Form A2-2: Compliance Verification Report for Synchronous and Asynchronous (non Inverter) Power Generating Modules > 50 kW and also for Synchronous and Asynchronous (non inverter) Power Generating Modules ≤ 50 kW where the approach of this form is preferred to that in Form A2-1

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 – 14 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 shall 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:

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		**Hybrid Inverter**	
Manufacturer name		**Shenzhen Lux Power TechnologyCo.,Ltd**	
Address		5th Floor,Building 11, Phase III, Yangbei Industrial Zone, Huangtian Community, Hangcheng Street, Baoan District, Shenzhen City，China	
Tel	+86 755 8520 9056	E-mail	service@luxpowertek.com
Web site	www.luxpowertek.com		
Registered Capacity		6 kW	

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 reference for **Manufacturers' Information** including the ENA Type Test Verification Report Register system reference number where applicable:

Tested option:	**1. Fully Type Tested**	**2. Partially Type Tested**	**3. One-off Manufacturers'. Info.**	**4. Tested on Site at time of Commissioning**
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	**N/A**			
2. PQ – Harmonics				
3. PQ – Voltage Fluctuation and Flicker				
4. PQ – DC Injection (**Power Park Module**s 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				
9. **LFSM-O** Test				
10. Protection – Reconnection Timer				

G99 Type A
Issue 1 Amendment 8 2021
Type A Power Generating Modules

There are four options for Testing: (1) **Fully Type Tested**, (2) Partially **Type Tested**, (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 PGM**s tests may be carried out at the time of commissioning (Form A4).
Insert Document reference(s) for **Manufacturers' Information**

Tested option:	**1. Fully Type Tested**	**2. Partially Type Tested**	**3. One-off Manufacturers'. Info.**	**4. Tested on Site at time of Commissioning**
11. Fault Level contribution				
12. Wiring functional tests if required by para 15.2.1 (attach relevant schedule of tests)				
13. Logic Interface (input port)				
14. 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 **Modification**s are required to ensure that the product meets all the requirements of EREC G99.

Signed	James Wang	On behalf of	**Shenzhen Lux Power TechnologyCo.,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.

A2-2 Compliance Verification Report –Tests for Type A Synchronous PowerGenerating Modules > 50 kW and also for Synchronous Power Generating Modules ≤ 50 kW where the approach of this form is preferred to that in Form	
1. Operating Range: Five 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 (eg 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 20 s	Pass
Test 2 Voltage = 85% of nominal (195.5 V), Frequency = 47.5 Hz, **Power Factor** = 1, Period of test 90 minutes	Pass
Test 3 Voltage = 110% of nominal (253 V)., Frequency = 51.5 Hz, **Power Factor** = 1, Period of test 90 minutes	Pass
Test 4 Voltage = 110% of nominal (253 V), Frequency = 52.0 Hz, **Power Factor** = 1, Period of test 15 minutes	Pass
Test 5 Voltage = 110% of nominal (253 V), Frequency = 52.0 Hz, **Power Factor** = 1, Period of test 15 minutes	Pass

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.	Pass

2. Power Quality – Harmonics:

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

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)	
Harmonic	At 45-55% of **Registered Capacity**		100% of **Registered Capacity**		Limit in BS EN 61000-3-12	
	Measured Value MV in Amps	%	Measured Value MV in Amps	%	1 phase	3 phase
2	0.0209	0.081	0.0367	0.141	8%	8%
3	0.0186	0.072	0.1275	0.49	21.6%	Not stated
4	0.0134	0.051	0.017	0.065	4%	4%
5	0.0242	0.093	0.0301	0.115	10.7%	10.7%
6	0.0056	0.021	0.0091	0.035	2.67%	2.67%
7	0.0458	0.176	0.041	0.157	7.2%	7.2%
8	0.0218	0.084	0.0062	0.024	2%	2%
9	0.0405	0.155	0.0369	0.141	3.8%	Not stated
10	0.013	0.051	0.0227	0.087	1.6%	1.6%
11	0.0322	0.123	0.0341	0.131	3.1%	3.1%
12	0.0124	0.048	0.0049	0.019	1.33%	1.33%
13	0.0364	0.140	0.0345	0.132	2%	2%
THD[17]	--	1.392	--	0.963	23%	13%
PWHD[18]	--	1.663	--	1.28	23%	22%

[17] THD = Total Harmonic Distortion

[18] PWHD = Partial Weighted Harmonic Distortion

3. Power Quality – Voltage fluctuations and Flicker:

For ***Power Generating Module***s of ***Registered Capacity*** of less than 75 A per phase (ie 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 Module***s of ***Registered Capacity*** of greater than 75 A per phase (ie 50 kW) the installation shall 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	2nd of February 2022			Test end date			4th of February 2022	
Test location	Luxpower Testing laboratory &Intertek Testing Services Shenzhen Ltd. Guangzhou Branch							
	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	0.22%	0.15%	0	0.22%	0.9%	0	0.13	0.25
Normalised to standard impedance	0.22%	0.15%	0	0.22%	0.9%	0	0.13	0.25
Normalised to required maximum impedance	NA	NA	NA	NA	NA	NA	NA	NA
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	0.4 ^	Ω	Xl	0.25 ^	Ω

Maximum Impedance	R	NA	Ω	XI	NA	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 50 kW three phase **Inverter** has a current output of 217 A so DC limit is 543 mA. These tests should be undertaken in accordance with Annex A.7.1.4.4.			
Test power level	10%	55%	100%
Recorded value in Amps	0.035A	0.026A	0.029A
as % of rated AC current	0.13%	0.1%	0.11%
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**. 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.			
Voltage	0.94 pu (216.2 V)	1 pu (230 V)	1.1 pu (253 V)
Measured value	0.9992	0.9995	0.9992
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.						
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	47.49 Hz	20.13s	47.7 Hz 30 s	No trip
U/F stage 2	47 Hz	0.5 s	46.99 Hz	0.525s	47.2 Hz 19.5 s	No trip
					46.8 Hz 0.45 s	No trip

O/F	52 Hz	0.5 s	52.01Hz	0.579s	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: These tests should be carried out in accordance with Annex A.7.1.2.2.						
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	183.4 V	2.59 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	262.7V	1.15s	258.2 V 5.0 s	No trip
O/V stage 2	1.19 pu (273.7 V)	0.5 s	274.1V	0.56s	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: 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	0.217s	0.245s	0.262s	0.246s	0.311s	0.24s
Loss of Mains Protection, Vector Shift Stability test. This test should be carried out in accordance with Annex A.7.1.2.6.						
	Start Frequency	Change	Confirm no trip			

Positive Vector Shift	49.5 H z	+50 degrees	No trip
Negative Vector Shift	50.5 H z	- 50 degrees	No trip

Loss of Mains Protection, RoCoF Stability test: This test should be carried out in accordance with Annex A.7.1.2.6.

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: The test should be carried out using the specific threshold frequency of 50.4 Hz and **Droop** of 10%.
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, test 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	5997 W	50.00Hz	6197 W	-
Step b) 50.45Hz ±0.05Hz	5938 W	50.45Hz		-
Step c) 50.70Hz ±0.10Hz	5638W	50.70Hz		-
Step d) 51.15Hz ±0.05Hz	5102 W	51.15Hz		-
Step e) 50.70Hz ±0.10Hz	5641W	50.70Hz		-
Step f) 50.45Hz ±0.05Hz	5941 W	50.45Hz		-
Step g) 50.00Hz ±0.01Hz	5995 W	50.00Hz		
Test sequence at **Registered Capacity** 40% - 60%	Measured **Active Power** Output	Frequency	Primary Power Source	**Active Power** Gradient

Step a) 50.00Hz ±0.01Hz	3009 W	50.00Hz	3135 W	-
Step b) 50.45Hz ±0.05Hz	2972 W	50.45Hz		-
Step c) 50.70Hz ±0.10Hz	2826 W	50.70Hz		-
Step d) 51.15Hz ±0.05Hz	2557 W	51.15Hz		-
Step e) 50.70Hz ±0.10Hz	2829W	50.70Hz		-
Step f) 50.45Hz ±0.05Hz	2973 W	50.45Hz		
Step g) 50.00Hz ±0.01Hz	3004 W	50.00Hz		

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.

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.			
20s	25s	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 **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.

For **Inverter** output

Time after fault	Volts	Amps
20ms	102	22.2
100ms	89.8	11
250ms	59.3	0.8
500ms	0	0
Time to trip	0.219	In seconds

12. Self-Monitoring solid state switching: No specified test requirements. Refer to Annex A.7.1.7.	
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.	NA
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)	NA
14. Logic interface (input port).	
Confirm that an input port is provided and can be used to shut down the module.	Yes
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.	
This equipment is equipped with RJ45 terminal for logic interface that being received the signal from the DNO, the connection should be installed per installation manual, and the signal should be a simple binary output that captured by RJ45 terminal(PIN 5 and 1 for detecting the signal). Once the signal actived, the inverter will reduce its active power to zero within 5s.	