hzs -1 as measured over a period of 500 ms. Note that this is not expected to be demonstrated on site.	No disconnection occurs. Pass.

2. Power Quality – Harmonics:

For **Power Generating Modules** of **Registered Capacity** of less than 75 A per phase (i.e. 50 kW) the test requirements are specified in Annex A.7.1.5.These tests should be carried out as specified in BS EN 61000-3-12, and measurements for the 2 nd – 13 th harmonics should be provided. The results need to comply with the limits of Table 2 of BS EN 61000-3-12 for single phase equipment and Table 3 of BS EN 610000-3-12 for three phase equipment. For three phase **Power Generating Modules**, measurements for all phases should be provided.

For **Power Generating Modules** of **Registered Capacity** of greater than 75 A per phase (ie 50 kW) the installation shall be designed in accordance with EREC G5.

The rating of the **Power Generating Module** (per phase) should be provided below, and the Total Harmonic Distortion (THD) and Partial Weighted Harmonic Distortion (PWHD) should be provided at the bottom of this section.

Power Generating Module tested to BS EN 61000-3-12

Power Generating Module rating per phase (rpp)	6	kVA	Harmonic % = Measured Value (A) x 23/rating per phase (kVA)
Single or three phase measurements (for single phase measurements, only complete L1 columns below).	Single		

Harmonic	At 45-55% of **Registered Capacity**						Limit in BS EN 61000-3-12	
	Measured Value (MV) in Amps			Measured Value (MV) in %				
	L1	L2	L3	L1	L2	L3	1 phase	3 phase
2	0.093	NA	NA	0.356	NA	NA	8%	8%
3	0.127	NA	NA	0.487	NA	NA	21.6%	Not stated
4	0.023	NA	NA	0.088	NA	NA	4%	4%
5	0.111	NA	NA	0.425	NA	NA	10.7%	10.7%
6	0.018	NA	NA	0.069	NA	NA	2.67%	2.67%
7	0.103	NA	NA	0.395	NA	NA	7.2%	7.2%
8	0.014	NA	NA	0.054	NA	NA	2%	2%
9	0.075	NA	NA	0.287	NA	NA	3.8%	Not stated
10	0.011	NA	NA	0.042	NA	NA	1.6%	1.6%
11	0.071	NA	NA	0.272	NA	NA	3.1%	3.1%
12	0.010	NA	NA	0.038	NA	NA	1.33%	1.33%

13	0.067	NA	NA	0.257	NA	NA	2%	2%
THD[23]	---	NA	NA	1.152	NA	NA	23%	13%
PWHD[24]	---	NA	NA	2.836	NA	NA	23%	22%
Harmonic	At 100% of **Registered Capacity**						Limit in BS EN 61000-3-12	
	Measured Value (MV) in Amps			Measured Value (MV) in %				
	L1	L2	L3	L1	L2	L3	1 phase	3 phase
2	0.162	NA	NA	0.621	NA	NA	8%	8%
3	0.227	NA	NA	0.870	NA	NA	21.6%	Not stated
4	0.041	NA	NA	0.157	NA	NA	4%	4%
5	0.199	NA	NA	0.762	NA	NA	10.7%	10.7%
6	0.030	NA	NA	0.115	NA	NA	2.67%	2.67%
7	0.149	NA	NA	0.571	NA	NA	7.2%	7.2%
8	0.023	NA	NA	0.088	NA	NA	2%	2%
9	0.109	NA	NA	0.418	NA	NA	3.8%	Not stated
10	0.020	NA	NA	0.077	NA	NA	1.6%	1.6%
11	0.104	NA	NA	0.398	NA	NA	3.1%	3.1%
12	0.019	NA	NA	0.073	NA	NA	1.33%	1.33%
13	0.094	NA	NA	0.360	NA	NA	2%	2%
THD[25]	---	NA	NA	1.874	NA	NA	23%	13%
PWHD[26]	---	NA	NA	4.688	NA	NA	23%	22%

3. Power Quality – Voltage fluctuations and Flicker:

For **Power Generating Modules** of **Registered Capacity** of less than 75 A per phase (i.e. 50 kW) these tests should be undertaken in accordance with Annex A.7.1.4.3. Results should be normalised to a standard source impedance, or if this results in figures above the limits set in BS EN 61000-3-11 to a suitable Maximum Impedance.

For **Power Generating Modules** of **Registered Capacity** of greater than 75 A per phase (i.e. 50 kW) the installation must be designed in accordance with EREC P28.

The standard test impedance is 0.4 Ω for a single phase Power Generating Module (and for a two phase unit in a three phase system) and 0.24 Ω for a three phase Power Generating Module (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	14. Sep.2021	Test end date	14. Sep.2021
Test location	Ginlong Technologies Co.,Ltd.		

	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	0.525%	0.035%	0	0.068%	0.047%	0	0.065	0.067
Normalised to standard impedance	0.525%	0.035%	0	0.068%	0.047%	0	0.065	0.067
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 **Power Generating Modules.** Delete as appropriate.

^ Applies to single phase **Power Generating Module** and **Power Generating Module**s using two phases on a three phase system. Delete as appropriate.

4. Power quality – DC injection: The tests should be carried out on a single **Generating Unit.** Tests are to be carried out at three defined power levels ±5%. At 230 V a 6 kW single phase **Inverter** has a current

output of 26.1 A, so DC limit is 65.22 mA. These tests should be undertaken in accordance with Annex A.7.1.4.4.

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) / V phase. The % DC injection should not be greater than 0.25%.

Test power level	10%	55%	100%
Recorded DC value in mA	34.28	21.69	41.51
as % of rated AC current	0.131	0.083	0.159
Limit	0.25%	0.25%	0.25%

5. Power Factor: The tests should be carried out on a single **Power Generating Module**. Tests are to be carried out 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. These tests should be undertaken in accordance with Annex A.7.1.4.2.

Note that the value of voltage stated in brackets assumes a **LV** connection. This should be adjusted for **HV** as required.

Voltage	0.94 pu (216.2 V)	1 pu (230 V)	1.1 pu (253 V)
Measured value	0.9995	0.9995	0.9994
Power Factor Limit	>0.95	>0.95	>0.95

6. Protection – Frequency tests: These tests should be carried out in accordance with the Annex A.7.1.2.3. For trip tests, frequency and time delay should be stated. For "no trip tests", "no trip" can be stated.

Function	Setting		Trip test		"No trip tests"	
	Frequency	Time delay	Frequency	Time delay	Frequency /time	Confirm no trip
U/F stage 1	47.5Hz	20s	47.48Hz	20.04s	47.7Hz 30s	Yes
U/F stage 2	47Hz	0.5s	47.01Hz	0.532s	47.2Hz 19.5s	Yes
					46.8Hz 0.45s	Yes
O/F	52Hz	0.5s	52.01Hz	0.528s	51.8Hz 120s	Yes
					52.2Hz	Yes

					0.45s	

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: These tests should be carried out in accordance with Annex A.7.1.2.2. For trip tests, voltage and time delay should be stated. For "no trip tests", "no trip" can be stated.

Note that the value of voltage stated below assumes a **LV** connection This should be adjusted for **HV** taking account of the VT ratio as required.

Function	Setting		Trip test		"No trip tests"	
	Voltage	Time delay	Voltage	Time delay	Voltage /time	Confirm no trip
U/V	0.8 pu (184V)	2.5s	185V	2.526s	188V 5s	Yes
					180V 2.45s	Yes
O/V stage 1	1.14 pu (262.2V)	1.0s	261.5V	1.028s	258.2V 5.0s	Yes
O/V stage 2	1.19 pu (273.7V)	0.5s	273V	0.529s	269.7V 0.95s	Yes
					277.7V 0.45s	Yes

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: These tests should be carried out in accordance with BS EN 62116. Annex A.7.1.2.4.

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	0.312s	0.326s	0.342s	0.326s	0.323s	0.338s

Loss of Mains Protection, Vector Shift Stability test. This test should be carried out in accordance with Annex A.7.1.2.6. Confirmation is required that the **Power Generating Module** does not trip under positive /

negative vector shift.			
	Start Frequency	Change	Confirm no trip
Positive Vector Shift	49.5Hz	+50 degrees	Yes
Negative Vector Shift	50.5Hz	- 50 degrees	Yes

Loss of Mains Protection, RoCoF Stability test: This test should be carried out in accordance with Annex A.7.1.2.6. Confirmation is required that the **Power Generating Module** does not trip for the duration of the ramp up and ramp down test.

Ramp range	Test frequency ramp:	Test Duration	Confirm no trip
49.0Hz to 51.0Hz	+0.95Hzs^{-1}	2.1 s	Yes
51.0Hz to 49.0Hz	-0.95Hzs^{-1}	2.1 s	Yes

9. Limited Frequency Sensitive Mode – Over frequency test: The test should be carried out using the specific threshold frequency of 50.4 Hz and **Droop** of 5%.

This test should be carried out in accordance with Annex A.7.1.3, which also contains the measurement tolerances.

Active Power response to rising frequency/time plots are attached if frequency injection tests are undertaken in accordance with Annex A.7.2.4.	**Yes**

Alternatively, simulation results should be noted below:

Test sequence at **Registered Capacity**>80%	Measured **Active Power** Output	Frequency	Primary Power Source	**Active Power** Gradient
Step a) 50.00Hz ±0.01Hz	5990W	50.00Hz	6207W	-
Step b) 50.45Hz ±0.05Hz	5880W	50.45Hz		-
Step c) 50.70Hz ±0.10Hz	5297W	50.70Hz		-
Step d) 51.15Hz ±0.05Hz	4229W	51.15Hz		-
Step e) 50.70Hz ±0.10Hz	5294W	50.70Hz		-
Step f) 50.45Hz ±0.05Hz	5881W	50.45Hz		-
Step g) 50.00Hz ±0.01Hz	5993W	50.00Hz		21.6kW/min
Test sequence at **Registered Capacity** 40% - 60%	Measured **Active Power** Output	Frequency	Primary Power Source	**Active Power** Gradient
Step a) 50.00Hz ±0.01Hz	3029W	50.00Hz	3140W	-
Step b) 50.45Hz ±0.05Hz	2921W	50.45Hz		-

Step c) 50.70Hz ±0.10Hz	2351W	50.70Hz		-
Step d) 51.15Hz ±0.05Hz	1308W	51.15Hz		-
Step e) 50.70Hz ±0.10Hz	2350W	50.70Hz		-
Step f) 50.45 Hz ±0.05 Hz	2922W	50.45Hz	3029W	0kW/min
Step g) 50.00 Hz ±0.01 Hz	3020W	50.00Hz	3130W	21.6kW/min

10. Protection – Re-connection timer.

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 10.1. 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 **Power Generating Module** 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.			
30s	49s	At 1.16 pu (266.8 V)	At 0.78 pu (179.4V)	At 47.4 Hz	At 52.1 Hz
Confirmation that the **Power Generating Module** does not re-connect.		Yes	Yes	Yes	Yes

11. Fault level contribution: These tests shall be carried out in accordance with EREC G99 Annex A.7.1.5. Please complete each entry, even if the contribution to the fault level is zero.

For **Inverter** output

Time after fault	Volts	Amps
20ms	52.6V	38.7A
100ms	51.0V	0A
250ms	51.6V	0A
500ms	51.3V	0A
Time to trip	0.045s	In seconds

12. Self-Monitoring solid state switching: No specified test requirements. Refer to Annex A.7.1.6.

It has been verified that in the event of the solid state switching device failing to disconnect the **Power Park Module**, the voltage on the output side of the switching device is reduced to a value below 50 volts within 0.5 s.	N/A (Solid state switch means electronic switch, Solis inverter uses mechanical dual relay protection with relay checks, which drops the voltage below 50V in 0.5s)

13. Wiring functional tests: If required by para 15.2.1.	
Confirm that the relevant test schedule is attached (tests to be undertaken at time of commissioning)	N/A (Not applicable. Refer to 15.2.1, inverter is using special connector for wiring)
14. Logic interface (input port).	
Confirm that an input port is provided and can be used to shut down the module.	Yes. (Logic interface is marked as "DRM" on inverter. Please see inverter manual part 4.9 for detail.)
Provide high level description of logic interface, e.g. details in 11.1.3.1 such as AC or DC signal (the additional comments box below can be used)	Yes. (Logic interface marked "DRM" on inverter which can be operated by a simple switch or contactor. When the switch is closed the inverter can operated normally. When the switch is opened, the inverter will reduce it's output power to zero within 5s. The signal from the inverter that is being switched is DC about 10 V.)
15. Cyber security	
Confirm that the **Power Generating Module** has been designed to comply with cyber security requirements, as detailed in 9.1.7.	Yes
Additional comments.	
The test result is based on S5-EH1P6K-L. All the series of inverters electrical character are the same. So the test result can cover all other models.	