Certificate of compliance

Applicant:	**SMA Solar Technology AG** Sonnenallee 1 34266 Niestetal **Germany**
Product:	**Battery Inverter**
Model:	**STPS30-20** **STPS50-20** **SI30-20** **SI50-20**

Use in accordance with regulations:

Automatic disconnection device with three-phase mains surveillance in accordance with Engineering Recommendation G99/1 for systems with a three-phase parallel coupling via an inverter in the public mains supply. The automatic disconnection device is an integral part of the aforementioned inverter. This serves as a replacement for the disconnection device with isolating function, which can be accessed the distribution network provider at any time.

Applied rules and standards:

Engineering Recommendation G99/1-9:2022
Requirements for the connection of generation equipment in parallel with public distribution networks

DIN V VDE V 0126-1-1:2006 (4.1 Functional safety)
Automatic disconnection device between a generator and the public low-voltage grid

At the time of issue of this certificate the safety concept of an aforementioned representative product corresponds to the valid safety specifications for the specified use in accordance with regulations.

Report number:	**22TH0488-G99-1_0**	**Certification program:**	**NSOP-0032-DEU-ZE-V01**
Certificate number:	**U24-0173**	**Date of issue:**	**2024-03-20**

Certification body

Domenik Koll
Head of Energy Systems

DAkkS Deutsche Akkreditierungsstelle D-ZE-12024-01-00

Certification body Bureau Veritas Consumer Products Services Germany GmbH accredited according to DIN EN ISO/IEC 17065

Testing laboratory accredited according to DIN EN ISO/IEC 17025

A partial representation of the certificate requires the written approval of Bureau Veritas Consumer Products Services Germany GmbH

Appendix A2-3 Compliance Verification Report for Inverter Connected Power Generating Modules

Extract from test report according to the Engineering Recommendation G99 **Nr. 22TH0488-G99-1_0**

Type Approval and declaration of compliance with the requirements of Engineering Recommendation G99.				
PGM Technology:	Battery Inverter			
Manufacturer / applicant:	SMA Solar Technology AG			
Address:	Sonnenallee 1 34266 Niestetal Germany			
Tel	+49 5619522-0	**Fax:**	+49 5619522-100	
Email:	info@SMA.de	**Website:**	www.SMA.de	
Rated values	STPS30-20	STPS50-20	SI30-20	SI50-20
Input DC voltage range [V]	200 - 980	200 - 980	200 - 980	200 - 980
Input DC current [A]	150	150	150	150
Output AC voltage [V]	400	400	400	400
Output AC current [A]	45,6	75,5	45,6	75,5
Output power [VA]	30000	50000	30000	50000
Firmware version	03.00.39.R			
Description of the structure of the power generation unit: The power generation unit is equipped with a DC and line-side EMC filter. The power generation unit has no galvanic isolation between DC input and AC output. Output switch-off is performed with single-fault tolerance based on two series-connected relays in (each) line and neutral. This enables a safe disconnection of the power generation unit from the network in case of error.				
Differences between Generating Units: The SMA battery inverter model “STPS50-20” has been selected by the applicant as the representative type for testing for the inverter series STPSxx-20 / SIxx-20 (STPS50-20, STPS30-20, SI50-20 and SI30-20). According to the applicant the STPSxx-20 and SIxx-20 share the same hardware concept, topology and the same software platform, only difference among the models is the maximum power, such as 50kVA and 30kVA, which is reduced by software.				
The above stated Generating Units are tested according the requirements in the Engineering Recommendation G99/1. Any modification that affects the stated tests must be named by the manufacturer/supplier of the product to ensure that the product meets all requirements of the Engineering Recommendation G99/1.				

Appendix A2-3 Compliance Verification Report for Inverter Connected Power Generating Modules

Extract from test report according to the Engineering Recommendation G99 **Nr. 22TH0488-G99-1_0**

Operating Range.	
Test 1	Voltage = 85% of nominal (195,5 V) Frequency = 47 Hz Power Factor = 1 Period of test 20 s
Connection:	Always connected
Limit:	Always connected
Test 2	Voltage = 85% of nominal (195,5 V) Frequency = 47,5 Hz Power Factor = 1 Period of test 90 minutes
Connection:	Always connected
Limit:	Always connected
Test 3	Voltage = 110% of nominal (253,0 V) Frequency = 51,5 Hz Power Factor = 1 Period of test 90 minutes
Connection:	Always connected
Limit:	Always connected
Test 4	Voltage = 110% of nominal (253,0 V) Frequency = 52,0 Hz Power Factor = 1 Period of test 15 minutes
Connection:	Always connected
Limit:	Always connected
Test 5	Voltage = 100% of nominal (230,0 V) Frequency = 50,0 Hz Power Factor = 1 Period of test 90 minutes
Connection:	Always connected
Limit:	Always connected
Test 6	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.
Connection:	Always connected
Limit:	Always connected

Appendix A2-3 Compliance Verification Report for Inverter Connected Power Generating Modules

Extract from test report according to the Engineering Recommendation G99 **Nr. 22TH0488-G99-1_0**

Protection. Voltage tests.						
Phase 1						
Function	**Setting**		**Trip test**		**No trip test**	
	Voltage [V]	**Time delay [s]**	**Voltage [V]**	**Time delay [s]**	**Voltage / time**	**Confirm no trip**
U/V	184	2,5	183,7	2,517	188 V / 5,0 s	No trip
					180 V / 2,45 s	No trip
O/V stage 1	262,2	1,0	264,5	1,021	258,2 V 5,0 s	No trip
O/V stage 2	273,7	0,5	276,1	0,520	269,7 V 0,95 s	No trip
					277,7V 0,45 s	No trip

Protection. Voltage tests.						
Phase 2						
Function	**Setting**		**Trip test**		**No trip test**	
	Voltage [V]	**Time delay [s]**	**Voltage [V]**	**Time delay [s]**	**Voltage / time**	**Confirm no trip**
U/V	184	2,5	184,9	2,530	188 V / 5,0 s	No trip
					180 V / 2,45 s	No trip
O/V stage 1	262,2	1,0	264,6	1,018	258,2 V 5,0 s	No trip
O/V stage 2	273,7	0,5	276,1	0,520	269,7 V 0,95s	No trip
					277,7 V 0,45 s	No trip

Appendix A2-3 Compliance Verification Report for Inverter Connected Power Generating Modules

Extract from test report according to the Engineering Recommendation G99 **Nr. 22TH0488-G99-1_0**

Protection. Voltage tests.

Phase 3

Function	Setting		Trip test		No trip test	
	Voltage [V]	Time delay [s]	Voltage [V]	Time delay [s]	Voltage / time	Confirm no trip
U/V	184	2,5	184,9	2,531	188 V / 5,0 s	No trip
					180 V / 2,45 s	No trip
O/V stage 1	262,2	1,0	264,6	1,016	258,2 V 5,0 s	No trip
O/V stage 2	273,7	0,5	276,2	0,516	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 ±3,45V. 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 ±4V and for the relevant times as shown in the table above to ensure that the protection will not trip in error.

Protection. Frequency tests.

Function	Setting		Trip test		No trip test	
	Frequency [Hz]	Time delay [s]	Frequency [Hz]	Time delay [s]	Frequency / time	Confirm no trip
U/F stage 1	47,5	20	47,45	20,073	47,7 Hz / 30 s	No trip
U/F stage 2	47	0,5	47,00	0,579	47,2 Hz / 19,5 s	No trip
					46,8 Hz / 0,45 s	No trip
O/F stage 2	52	0,5	52,05	0,580	51,8 Hz / 120 s	No trip
					52,2 Hz / 0,45 s	No trip

Note. For Frequency Trip tests the Frequency required to trip is the setting ±0,1Hz. 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 ±0,2Hz and for the relevant times as shown in the table above to ensure that the protection will not trip in error.

Appendix A2-3 Compliance Verification Report for Inverter Connected Power Generating Modules

Extract from test report according to the Engineering Recommendation G99 **Nr. 22TH0488-G99-1_0**

Protection. Loss of Mains.						
Inverters tested according to BS EN 62116.						
Balancing load on islanded network	33% of -5% Q Test 22	66% of -5% Q Test 12	100% of -5% P Test 5	33% of +5% Q Test 31	66% of +5% Q Test 21	100% of +5% P Test 10
Trip time. Ph1 fuse removed [s]	0,369	0,357	0,416	0,412	0,401	0,434
Note. Trip time limit is 0,5s.						

Protection. Re-connection timer.	
Test should prove that the reconnection sequence starts in no less than 20 seconds for restoration of voltage and frequency to within the stage 1 settings of table 10.1.	
Over Voltage	
Time delay setting	**Measured delay**
20 s	86,95
Under Voltage	
Time delay setting	**Measured delay**
20 s	86,89
Over Frequency	
Time delay setting	**Measured delay**
20 s	86,51
Under Frequency	
Time delay setting	**Measured delay**
20 s	85,51

	Checks on no reconnection when voltage or frequency is brought to just outside stage 1 limits of table 1.			
	At 266,2 V	At 180,0 V	At 47,4 Hz	At 52,1 Hz
Confirmation that the Generating Unit does not re-connect.	No reconnection	No reconnection	No reconnection	No reconnection

Protection. Frequency change, Stability test.				
	Start Frequency [Hz]	**Change**	**Test Duration**	**Confirm no trip**
Positive Vector Shift	49,5	+50 degrees		No trip
Negative Vector Shift	50,5	-50 degrees		No trip
Positive Frequency drift	49,0 to 51,0	+0,95Hz/sec	2,1s	No trip
Negative Frequency drift	51,0 to 49,0	-0,95Hz/sec	2,1s	No trip

Appendix A2-3 Compliance Verification Report for Inverter Connected Power Generating Modules

Extract from test report according to the Engineering Recommendation G99 — **Nr. 22TH0488-G99-1_0**

Limited Frequency Sensitive Mode – Over Frequency							
1-min mean value [Hz]:	**a) 50,00**	**b) 50,45**	**c) 50,70**	**d) 51,15**	**e) 50,70**	**f) 50,45**	**g) 50,00**
1. Measurement a) to g): Active power output > 80% Pn							
Frequency [Hz]:	50,00	50,45	50,70	51,15	50,70	50,45	50,00
$P_{expected}$ [kW]:	50392	49887	47387	42887	47387	49887	50392
$P_{measured}$ [kW]:	50392	49889	47370	42837	47369	49886	50392
2. Measurement a) to g): Active power output 40% and 60% Pn							
Frequency [Hz]:	50,00	50,45	50,70	51,15	50,70	50,45	50,00
$P_{expected}$ [kW]:	25448	24942	25252	17942	22442	24942	N/A
$P_{measured}$ [kW]:	25448	24952	22431	17892	22432	24953	N/A

Appendix A2-3 Compliance Verification Report for Inverter Connected Power Generating Modules

Extract from test report according to the Engineering Recommendation G99 — **Nr. 22TH0488-G99-1_0**

Power Quality. Harmonics.

Phase 1

Testconditions:

dut = STPS 50-20; phase = L1; voltage = 230.00 V; frequency = 50 Hz; test duration = 180 s;

standard = G99 Issue 1; DC voltage = 750 V; power factor = 1u; power stage = 100 %

Order	Maximum	Window	Limits*1.5 [A]	Result	Average	Limits [A]*	Result
DC	0.0740	606	---	---	0.0670	---	ok
1	73.0270	300	---	---	73.0180	---	ok
2	0.1390	607	8.7620	---	0.1220	5.8410	ok
3	0.0420	500	5.4760	---	0.0360	3.6510	ok
4	0.0590	153	4.3810	---	0.0470	2.9210	ok
5	0.0490	350	11.7190	---	0.0460	7.8130	ok
6	0.0260	288	2.9210	---	0.0200	1.9470	ok
7	0.0420	894	7.8860	---	0.0400	5.2570	ok
8	0.0250	635	2.1910	---	0.0220	1.4600	ok
9	0.2520	652	5.4760	---	0.2450	3.6510	ok
10	0.0210	461	1.7520	---	0.0190	1.1680	ok
11	0.3160	345	3.3950	---	0.3120	2.2640	ok
12	0.0090	671	1.4600	---	0.0080	0.9740	ok
13	0.1740	210	2.1910	---	0.1710	1.4600	ok
14	0.0050	604	1.2520	---	0.0040	0.8340	ok
15	0.0690	808	1.0950	---	0.0660	0.7300	ok
16	0.0050	230	1.0950	---	0.0040	0.7300	ok
17	0.0610	269	1.0950	---	0.0590	0.7300	ok
18	0.0060	773	1.0950	---	0.0050	0.7300	ok
19	0.0970	127	1.0950	---	0.0650	0.7300	ok
20	0.0040	832	1.0950	---	0.0030	0.7300	ok
21	0.0770	401	1.0950	---	0.0510	0.7300	ok
22	0.0030	756	1.0950	---	0.0030	0.7300	ok
23	0.0500	165	1.0950	---	0.0490	0.7300	ok
24	0.0040	809	1.0950	---	0.0030	0.7300	ok
25	0.0480	423	1.0950	---	0.0470	0.7300	ok
26	0.0030	800	1.0950	---	0.0020	0.7300	ok
27	0.0280	252	1.0950	---	0.0270	0.7300	ok
28	0.0030	206	1.0950	---	0.0020	0.7300	ok
29	0.0310	352	1.0950	---	0.0300	0.7300	ok
30	0.0030	333	1.0950	---	0.0020	0.7300	ok
31	0.0210	803	1.0950	---	0.0200	0.7300	ok
32	0.0020	575	1.0950	---	0.0020	0.7300	ok
33	0.0120	378	1.0950	---	0.0120	0.7300	ok
34	0.0020	368	1.0950	---	0.0020	0.7300	ok
35	0.0200	701	1.0950	---	0.0200	0.7300	ok
36	0.0020	332	1.0950	---	0.0020	0.7300	ok
37	0.0240	420	1.0950	---	0.0230	0.7300	ok
38	0.0020	690	1.0950	---	0.0010	0.7300	ok
39	0.0290	98	1.0950	---	0.0200	0.7300	ok
40	0.0020	440	1.0950	---	0.0010	0.7300	ok

* limits at minimum Rsce = 33

Appendix A2-3 Compliance Verification Report for Inverter Connected Power Generating Modules

Extract from test report according to the Engineering Recommendation G99 **Nr. 22TH0488-G99-1_0**

Power Quality. Harmonics.

Phase 2

Testconditions:

dut = STPS 50-20; phase = L2; voltage = 230.00 V; frequency = 50 Hz; test duration = 180 s;

standard = G99 Issue 1; DC voltage = 750 V; power factor = 1u; power stage = 100 %

Order	Maximum	Window	Limits*1.5 [A]	Result	Average	Limits [A]*	Result
DC	0.0740	606	---	---	0.0670	---	ok
1	73.0290	301	---	---	73.0190	---	ok
2	0.0970	863	8.7620	---	0.0820	5.8420	ok
3	0.0360	133	5.4760	---	0.0310	3.6510	ok
4	0.0880	637	4.3810	---	0.0730	2.9210	ok
5	0.0510	770	11.7200	---	0.0480	7.8130	ok
6	0.0470	23	2.9210	---	0.0370	1.9470	ok
7	0.0490	690	7.8860	---	0.0450	5.2570	ok
8	0.0400	472	2.1910	---	0.0350	1.4600	ok
9	0.2700	748	5.4760	---	0.2620	3.6510	ok
10	0.0220	294	1.7520	---	0.0190	1.1680	ok
11	0.3110	84	3.3950	---	0.3060	2.2640	ok
12	0.0120	792	1.4600	---	0.0100	0.9740	ok
13	0.1970	418	2.1910	---	0.1940	1.4600	ok
14	0.0060	13	1.2520	---	0.0040	0.8350	ok
15	0.0700	115	1.0950	---	0.0670	0.7300	ok
16	0.0070	438	1.0950	---	0.0060	0.7300	ok
17	0.0600	29	1.0950	---	0.0570	0.7300	ok
18	0.0060	119	1.0950	---	0.0050	0.7300	ok
19	0.1000	268	1.0950	---	0.0620	0.7300	ok
20	0.0060	879	1.0950	---	0.0050	0.7300	ok
21	0.0780	102	1.0950	---	0.0540	0.7300	ok
22	0.0050	500	1.0950	---	0.0040	0.7300	ok
23	0.0500	353	1.0950	---	0.0480	0.7300	ok
24	0.0030	650	1.0950	---	0.0020	0.7300	ok
25	0.0530	85	1.0950	---	0.0510	0.7300	ok
26	0.0030	348	1.0950	---	0.0020	0.7300	ok
27	0.0280	440	1.0950	---	0.0270	0.7300	ok
28	0.0030	853	1.0950	---	0.0020	0.7300	ok
29	0.0310	84	1.0950	---	0.0300	0.7300	ok
30	0.0030	335	1.0950	---	0.0020	0.7300	ok
31	0.0240	803	1.0950	---	0.0230	0.7300	ok
32	0.0030	180	1.0950	---	0.0020	0.7300	ok
33	0.0130	543	1.0950	---	0.0120	0.7300	ok
34	0.0020	747	1.0950	---	0.0020	0.7300	ok
35	0.0200	46	1.0950	---	0.0190	0.7300	ok
36	0.0020	257	1.0950	---	0.0010	0.7300	ok
37	0.0260	349	1.0950	---	0.0250	0.7300	ok
38	0.0020	308	1.0950	---	0.0010	0.7300	ok
39	0.0280	455	1.0950	---	0.0190	0.7300	ok
40	0.0020	412	1.0950	---	0.0010	0.7300	ok

* limits at minimum Rsce = 33

Appendix A2-3 Compliance Verification Report for Inverter Connected Power Generating Modules

Extract from test report according to the Engineering Recommendation G99 — **Nr. 22TH0488-G99-1_0**

Power Quality. Harmonics.

Phase 3

Testconditions:

dut = STPS 50-20; phase = L3; voltage = 230.00 V; frequency = 50 Hz; test duration = 180 s;

standard = G99 Issue 1; DC voltage = 750 V; power factor = 1u; power stage = 100 %

Order	Maximum	Window	Limits*1.5 [A]	Result	Average	Limits [A]*	Result
DC	0.0740	606	---	---	0.0670	---	ok
1	73.0440	300	---	---	73.0350	---	ok
2	0.1340	37	8.7640	---	0.1190	5.8430	ok
3	0.0510	84	5.4780	---	0.0450	3.6520	ok
4	0.0530	810	4.3820	---	0.0460	2.9210	ok
5	0.0420	81	11.7220	---	0.0380	7.8150	ok
6	0.0280	50	2.9210	---	0.0200	1.9480	ok
7	0.0540	92	7.8880	---	0.0510	5.2580	ok
8	0.0310	861	2.1910	---	0.0270	1.4610	ok
9	0.2780	854	5.4780	---	0.2680	3.6520	ok
10	0.0160	557	1.7530	---	0.0140	1.1690	ok
11	0.3140	79	3.3960	---	0.3100	2.2640	ok
12	0.0110	479	1.4610	---	0.0090	0.9740	ok
13	0.1790	865	2.1910	---	0.1750	1.4610	ok
14	0.0050	678	1.2520	---	0.0040	0.8350	ok
15	0.0740	691	1.0960	---	0.0710	0.7300	ok
16	0.0060	271	1.0960	---	0.0050	0.7300	ok
17	0.0600	130	1.0960	---	0.0570	0.7300	ok
18	0.0070	183	1.0960	---	0.0060	0.7300	ok
19	0.0980	797	1.0960	---	0.0640	0.7300	ok
20	0.0060	593	1.0960	---	0.0050	0.7300	ok
21	0.0810	676	1.0960	---	0.0490	0.7300	ok
22	0.0030	233	1.0960	---	0.0030	0.7300	ok
23	0.0500	21	1.0960	---	0.0490	0.7300	ok
24	0.0040	849	1.0960	---	0.0030	0.7300	ok
25	0.0500	665	1.0960	---	0.0490	0.7300	ok
26	0.0020	108	1.0960	---	0.0020	0.7300	ok
27	0.0320	539	1.0960	---	0.0300	0.7300	ok
28	0.0030	253	1.0960	---	0.0020	0.7300	ok
29	0.0310	665	1.0960	---	0.0310	0.7300	ok
30	0.0040	344	1.0960	---	0.0030	0.7300	ok
31	0.0210	887	1.0960	---	0.0200	0.7300	ok
32	0.0030	843	1.0960	---	0.0020	0.7300	ok
33	0.0140	682	1.0960	---	0.0130	0.7300	ok
34	0.0020	82	1.0960	---	0.0020	0.7300	ok
35	0.0200	181	1.0960	---	0.0190	0.7300	ok
36	0.0030	335	1.0960	---	0.0020	0.7300	ok
37	0.0250	298	1.0960	---	0.0240	0.7300	ok
38	0.0020	796	1.0960	---	0.0010	0.7300	ok
39	0.0300	176	1.0960	---	0.0200	0.7300	ok
40	0.0020	514	1.0960	---	0.0010	0.7300	ok

* limits at minimum Rsce = 33

Appendix A2-3 Compliance Verification Report for Inverter Connected Power Generating Modules

Extract from test report according to the Engineering Recommendation G99 — **Nr. 22TH0488-G99-1_0**

Power Quality. Harmonics.

Phase 1

Testconditions:

dut = STPS 50-20; phase = L1; voltage = 230.00 V; frequency = 50 Hz; test duration = 180 s;

standard = G99 Issue 1; DC voltage = 750 V; power factor = 1u; power stage = 50 %

Order	Maximum	Window	Limits*1.5 [A]	Result	Average	Limits [A]*	Result
DC	0.0300	92	---	---	0.0250	---	ok
1	36.5190	21	---	---	36.5140	---	ok
2	0.0880	634	8.7620	---	0.0790	5.8410	ok
3	0.0280	289	5.4760	---	0.0220	3.6510	ok
4	0.0380	655	4.3810	---	0.0320	2.9210	ok
5	0.0420	35	11.7190	---	0.0390	7.8130	ok
6	0.0280	152	2.9210	---	0.0240	1.9470	ok
7	0.0350	215	7.8860	---	0.0320	5.2570	ok
8	0.0220	339	2.1910	---	0.0190	1.4600	ok
9	0.1680	96	5.4760	---	0.1590	3.6510	ok
10	0.0190	495	1.7520	---	0.0170	1.1680	ok
11	0.2460	383	3.3950	---	0.2430	2.2640	ok
12	0.0090	497	1.4600	---	0.0070	0.9740	ok
13	0.1340	464	2.1910	---	0.1320	1.4600	ok
14	0.0060	512	1.2520	---	0.0050	0.8340	ok
15	0.0440	571	1.0950	---	0.0390	0.7300	ok
16	0.0040	615	1.0950	---	0.0030	0.7300	ok
17	0.0400	51	1.0950	---	0.0380	0.7300	ok
18	0.0060	437	1.0950	---	0.0050	0.7300	ok
19	0.0990	334	1.0950	---	0.0620	0.7300	ok
20	0.0030	435	1.0950	---	0.0020	0.7300	ok
21	0.0750	192	1.0950	---	0.0490	0.7300	ok
22	0.0030	766	1.0950	---	0.0030	0.7300	ok
23	0.0470	382	1.0950	---	0.0460	0.7300	ok
24	0.0030	888	1.0950	---	0.0030	0.7300	ok
25	0.0370	561	1.0950	---	0.0360	0.7300	ok
26	0.0020	21	1.0950	---	0.0020	0.7300	ok
27	0.0240	514	1.0950	---	0.0230	0.7300	ok
28	0.0020	246	1.0950	---	0.0020	0.7300	ok
29	0.0250	162	1.0950	---	0.0240	0.7300	ok
30	0.0030	445	1.0950	---	0.0020	0.7300	ok
31	0.0160	570	1.0950	---	0.0150	0.7300	ok
32	0.0020	342	1.0950	---	0.0020	0.7300	ok
33	0.0070	852	1.0950	---	0.0060	0.7300	ok
34	0.0020	128	1.0950	---	0.0020	0.7300	ok
35	0.0080	547	1.0950	---	0.0070	0.7300	ok
36	0.0020	426	1.0950	---	0.0020	0.7300	ok
37	0.0100	144	1.0950	---	0.0090	0.7300	ok
38	0.0010	762	1.0950	---	0.0010	0.7300	ok
39	0.0190	500	1.0950	---	0.0120	0.7300	ok
40	0.0020	780	1.0950	---	0.0010	0.7300	ok

* limits at minimum Rsce = 33

Appendix A2-3 Compliance Verification Report for Inverter Connected Power Generating Modules

Extract from test report according to the Engineering Recommendation G99 — **Nr. 22TH0488-G99-1_0**

Power Quality. Harmonics.

Phase 2

Testconditions:

dut = STPS 50-20; phase = L2; voltage = 230.00 V; frequency = 50 Hz; test duration = 180 s;

standard = G99 Issue 1; DC voltage = 750 V; power factor = 1u; power stage = 50 %

Order	Maximum	Window	Limits*1.5 [A]	Result	Average	Limits [A]*	Result
DC	0.0300	92	---	---	0.0250	---	ok
1	36.5200	20	---	---	36.5160	---	ok
2	0.0680	240	8.7620	---	0.0590	5.8420	ok
3	0.0250	25	5.4760	---	0.0190	3.6510	ok
4	0.0590	24	4.3810	---	0.0490	2.9210	ok
5	0.0440	215	11.7200	---	0.0410	7.8130	ok
6	0.0350	366	2.9210	---	0.0290	1.9470	ok
7	0.0350	81	7.8860	---	0.0310	5.2570	ok
8	0.0250	333	2.1910	---	0.0220	1.4600	ok
9	0.1640	872	5.4760	---	0.1550	3.6510	ok
10	0.0180	516	1.7520	---	0.0150	1.1680	ok
11	0.2430	81	3.3950	---	0.2390	2.2640	ok
12	0.0130	525	1.4600	---	0.0120	0.9740	ok
13	0.1450	183	2.1910	---	0.1410	1.4600	ok
14	0.0060	774	1.2520	---	0.0050	0.8350	ok
15	0.0500	650	1.0950	---	0.0440	0.7300	ok
16	0.0040	546	1.0950	---	0.0030	0.7300	ok
17	0.0360	262	1.0950	---	0.0340	0.7300	ok
18	0.0040	336	1.0950	---	0.0040	0.7300	ok
19	0.1010	876	1.0950	---	0.0660	0.7300	ok
20	0.0050	83	1.0950	---	0.0040	0.7300	ok
21	0.0740	302	1.0950	---	0.0470	0.7300	ok
22	0.0050	31	1.0950	---	0.0040	0.7300	ok
23	0.0470	152	1.0950	---	0.0460	0.7300	ok
24	0.0030	583	1.0950	---	0.0030	0.7300	ok
25	0.0400	554	1.0950	---	0.0390	0.7300	ok
26	0.0030	612	1.0950	---	0.0020	0.7300	ok
27	0.0250	649	1.0950	---	0.0230	0.7300	ok
28	0.0030	127	1.0950	---	0.0030	0.7300	ok
29	0.0250	584	1.0950	---	0.0240	0.7300	ok
30	0.0020	463	1.0950	---	0.0020	0.7300	ok
31	0.0170	263	1.0950	---	0.0160	0.7300	ok
32	0.0030	714	1.0950	---	0.0020	0.7300	ok
33	0.0080	605	1.0950	---	0.0080	0.7300	ok
34	0.0020	708	1.0950	---	0.0010	0.7300	ok
35	0.0080	286	1.0950	---	0.0070	0.7300	ok
36	0.0020	686	1.0950	---	0.0010	0.7300	ok
37	0.0100	594	1.0950	---	0.0090	0.7300	ok
38	0.0010	327	1.0950	---	0.0010	0.7300	ok
39	0.0190	204	1.0950	---	0.0120	0.7300	ok
40	0.0010	790	1.0950	---	0.0010	0.7300	ok

* limits at minimum Rsce = 33

Appendix A2-3 Compliance Verification Report for Inverter Connected Power Generating Modules

Extract from test report according to the Engineering Recommendation G99 — **Nr. 22TH0488-G99-1_0**

Power Quality. Harmonics.

Phase 3

Testconditions:

dut = STPS 50-20; phase = L3; voltage = 230.00 V; frequency = 50 Hz; test duration = 180 s;

standard = G99 Issue 1; DC voltage = 750 V; power factor = 1u; power stage = 50 %

Order	Maximum	Window	Limits*1.5 [A]	Result	Average	Limits [A]*	Result
DC	0.0300	92	---	---	0.0250	---	ok
1	36.5050	19	---	---	36.5010	---	ok
2	0.0870	59	8.7640	---	0.0780	5.8430	ok
3	0.0380	113	5.4780	---	0.0330	3.6520	ok
4	0.0410	579	4.3820	---	0.0370	2.9210	ok
5	0.0430	760	11.7220	---	0.0400	7.8150	ok
6	0.0150	52	2.9210	---	0.0110	1.9480	ok
7	0.0280	697	7.8880	---	0.0250	5.2580	ok
8	0.0180	859	2.1910	---	0.0160	1.4610	ok
9	0.1640	874	5.4780	---	0.1550	3.6520	ok
10	0.0150	543	1.7530	---	0.0130	1.1690	ok
11	0.2380	696	3.3960	---	0.2350	2.2640	ok
12	0.0090	508	1.4610	---	0.0070	0.9740	ok
13	0.1330	192	2.1910	---	0.1300	1.4610	ok
14	0.0060	809	1.2520	---	0.0050	0.8350	ok
15	0.0500	293	1.0960	---	0.0450	0.7300	ok
16	0.0050	635	1.0960	---	0.0040	0.7300	ok
17	0.0350	321	1.0960	---	0.0340	0.7300	ok
18	0.0040	371	1.0960	---	0.0040	0.7300	ok
19	0.0980	178	1.0960	---	0.0620	0.7300	ok
20	0.0040	854	1.0960	---	0.0030	0.7300	ok
21	0.0740	462	1.0960	---	0.0490	0.7300	ok
22	0.0030	889	1.0960	---	0.0030	0.7300	ok
23	0.0460	286	1.0960	---	0.0450	0.7300	ok
24	0.0020	643	1.0960	---	0.0020	0.7300	ok
25	0.0380	265	1.0960	---	0.0370	0.7300	ok
26	0.0030	479	1.0960	---	0.0020	0.7300	ok
27	0.0260	396	1.0960	---	0.0250	0.7300	ok
28	0.0030	238	1.0960	---	0.0020	0.7300	ok
29	0.0250	706	1.0960	---	0.0240	0.7300	ok
30	0.0030	769	1.0960	---	0.0020	0.7300	ok
31	0.0150	294	1.0960	---	0.0140	0.7300	ok
32	0.0020	622	1.0960	---	0.0020	0.7300	ok
33	0.0080	330	1.0960	---	0.0070	0.7300	ok
34	0.0020	430	1.0960	---	0.0010	0.7300	ok
35	0.0080	814	1.0960	---	0.0070	0.7300	ok
36	0.0020	357	1.0960	---	0.0010	0.7300	ok
37	0.0100	828	1.0960	---	0.0090	0.7300	ok
38	0.0010	663	1.0960	---	0.0010	0.7300	ok
39	0.0190	366	1.0960	---	0.0110	0.7300	ok
40	0.0010	518	1.0960	---	0.0010	0.7300	ok

* limits at minimum Rsce = 33

Appendix A2-3 Compliance Verification Report for Inverter Connected Power Generating Modules

Extract from test report according to the Engineering Recommendation G99 — **Nr. 22TH0488-G99-1_0**

Power Quality. Harmonics.

Phase 1

Testconditions:

dut = STPS 30-20; phase = L1; voltage = 230.00 V; frequency = 50 Hz; test duration = 180 s;

standard = G99 Issue 1; DC voltage = 750 V; power factor = 1u; power stage = 100 %

Order	Maximum	Window	Limits*1.5 [A]	Result	Average	Limits [A]*	Result
DC	0.0430	782	---	---	0.0390	---	ok
1	43.8250	88	---	---	43.8190	---	ok
2	0.0960	285	5.2580	---	0.0850	3.5060	ok
3	0.0390	672	3.2860	---	0.0320	2.1910	ok
4	0.0390	623	2.6290	---	0.0310	1.7530	ok
5	0.0440	604	7.0330	---	0.0410	4.6890	ok
6	0.0270	760	1.7530	---	0.0210	1.1690	ok
7	0.0410	475	4.7320	---	0.0390	3.1550	ok
8	0.0240	431	1.3150	---	0.0210	0.8760	ok
9	0.1750	200	3.2860	---	0.1710	2.1910	ok
10	0.0180	126	1.0520	---	0.0170	0.7010	ok
11	0.1960	163	2.0380	---	0.1930	1.3580	ok
12	0.0090	717	0.8760	---	0.0080	0.5840	ok
13	0.1250	14	1.3150	---	0.1230	0.8760	ok
14	0.0050	437	0.7510	---	0.0040	0.5010	ok
15	0.0480	210	0.6570	---	0.0460	0.4380	ok
16	0.0040	248	0.6570	---	0.0030	0.4380	ok
17	0.0560	103	0.6570	---	0.0540	0.4380	ok
18	0.0050	108	0.6570	---	0.0040	0.4380	ok
19	0.0940	388	0.6570	---	0.0600	0.4380	ok
20	0.0040	141	0.6570	---	0.0040	0.4380	ok
21	0.0710	215	0.6570	---	0.0470	0.4380	ok
22	0.0030	441	0.6570	---	0.0030	0.4380	ok
23	0.0440	18	0.6570	---	0.0430	0.4380	ok
24	0.0030	485	0.6570	---	0.0020	0.4380	ok
25	0.0390	185	0.6570	---	0.0380	0.4380	ok
26	0.0020	105	0.6570	---	0.0020	0.4380	ok
27	0.0260	70	0.6570	---	0.0240	0.4380	ok
28	0.0020	12	0.6570	---	0.0020	0.4380	ok
29	0.0270	49	0.6570	---	0.0260	0.4380	ok
30	0.0020	581	0.6570	---	0.0020	0.4380	ok
31	0.0180	49	0.6570	---	0.0170	0.4380	ok
32	0.0020	638	0.6570	---	0.0020	0.4380	ok
33	0.0090	527	0.6570	---	0.0080	0.4380	ok
34	0.0020	419	0.6570	---	0.0020	0.4380	ok
35	0.0120	630	0.6570	---	0.0120	0.4380	ok
36	0.0020	390	0.6570	---	0.0010	0.4380	ok
37	0.0150	201	0.6570	---	0.0140	0.4380	ok
38	0.0020	764	0.6570	---	0.0010	0.4380	ok
39	0.0220	114	0.6570	---	0.0140	0.4380	ok
40	0.0020	105	0.6570	---	0.0010	0.4380	ok

* limits at minimum Rsce = 33

Appendix A2-3 Compliance Verification Report for Inverter Connected Power Generating Modules

Extract from test report according to the Engineering Recommendation G99 — **Nr. 22TH0488-G99-1_0**

Power Quality. Harmonics.

Phase 2

Testconditions:

dut = STPS 30-20; phase = L2; voltage = 230.00 V; frequency = 50 Hz; test duration = 180 s;

standard = G99 Issue 1; DC voltage = 750 V; power factor = 1u; power stage = 100 %

Order	Maximum	Window	Limits*1.5 [A]	Result	Average	Limits [A]*	Result
DC	0.0430	782	---	---	0.0390	---	ok
1	43.8210	87	---	---	43.8170	---	ok
2	0.0680	848	5.2580	---	0.0570	3.5050	ok
3	0.0530	127	3.2860	---	0.0300	2.1910	ok
4	0.0580	477	2.6290	---	0.0500	1.7530	ok
5	0.0470	195	7.0330	---	0.0440	4.6880	ok
6	0.0330	23	1.7530	---	0.0260	1.1680	ok
7	0.0400	140	4.7320	---	0.0380	3.1550	ok
8	0.0300	35	1.3150	---	0.0260	0.8760	ok
9	0.1680	228	3.2860	---	0.1630	2.1910	ok
10	0.0190	515	1.0520	---	0.0170	0.7010	ok
11	0.1950	559	2.0370	---	0.1920	1.3580	ok
12	0.0110	813	0.8760	---	0.0090	0.5840	ok
13	0.1340	167	1.3150	---	0.1320	0.8760	ok
14	0.0060	260	0.7510	---	0.0050	0.5010	ok
15	0.0510	235	0.6570	---	0.0490	0.4380	ok
16	0.0050	677	0.6570	---	0.0040	0.4380	ok
17	0.0530	252	0.6570	---	0.0510	0.4380	ok
18	0.0060	328	0.6570	---	0.0050	0.4380	ok
19	0.0990	48	0.6570	---	0.0650	0.4380	ok
20	0.0040	420	0.6570	---	0.0030	0.4380	ok
21	0.0710	370	0.6570	---	0.0480	0.4380	ok
22	0.0040	404	0.6570	---	0.0030	0.4380	ok
23	0.0450	276	0.6570	---	0.0440	0.4380	ok
24	0.0040	135	0.6570	---	0.0030	0.4380	ok
25	0.0420	348	0.6570	---	0.0410	0.4380	ok
26	0.0020	583	0.6570	---	0.0020	0.4380	ok
27	0.0250	242	0.6570	---	0.0240	0.4380	ok
28	0.0030	704	0.6570	---	0.0020	0.4380	ok
29	0.0260	212	0.6570	---	0.0250	0.4380	ok
30	0.0020	361	0.6570	---	0.0020	0.4380	ok
31	0.0190	199	0.6570	---	0.0180	0.4380	ok
32	0.0020	684	0.6570	---	0.0020	0.4380	ok
33	0.0110	242	0.6570	---	0.0100	0.4380	ok
34	0.0020	180	0.6570	---	0.0020	0.4380	ok
35	0.0120	397	0.6570	---	0.0110	0.4380	ok
36	0.0020	146	0.6570	---	0.0010	0.4380	ok
37	0.0140	218	0.6570	---	0.0140	0.4380	ok
38	0.0020	785	0.6570	---	0.0010	0.4380	ok
39	0.0220	251	0.6570	---	0.0140	0.4380	ok
40	0.0010	790	0.6570	---	0.0010	0.4380	ok

* limits at minimum Rsce = 33

Appendix A2-3 Compliance Verification Report for Inverter Connected Power Generating Modules

Extract from test report according to the Engineering Recommendation G99 — **Nr. 22TH0488-G99-1_0**

Power Quality. Harmonics.

Phase 3

Testconditions:

dut = STPS 30-20; phase = L3; voltage = 230.00 V; frequency = 50 Hz; test duration = 180 s;

standard = G99 Issue 1; DC voltage = 750 V; power factor = 1u; power stage = 100 %

Order	Maximum	Window	Limits*1.5 [A]	Result	Average	Limits [A]*	Result
DC	0.0430	782	---	---	0.0390	---	ok
1	43.8200	76	---	---	43.8140	---	ok
2	0.0930	509	5.2580	---	0.0830	3.5050	ok
3	0.0400	139	3.2860	---	0.0270	2.1910	ok
4	0.0430	330	2.6290	---	0.0380	1.7530	ok
5	0.0420	447	7.0320	---	0.0390	4.6880	ok
6	0.0140	674	1.7530	---	0.0100	1.1680	ok
7	0.0410	237	4.7320	---	0.0390	3.1550	ok
8	0.0210	219	1.3140	---	0.0180	0.8760	ok
9	0.1710	688	3.2860	---	0.1670	2.1910	ok
10	0.0180	843	1.0520	---	0.0160	0.7010	ok
11	0.1950	273	2.0370	---	0.1920	1.3580	ok
12	0.0130	209	0.8760	---	0.0110	0.5840	ok
13	0.1210	41	1.3140	---	0.1190	0.8760	ok
14	0.0040	220	0.7510	---	0.0040	0.5010	ok
15	0.0520	391	0.6570	---	0.0500	0.4380	ok
16	0.0040	650	0.6570	---	0.0030	0.4380	ok
17	0.0520	399	0.6570	---	0.0500	0.4380	ok
18	0.0050	21	0.6570	---	0.0040	0.4380	ok
19	0.0940	221	0.6570	---	0.0600	0.4380	ok
20	0.0050	524	0.6570	---	0.0040	0.4380	ok
21	0.0710	56	0.6570	---	0.0490	0.4380	ok
22	0.0030	432	0.6570	---	0.0020	0.4380	ok
23	0.0440	444	0.6570	---	0.0430	0.4380	ok
24	0.0030	802	0.6570	---	0.0020	0.4380	ok
25	0.0390	25	0.6570	---	0.0380	0.4380	ok
26	0.0020	663	0.6570	---	0.0020	0.4380	ok
27	0.0270	367	0.6570	---	0.0260	0.4380	ok
28	0.0030	379	0.6570	---	0.0020	0.4380	ok
29	0.0260	7	0.6570	---	0.0260	0.4380	ok
30	0.0020	280	0.6570	---	0.0020	0.4380	ok
31	0.0170	873	0.6570	---	0.0170	0.4380	ok
32	0.0030	728	0.6570	---	0.0020	0.4380	ok
33	0.0110	375	0.6570	---	0.0100	0.4380	ok
34	0.0020	28	0.6570	---	0.0010	0.4380	ok
35	0.0120	93	0.6570	---	0.0110	0.4380	ok
36	0.0020	784	0.6570	---	0.0020	0.4380	ok
37	0.0140	241	0.6570	---	0.0130	0.4380	ok
38	0.0020	747	0.6570	---	0.0010	0.4380	ok
39	0.0220	413	0.6570	---	0.0140	0.4380	ok
40	0.0010	565	0.6570	---	0.0010	0.4380	ok

* limits at minimum Rsce = 33

Appendix A2-3 Compliance Verification Report for Inverter Connected Power Generating Modules

Extract from test report according to the Engineering Recommendation G99 — **Nr. 22TH0488-G99-1_0**

Power Quality. Harmonics.

Phase 1

Testconditions:

dut = STPS 30-20; phase = L1; voltage = 230.00 V; frequency = 50 Hz; test duration = 180 s;

standard = G99 Issue 1; DC voltage = 750 V; power factor = 1u; power stage = 50 %

Order	Maximum	Window	Limits*1.5 [A]	Result	Average	Limits [A]*	Result
DC	0.0170	15	---	---	0.0120	---	ok
1	21.9110	752	---	---	21.9050	---	ok
2	0.0610	308	5.2580	---	0.0550	3.5060	ok
3	0.0360	51	3.2860	---	0.0300	2.1910	ok
4	0.0290	179	2.6290	---	0.0250	1.7530	ok
5	0.0420	349	7.0330	---	0.0390	4.6890	ok
6	0.0360	463	1.7530	---	0.0320	1.1690	ok
7	0.0400	125	4.7320	---	0.0370	3.1550	ok
8	0.0230	332	1.3150	---	0.0210	0.8760	ok
9	0.1510	418	3.2860	---	0.1460	2.1910	ok
10	0.0190	883	1.0520	---	0.0170	0.7010	ok
11	0.1800	288	2.0380	---	0.1770	1.3580	ok
12	0.0090	272	0.8760	---	0.0070	0.5840	ok
13	0.1200	353	1.3150	---	0.1170	0.8760	ok
14	0.0070	478	0.7510	---	0.0060	0.5010	ok
15	0.0420	398	0.6570	---	0.0390	0.4380	ok
16	0.0040	821	0.6570	---	0.0030	0.4380	ok
17	0.0590	341	0.6570	---	0.0580	0.4380	ok
18	0.0050	87	0.6570	---	0.0040	0.4380	ok
19	0.0890	168	0.6570	---	0.0580	0.4380	ok
20	0.0040	656	0.6570	---	0.0030	0.4380	ok
21	0.0590	433	0.6570	---	0.0440	0.4380	ok
22	0.0030	594	0.6570	---	0.0030	0.4380	ok
23	0.0280	687	0.6570	---	0.0270	0.4380	ok
24	0.0040	657	0.6570	---	0.0040	0.4380	ok
25	0.0250	274	0.6570	---	0.0230	0.4380	ok
26	0.0030	49	0.6570	---	0.0020	0.4380	ok
27	0.0140	236	0.6570	---	0.0120	0.4380	ok
28	0.0020	214	0.6570	---	0.0020	0.4380	ok
29	0.0160	584	0.6570	---	0.0160	0.4380	ok
30	0.0020	398	0.6570	---	0.0020	0.4380	ok
31	0.0150	545	0.6570	---	0.0140	0.4380	ok
32	0.0030	551	0.6570	---	0.0020	0.4380	ok
33	0.0150	534	0.6570	---	0.0150	0.4380	ok
34	0.0040	900	0.6570	---	0.0030	0.4380	ok
35	0.0110	517	0.6570	---	0.0100	0.4380	ok
36	0.0020	243	0.6570	---	0.0020	0.4380	ok
37	0.0040	90	0.6570	---	0.0030	0.4380	ok
38	0.0020	697	0.6570	---	0.0010	0.4380	ok
39	0.0110	344	0.6570	---	0.0090	0.4380	ok
40	0.0020	844	0.6570	---	0.0010	0.4380	ok

* limits at minimum Rsce = 33

Appendix A2-3 Compliance Verification Report for Inverter Connected Power Generating Modules

Extract from test report according to the Engineering Recommendation G99 **Nr. 22TH0488-G99-1_0**

Power Quality. Harmonics.

Phase 2

Testconditions:

dut = STPS 30-20; phase = L2; voltage = 230.00 V; frequency = 50 Hz; test duration = 180 s;

standard = G99 Issue 1; DC voltage = 750 V; power factor = 1u; power stage = 50 %

Order	Maximum	Window	Limits*1.5 [A]	Result	Average	Limits [A]*	Result
DC	0.0170	15	---	---	0.0120	---	ok
1	21.9140	437	---	---	21.9080	---	ok
2	0.0540	893	5.2580	---	0.0480	3.5050	ok
3	0.0350	245	3.2860	---	0.0200	2.1910	ok
4	0.0570	163	2.6290	---	0.0510	1.7530	ok
5	0.0480	892	7.0330	---	0.0460	4.6880	ok
6	0.0270	49	1.7530	---	0.0240	1.1680	ok
7	0.0390	72	4.7320	---	0.0370	3.1550	ok
8	0.0300	651	1.3150	---	0.0270	0.8760	ok
9	0.1420	44	3.2860	---	0.1360	2.1910	ok
10	0.0230	713	1.0520	---	0.0210	0.7010	ok
11	0.1720	106	2.0370	---	0.1690	1.3580	ok
12	0.0120	394	0.8760	---	0.0100	0.5840	ok
13	0.1320	492	1.3150	---	0.1280	0.8760	ok
14	0.0060	263	0.7510	---	0.0050	0.5010	ok
15	0.0430	66	0.6570	---	0.0390	0.4380	ok
16	0.0050	461	0.6570	---	0.0040	0.4380	ok
17	0.0610	568	0.6570	---	0.0590	0.4380	ok
18	0.0040	265	0.6570	---	0.0030	0.4380	ok
19	0.0900	306	0.6570	---	0.0570	0.4380	ok
20	0.0030	604	0.6570	---	0.0030	0.4380	ok
21	0.0570	147	0.6570	---	0.0450	0.4380	ok
22	0.0050	247	0.6570	---	0.0040	0.4380	ok
23	0.0270	841	0.6570	---	0.0250	0.4380	ok
24	0.0030	715	0.6570	---	0.0020	0.4380	ok
25	0.0270	438	0.6570	---	0.0250	0.4380	ok
26	0.0020	17	0.6570	---	0.0020	0.4380	ok
27	0.0140	346	0.6570	---	0.0120	0.4380	ok
28	0.0030	424	0.6570	---	0.0020	0.4380	ok
29	0.0190	289	0.6570	---	0.0180	0.4380	ok
30	0.0020	257	0.6570	---	0.0020	0.4380	ok
31	0.0160	666	0.6570	---	0.0150	0.4380	ok
32	0.0030	261	0.6570	---	0.0030	0.4380	ok
33	0.0150	317	0.6570	---	0.0140	0.4380	ok
34	0.0040	639	0.6570	---	0.0030	0.4380	ok
35	0.0110	661	0.6570	---	0.0110	0.4380	ok
36	0.0020	699	0.6570	---	0.0020	0.4380	ok
37	0.0040	254	0.6570	---	0.0030	0.4380	ok
38	0.0020	213	0.6570	---	0.0020	0.4380	ok
39	0.0110	854	0.6570	---	0.0100	0.4380	ok
40	0.0020	571	0.6570	---	0.0010	0.4380	ok

* limits at minimum Rsce = 33

Appendix A2-3 Compliance Verification Report for Inverter Connected Power Generating Modules

Extract from test report according to the Engineering Recommendation G99 — **Nr. 22TH0488-G99-1_0**

Power Quality. Harmonics.

Phase 3

Testconditions:

dut = STPS 30-20; phase = L3; voltage = 230.00 V; frequency = 50 Hz; test duration = 180 s;

standard = G99 Issue 1; DC voltage = 750 V; power factor = 1u; power stage = 50 %

Order	Maximum	Window	Limits*1.5 [A]	Result	Average	Limits [A]*	Result
DC	0.0170	15	---	---	0.0120	---	ok
1	21.8790	10	---	---	21.8730	---	ok
2	0.0590	60	5.2580	---	0.0530	3.5050	ok
3	0.0470	135	3.2860	---	0.0400	2.1910	ok
4	0.0230	897	2.6290	---	0.0190	1.7530	ok
5	0.0340	276	7.0320	---	0.0310	4.6880	ok
6	0.0300	833	1.7530	---	0.0260	1.1680	ok
7	0.0420	9	4.7320	---	0.0390	3.1550	ok
8	0.0190	185	1.3140	---	0.0170	0.8760	ok
9	0.1520	250	3.2860	---	0.1460	2.1910	ok
10	0.0180	701	1.0520	---	0.0160	0.7010	ok
11	0.1750	157	2.0370	---	0.1720	1.3580	ok
12	0.0090	577	0.8760	---	0.0070	0.5840	ok
13	0.1190	140	1.3140	---	0.1160	0.8760	ok
14	0.0080	525	0.7510	---	0.0070	0.5010	ok
15	0.0380	118	0.6570	---	0.0350	0.4380	ok
16	0.0040	551	0.6570	---	0.0030	0.4380	ok
17	0.0580	304	0.6570	---	0.0560	0.4380	ok
18	0.0030	539	0.6570	---	0.0030	0.4380	ok
19	0.0860	858	0.6570	---	0.0580	0.4380	ok
20	0.0030	851	0.6570	---	0.0030	0.4380	ok
21	0.0580	742	0.6570	---	0.0420	0.4380	ok
22	0.0040	767	0.6570	---	0.0040	0.4380	ok
23	0.0270	152	0.6570	---	0.0250	0.4380	ok
24	0.0030	478	0.6570	---	0.0020	0.4380	ok
25	0.0250	106	0.6570	---	0.0240	0.4380	ok
26	0.0030	305	0.6570	---	0.0020	0.4380	ok
27	0.0160	521	0.6570	---	0.0150	0.4380	ok
28	0.0030	75	0.6570	---	0.0020	0.4380	ok
29	0.0190	850	0.6570	---	0.0180	0.4380	ok
30	0.0030	883	0.6570	---	0.0020	0.4380	ok
31	0.0160	727	0.6570	---	0.0160	0.4380	ok
32	0.0030	676	0.6570	---	0.0030	0.4380	ok
33	0.0160	872	0.6570	---	0.0150	0.4380	ok
34	0.0030	542	0.6570	---	0.0030	0.4380	ok
35	0.0110	386	0.6570	---	0.0100	0.4380	ok
36	0.0020	646	0.6570	---	0.0020	0.4380	ok
37	0.0040	393	0.6570	---	0.0030	0.4380	ok
38	0.0020	743	0.6570	---	0.0020	0.4380	ok
39	0.0110	175	0.6570	---	0.0090	0.4380	ok
40	0.0010	828	0.6570	---	0.0010	0.4380	ok

* limits at minimum Rsce = 33

Appendix A2-3 Compliance Verification Report for Inverter Connected Power Generating Modules

Extract from test report according to the Engineering Recommendation G99 **Nr. 22TH0488-G99-1_0**

Power Quality. Power factor.				
Output power	216,2V	230V	253V	Measured at three voltage levels and at full output. Voltage to be maintained within ±1,5% of the stated level during the test.
20%	0,997	0,998	0,988	
50%	0,999	0,999	0,999	
75%	0,999	0,999	0,999	
100%	0,999	0,999	0,999	
Limit	>0,95	>0,95	>0,95	

Power Quality. Voltage fluctuation and Flicker.								
	Starting			**Stopping**			**Running**	
	dmax	**dc**	**d(t)**	**dmax**	**dc**	**d(t)**	**Pst**	**Plt 2 hours**
Measured values at test impedance	4,43%	4,10%	0,052 s	4,48%	4,10%	0,022 s	0,100	0,100
Measured values at standard impedance	7,09%	6,55%	0,052 s	7,17%	6,56%	0,022 s	0,160	0,160
Values for maximum impedance	3,57%	3,30%	0,052 s	3,60%	3,30%	0,022 s	0,097	0,097
Limits set under BS EN 61000-3-11	4%	3,3%	3,3% 500ms	4%	3,3%	3,3% 500ms	1,0	0,65

Test impedance	R	0,15	Ω	Xl	0,15*	Ω
	Z	0,212	Ω			
Standard impedance	R	0,24	Ω	Xl	0,15*	Ω
	Z	0,283	Ω			
Maximum impedance	R	0,12	Ω	Xl	0,08	Ω
	Zmax	0,144	Ω			

Appendix A2-3 Compliance Verification Report for Inverter Connected Power Generating Modules

Extract from test report according to the Engineering Recommendation G99 **Nr. 22TH0488-G99-1_0**

Power Quality. DC injection.			
Phase 1			
Test level power [%]	10	55	100
Recorded value [mA]	2,13	14,05	55,20
Recorded value [%]	0,00	0,02	0,08
Limit [%]	0,25	0,25	0,25
Phase 2			
Test level power [%]	10	55	100
Recorded value [mA]	1,39	19,56	59,34
Recorded value [%]	0,00	0,03	0,08
Limit [%]	0,25	0,25	0,25
Phase 3			
Test level power [%]	10	55	100
Recorded value [mA]	17,15	12,26	54,26
Recorded value [%]	0,02	0,02	0,08
Limit [%]	0,25	0,25	0,25

Note. Informative measurement of DC-injection of each phase of the inverter and a limit of 0,25% per phase of the rated current per phase as pass criteria.

Sum of all Phases

Tests are carried out at three defined power levels ±5%. At 230 V a 50 kW three phase Inverter has a current output of 72,4 A so DC limit is 543 mA. These tests is 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%.

Sum of all Phases			
Test level power [%]	10	55	100
Recorded value [mA]	20,67	45,87	168,8
Recorded value [%]	0,01	0,02	0,07
Limit [%]	0,25	0,25	0,25

Appendix A2-3 Compliance Verification Report for Inverter Connected Power Generating Modules

Extract from test report according to the Engineering Recommendation G99 **Nr. 22TH0488-G99-1_0**

Fault level Contribution.					
For a directly coupled SSEG			**For a Inverter SSEG**		
Parameter	**Symbol**	**Value**	**Time after fault**	**Volts [V]**	**Amps [A]**
Peak Short Circuit current	I_p	N/A	20ms	230,92	76,74
Initial Value of aperiodic current	A	N/A	100ms	6,39	75,98
Initial symmetrical short-circuit current*	I_k	N/A	250ms	5,22	76,08
Decaying (aperiodic) component of short circuit current*	i_{DC}	N/A	500ms	12	0,04
Reactance/Resistance Ratio of source*	X/R	N/A	**Time to Trip [s]**	0,46	
For rotating machines and linear piston machines the test should produce a 0s – 2s plot of the short circuit current as seen at the Generating Unit terminals. * Values for these parameters should be provided where the short circuit duration is sufficiently long to enable interpolation of the plot.					

Self Monitoring – Solid state switching.	**N/A**
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 seconds.	N/A
Note. Unit do not provide solid state switching relays. In case the semiconductor bridge is switched off, then the voltage on the output drops to 0. In this case the relays on the output will also open (Functional safety of the internal automatic disconnection device according to VDE 0126-1-1 / VDE 0124-100).	

Cyber security	**P**
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
Note. Different levels of access, all are password protected, only certain parameters can be changed on maintenance level. Manufacturer information provided, see test report.	

Wiring functional tests if required by para. 15.2.1	**N/A**
Confirm that the relevant test schedule is attached (tests to be undertaken at time of commissioning).	N/A
Note. The inverter was tested in a test laboratory. The correct wiring functional test in the field has to be done by the responsible person for the installation of the plant.	

Logic Interface (input port) Required by paragraph 11.1.3.1	**P**
Confirm that an input port is provided and can be used to reduce the Active Power output to zero	Yes
Note. Manufacturer information provided. A Modbus signal can be used to cease Active Power output within 5 s. See test report.	
Provide high level description of logic interface, e.g. details in 11.1.3.1 such as AC or DC signal	Yes
Note. Manufacturer information provided. For more functions and more detailed information see SunSpec Modbus Interace manual and installation manual.	