



Compliance Verification Report with the G98 Issue 1 Amendment 4 2019

Test record for Type A Inverter Connected Power Generating Modules

Manufacturer	SMA Solar Technology AG
Address	Sonnenallee 1, 34266 Niestetal (Germany)

Type Tested reference number	ZE_G98-1_SI_44M-13_en_11
Generating Unit technology	Single phase inverter
Test house details	SMA Solar Technology AG
Test period	From 2019-04-06 until 2019-07-01

Type reference	Max. apparent AC power (VA)	Rated AC power (W)	From FW Pack
SI 4.4_M-12	3300	3300	V3.00.00.R
SI 4.4_M-13	3300	3300	V3.00.00.R

Furthermore, it is declared that the products listed above are identical.

In the software, there are only minor differences which result from the respective values of power limit function.

The activity-independent tests were carried out with the most powerful device. All service-specific tests were each carried out with the appropriate product.

The results of the G98/1 are summarized in this certificate. SMA declares that all units shipped to the UK, with at least the aforementioned FW version, are within the specifications and parameters set by the G98/1 Engineering Recommendation, Amendment 4 2019.

These settings cannot be changed by an installer, user or by any person without authorization from SMA.

Note that all tests were carried out with the biggest inverter of the family under test. The results for the other inverters of the family are equivalent.



Test Results

Power quality

Harmonics as per BS EN 61000-3-2								
Order	Frequency [Hz]	Thresholds [A]	P/Pn [%]				Max. NV / Limit [%]	
			50		100			
			MV [A]	NV [A]	MV [A]	NV [A]		
2	100	1,08	0,035	0,039	0,055	0,061	5,68%	✓
3	150	2,3	0,017	0,019	0,341	0,380	16,53%	✓
4	200	0,43	0,010	0,011	0,034	0,038	8,82%	✓
5	250	1,14	0,077	0,086	0,239	0,267	23,38%	✓
6	300	0,3	0,005	0,006	0,029	0,032	10,78%	✓
7	350	0,77	0,028	0,031	0,198	0,221	28,68%	✓
8	400	0,23	0,003	0,003	0,013	0,014	6,30%	✓
9	450	0,4	0,015	0,017	0,034	0,038	9,48%	✓
10	500	0,184	0,002	0,002	0,013	0,014	7,88%	✓
11	550	0,33	0,013	0,014	0,057	0,064	19,26%	✓
12	600	0,153	0,003	0,003	0,009	0,010	6,55%	✓
13	650	0,21	0,010	0,011	0,027	0,030	14,34%	✓
14	700	0,131	0,002	0,002	0,008	0,009	6,79%	✓
15	750	0,15	0,006	0,007	0,028	0,031	20,82%	✓
16	800	0,115	0,001	0,001	0,005	0,006	4,85%	✓
17	850	0,132	0,004	0,004	0,011	0,012	9,27%	✓
18	900	0,102	0,001	0,001	0,003	0,003	3,27%	✓
19	950	0,118	0,003	0,003	0,010	0,011	9,42%	✓
20	1000	0,092	0,001	0,001	0,003	0,003	3,64%	✓
21	1050	0,107	0,003	0,003	0,009	0,010	9,37%	✓
22	1100	0,084	0,001	0,001	0,002	0,002	2,67%	✓
23	1150	0,098	0,002	0,002	0,006	0,007	6,84%	✓
24	1200	0,077	0,001	0,001	0,001	0,001	1,45%	✓
25	1250	0,09	0,002	0,002	0,002	0,002	2,48%	✓
26	1300	0,071	0,001	0,001	0,001	0,001	1,58%	✓
27	1350	0,083	0,002	0,002	0,003	0,003	4,01%	✓
28	1400	0,066	0,001	0,001	0,001	0,001	1,70%	✓
29	1450	0,078	0,001	0,001	0,002	0,002	2,87%	✓
30	1500	0,061	0,001	0,001	0,001	0,001	1,82%	✓
31	1550	0,073	0,001	0,001	0,002	0,002	3,07%	✓
32	1600	0,058	0,001	0,001	0,001	0,001	1,94%	✓
33	1650	0,068	0,001	0,001	0,001	0,001	1,64%	✓
34	1700	0,054	0,001	0,001	0,001	0,001	2,06%	✓
35	1750	0,064	0,001	0,001	0,000	0,000	1,73%	✓
36	1800	0,051	0,001	0,001	0,001	0,001	2,18%	✓
37	1850	0,061	0,001	0,001	0,001	0,001	1,83%	✓
38	1900	0,048	0,000	0,000	0,001	0,001	2,30%	✓
39	1950	0,058	0,001	0,001	0,002	0,002	3,87%	✓
40	2000	0,046	0,001	0,001	0,001	0,001	2,42%	✓

MV - Measured Value NV - Normalized Value $NV = MV \cdot 3,68 / \text{power per phase}$

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Active power operating range					
Test	Voltage	Frequency	cosphi	Time	Verification
1	195,5 V	47,5 Hz	1	90 min	✓
2	253 V	51,5 Hz	1	90 min	✓
3	253 V	52 Hz	1	15 min	✓

Power quality

Voltage fluctuations and flicker as per BS EN 61000-3-3								
	Starting			Stopping			Running	
	dmax	dc	d(t) in ms	dmax	dc	d(t) in ms	Pst	Plt (2hours)
Limit	4,0%	3,3%	500	4,0%	3,3%	500	1	0,65
MV	0,5%	0,1%	0	3,0%	2,9%	0	0,070	0,070
NV (to ZRef)	0,5%	0,1%		3,0%	2,9%		0,070	0,070
Verification	✓	✓		✓	✓		✓	✓
ZTest	R	0,40	Ω	XL	0,25	Ω		

DC injection					Power factor			
	P/Pn [%]				P/Pn [%]	Voltage [V]		
	20	50	75	100		216,2	230	253
Limit	0,25% In	0,25% In	0,25% In	0,25% In	Limit	>0,95	>0,95	>0,95
MV	A	A	A	A	20	1,00	1,00	1,00
%Inom	0,00%	0,00%	0,00%	137,93%	50	1,00	1,00	1,00
Verification	✓	✓	✓	✓	75	1,00	1,00	1,00
					100	1,00	1,00	1,00
					Verification	✓	✓	✓

MV - Measured value

NV - Normalised value

Protection - Grid monitoring and reconnection time

Trip Tests		G98/1		Setting		Measures Values		Verification
Function		Magnitude	Time	Magnitude	Time	Magnitude	Time	
Undervoltage		184 V	2,5 s	184 V	2,5 s	182,232 V	2,63 s	✓
Overvoltage stage 1		262,2 V	1 s	262,2 V	1 s	262,813 V	1,14 s	✓
Overvoltage stage 2		273,7 V	0,5 s	273,7 V	0,5 s	274,378 V	0,64 s	✓
Underfrequency stage 1		47,5 Hz	20 s	47,5 Hz	20 s	47,45 Hz	20,2 s	✓
Underfrequency stage 2		47 Hz	0,5 s	47 Hz	0,5 s	46,95 Hz	0,67 s	✓
Overfrequency		52 Hz	0,5 s	52 Hz	0,5 s	52,05 Hz	0,67 s	✓

No trip test	G98/1		Verification
	Magnitude	Time	
U/V 1	188 V	5,0 s	✓
U/V 2	180 V	2,45 s	✓
O/V 1	258,2 V	5,0 s	✓
O/V 2	269,7 V	0,95 s	✓
O/V 3	277,7 V	0,45 s	✓

No trip test	G98/1		Verification
	Magnitude	Time	
U/F 1	47,7 Hz	30 s	✓
U/F 2	47,2 Hz	19,5 s	✓
U/F 3	46,8 Hz	0,45 s	✓
O/F 1	51,8 Hz	120 s	✓
O/F 2	52,2 Hz	0,45 s	✓

Reconnection time			
Limit	Setting	MV	Verification
20 s	20 s	35,59 s	✓

No reconnection			
At 266,2 V	At 180 V	At 47,4 Hz	At 52,1 Hz
✓	✓	✓	✓



Protection - Loss of mains

Loss of mains test according to the BS EN 62116						
Test power and imbalance	28 % -5%Q (Test 22)	58 % -5%Q (Test 12)	100 % -5%P (Test 5)	28 % +5%Q (Test 31)	58 % +5%Q (Test 21)	100 % +5%P (Test 10)
Trip time limit (s)	0,5	0,5	0,5	0,5	0,5	0,5
Measured Value L1 (s)	0,165	0,159	0,215	0,169	0,165	0,243
Measured Value L1L2L3 (s)*	0	0	0	0	0	0
Verification	✓	✓	✓	✓	✓	✓

* Only applicable to three phase inverters

Frequency change - Stability test				
	Start frequency	Change	End frequency	Verification
Positive vector shift	49,0 Hz	+50 degrees	N/A	✓
Negative vector shift	50,0 Hz	-50 degrees	N/A	✓
Positive frequency drift	49 Hz	+0,95 Hz/s	51 Hz	✓
Negative frequency drift	51 Hz	-0,95 Hz/s	49 Hz	✓

Behavior in case of frequency changes

Over-frequency test								
Frequency	P > 80%				P 40% - 60%			
	PDC	P (W)	Gradient	Verification	PDC	P (W)	Gradient	Verification
50 Hz	3480	3292	N/A	✓	1730	1643	N/A	✓
50,45 Hz	3480	3140	N/A	✓	1730	1585	N/A	✓
50,70 Hz	3480	2975	-21,02%	✓	3480	1503	-20,69%	✓
51,15 Hz	3480	2682	-20,74%	✓	3480	1361	-19,91%	✓
50,70 Hz	3480	2962	19,82%	✓	3480	1500	19,49%	✓
50,45 Hz	3480	3122	20,38%	✓	3480	1580	20,19%	✓
50 Hz	3480	3291	N/A	✓	3480	1640	N/A	✓

Under-frequency test				
Frequency	P = P _n			
	PDC	P (W)	Gradient	Verification
50,00 Hz	3480	3297	N/A	✓
49,55 Hz	3480	3283	N/A	✓
47,55 Hz	3480	3285	-0,06%	✓

Various requirements

Fault level contribution		
Time after fault	Voltage (V)	Current (A)
< 50 ms	230,35	15,07
100 ms	12,73	0,02
250 ms	11,32	0,02
500 ms	11,76	0,02
Time to Trip	0,01	in seconds

Self monitoring - solid state switching
Not applicable as electro-mechanical relays are used

Active power curtailment
A Modbus signal can be used to cease Active Power output within 5 s

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