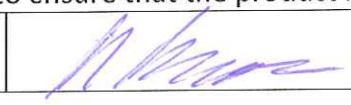
Engineering Recommendation G83/2
Type Verification Test Report

Type approval and manufacturer/supplier declaration of compliance with the requirements of Engineering Recommendation G83/2

SSEG DETAILS	
SSEG Type Reference:	**EnaSolar 1.5kWGT-UK (Photovoltaic)** **EnaSolar 1.5kWGTW-UK (Wind)**
SSEG Type:	Photovoltaic, Wind Inverter
Manufacturer:	**EnaSolar Ltd** 66 Treffers Road, Christchurch 8042, New Zealand Telephone: +64 3 366 4550, Fax:+64 3 366 0884 www.enasolar.net support@enasolar.net
Maximum Rated Capacity: (SSEG Rating Less Parasitic Load)	1500W

SSEG MANUFACTURER DECLARATION			
I certify on behalf of EnaSolar as the manufacturer of Small Scale Embedded Generators, that all products manufactured by the company with the above SSEG Type reference number will be manufactured and tested to ensure that they perform as stated in this Type Verification Test Report, prior to shipment to site and that no site modifications are required to ensure that the product meets all the requirements of G83/2.			
Signed		On behalf of	**EnaSolar Ltd**

Power Quality. Harmonics						
SSEG rating per phase (rpp)			1.5	kW	NV=MV*3.68/rpp	
Harmonic	At 45-55% of rated output		At 100% of rated output			
	Measured value (MV) in Amps	Normalised Value (NV) in Amps	Measured value (MV) in Amps	Normalised Value (NV) in Amps	Limit in BS EN3100-3-2 in Amps	Higher limit for odd harmonics 21 and above
2	0.008	0.020	0.011	0.027	1.08	
3	0.171	0.420	0.124	0.304	2.3	
4	0.001	0.002	0.003	0.007	0.43	
5	0.019	0.047	0.033	0.081	1.14	
6	0.010	0.025	0.002	0.005	0.3	
7	0.010	0.025	0.022	0.054	0.77	
8	0.003	0.007	0.006	0.015	0.23	
9	0.015	0.037	0.019	0.047	0.4	
10	0.009	0.022	0.003	0.007	0.184	
11	0.034	0.083	0.012	0.029	0.33	
12	0.002	0.005	0.004	0.010	0.153	
13	0.026	0.064	0.007	0.017	0.21	
14	0.006	0.015	0.002	0.005	0.131	
15	0.030	0.074	0.021	0.052	0.15	
16	0.005	0.012	0.002	0.005	0.115	
17	0.025	0.061	0.015	0.037	0.132	
18	0.010	0.025	0.006	0.015	0.102	
19	0.002	0.005	0.036	0.088	0.118	
20	0.014	0.034	0.015	0.037	0.092	
21	0.021	0.052	0.022	0.054	0.107	
22	0.007	0.017	0.003	0.007	0.084	
23	0.009	0.022	0.014	0.034	0.098	
24	0.004	0.010	0.004	0.010	0.077	
25	0.013	0.032	0.011	0.027	0.09	
26	0.003	0.007	0.004	0.010	0.071	
27	0.007	0.017	0.004	0.010	0.083	
28	0.003	0.007	0.001	0.002	0.066	
29	0.007	0.017	0.007	0.017	0.078	
30	0.002	0.005	0.004	0.010	0.061	
31	0.006	0.015	0.004	0.010	0.073	
32	0.002	0.005	0.003	0.007	0.058	
33	0.005	0.012	0.016	0.039	0.068	
34	0.003	0.007	0.007	0.017	0.054	
35	0.007	0.017	0.002	0.005	0.064	
36	0.002	0.005	0.001	0.002	0.051	
37	0.004	0.010	0.003	0.007	0.061	
38	0.002	0.005	0.001	0.002	0.048	
39	0.004	0.010	0.003	0.007	0.058	
40	0.007	0.017	0.006	0.015	0.046	

Power Quality. Voltage fluctuations and flicker								
	Starting			Stopping			Running	
	d_{max}	d_c	$d_{(t)}$	d_{max}	d_c	$d_{(t)}$	P_{st}	P_{lt} 2 hours
Measured Values	0.28	0.04	0.16	1.8	1.75	0.19	0.268	0.241
Normalised to standard impedance and 3.68kW for multiple units	0.42	0.59	0.24	2.68	2.60	0.28	0.398	0.358
Limits in BS EN61000-3-3	4%	3.3%	3.3% 500ms	4%	3.3%	3.3% 500ms	1.0	0.65
Test start date	18/09/2013			Test end date	19\09\2013			
Test location	EnaSolar, 66 Treffers Road, Christchurch, New Zealand							
EnaSolar declare that the **EnaSolar 1.5kWGTW-UK (Wind)** has a **maximum ramp up power limit of 333 watts per second.**								

Power Quality. DC injection			
Test Power Level	**10%**	**55%**	**100%**
Recorded value	11mA	7.5mA	7.2mA
% of rated AC current	0.17%	0.15%	0.11%
Limit	0.25%	0.25%	0.25%

Power Quality. Power Factor			
	216.2V	**230V**	**253V**
Recorded value	0.998	0.998	0.997
Limit	>0.95	>0.95	>0.95

Protection. Frequency tests.						
Function	Setting		Trip test		"No trip test"	
	Frequency	Time delay	Frequency	Time delay	Frequency /time	Confirm no trip
U/F stage 1	47.5Hz	20s	47.45	20.13s	47.7Hz 25s	Y
U/F stage 2	47Hz	0.5s	46.95	0.61s	47.2Hz 19.98s	Y
					46.8Hz 0.48s	Y
O/F stage 1	51.5Hz	90s	51.55	90.3s	51.3Hz 95s	Y
O/F stage 2	52Hz	0.5s	52.05	0.59s	51.8Hz 89.98s	Y
					52.2Hz 0.48s	Y

Protection. Voltage tests.						
Function	Setting		Trip test		"No trip test"	
	Voltage	Time delay	Voltage	Time delay	Voltage /time	Confirm no trip
U/V stage 1	200.1V	2.5s	198.5	2.59s	204.1V 3.5s	Y
U/V stage 2	184V	0.5s	182	0.51s	188V 2.48s	Y
					180V 0.48s	Y
O/V stage 1	262.2V	1.0s	261.8	1.04s	258.2V 2s	Y
O/V stage 2	273.7V	0.5s	274.7	0.52s	269.7V 0.98s	Y
					277.7V 0.48s	y

Protection. Loss of mains test.						
Test Power	10%	55%	100%	10%	55%	100%
Balancing load on islanded network	95% of SSEG output			105% of SSEG output		
Trip Time	492ms	91ms	120ms	480ms	52ms	85ms
Limit	0.5s	0.5s	0.5s	0.5s	0.5s	0.5s

Protection. Frequency change, Stability test.				
	Start Frequency	Change	End Frequency	Confirm no trip
Positive Vector Shift	49.5Hz	+9 degrees		Y
Negative Vector Shift	50.5Hz	-9 degrees		Y
Positive Frequency drift	49.5Hz	+0.19Hz/Sec	51.5Hz	Y
Positive Frequency drift	50.5Hz	-0.19Hz/Sec	47.5Hz	Y

Protection. Re-connection timer.					
Time delay setting	Measured Delay				
20 Seconds	>20 Sec	At 266.2V	At 196.1V	At 47.4Hz	At 51.6Hz
Confirmation that the SSEG does not re-connect		Y	Y	Y	Y

Fault level contribution – Inverter SSEG.		
Time after fault	Volts	Amps
20ms	101	5.8
100ms	57.4	4.2
250ms	57.4	1.5
500ms	66.2	0
Time to trip	0.25	In seconds

Self Monitoring – Solid state switching.
Not applicable as electro-mechanical relays are used.