TEST REPORT

Engineering recommendation G99

Requirements for the connection of generation equipment in parallel with public distribution networks

Report reference number .....:	**14TH0075_G99/1-6_4**
Date of issue.....:	2020-10-01
Total number of pages .....:	102
Testing laboratory name.....:	**Bureau Veritas Consumer Products Services Germany GmbH**
Address .....:	Businesspark A96 86842 Türkheim Germany
Accreditation.....:	ilac-MRA DAkkS Deutsche Akkreditierungsstelle D-PL-12024-03-03
Applicant's name.....:	**SMA Solar Technology AG**
Address .....:	Sonnenallee 1, 34266 Niestetal, Germany
Test specification	
Standard.....:	G99/1-6:2020 Tests for Type A Inverter Connected Power Generating Modules
Certificate.....:	**Certificate of compliance**
Test report form number.....:	G99/1
Master TRF.....:	Bureau Veritas Consumer Products Services Germany GmbH
Test item description .....:	**Photovoltaic and battery inverter**
Trademark .....:	SMA
Model / Type.....:	SHP 75-10[1]; STP60-10[1], STPS60-10[2]

Note: [1] grid-tied photovoltaic inverter
[2] battery inverter

Photovoltaic inverter		
Ratings .....:	**SHP 75-10**	**STP 60-10**
MPP DC voltage range [V] .....:	570-800	
Input DC voltage range [V] .....:	565-1000	
Input DC current [A].....:	140	110
Output AC voltage [V].....:	400 (3P + PE)	400 (3P + PE)
Output AC current [A] .....:	3 x 109	3 x 87
Output power [VA] .....:	75000	60000
Battery inverter		
Ratings .....:	**STPS60-10**	
Input DC voltage range [V] .....:	570-800	
Input DC current (discharge) [A].....:	140	
Output DC current (charge) [A] .....:	108	
Output AC voltage [V].....:	400 (3P + PE)	
Output AC current [A] .....:	3 x 109	
Output power [VA] .....:	75000	

Testing Location.....:	**Bureau Veritas Consumer Products Services Germany GmbH**
Address .....:	Businesspark A96, 86842 Türkheim, Germany
Tested by (name and signature) .....:	Adrian Böck
Approved by (name and signature) .....:	Georg Loritz
Manufacturer's name .....:	**SMA Solar Technology AG**
Manufacturer address .....:	Sonnenallee 1, 34266 Niestetal, Germany

Document History

Date	Internal reference	Modification / Change / Status	Revision
2019-06-05	Adrian Boeck	Initial report was written	0
2019-06-07	Adrian Boeck	- comment about logic interface included	1
2019-06-14	Adrian Boeck	- A7.1.3 with standard droop test of 5% - A.7.1.4.3 comment attached - A.7.1.2.5 note added	2
2019-12-16	Adrian Boeck	Retesting according to G99/1-4:2019	3
2020-10-01	Adrian Boeck	Update to G99/1-6:2020 update or voltage values For each voltage measurement the annex p-p and p-n für phase-phase voltage and phase-neutral included. update of flicker	4

Supplementary information:

Test items particulars

Equipment mobility ..... :	Permanent connection
Operating condition ..... :	Continuous
Class of equipment..... :	Class I
Protection against ingress of water .. :	IP65 according to EN 60529
Mass of equipment [kg] ..... :	80

Test case verdicts

Test case does not apply to the test object ..... :	N/A
Test item does meet the requirement ..... :	P(ass)
Test item does not meet the requirement ..... :	F(ail)

Testing

Date of receipt of test item ..... :	2019-03-22
Date(s) of performance of test..... :	2018-03-09 to 2018-05-14, 2018-03-12 to 2018-08-05; 2019-04-05 to 2019-04-10; 2019-09-25 to 2019-09-27

General remarks:

The test result presented in this report relate only to the object(s) tested. The report shall state compliance of the tested objects with the requirements of G99-1. This report must not be reproduced in part or in full without the written approval of the issuing testing laboratory.

"(see Annex #)" refers to additional information appended to the report.
"(see appended table)" refers to a table appended to the report.

Throughout this report a comma is used as the decimal separator.

This Test Report consists of the following documents:

1. Test Results
2. Annex No. 1 – EMC Test Report
3. Annex No. 2 – Pictures of the unit
4. Annex No. 3 – Test equipment list

Copy of marking plate

Photovoltaic inverter

SMA Solar Technology AG
Sonnenallee 1
34266 Niestetal
Germany
www.sma.de

Model
SHP 75-10
Made in Denmark

Input:	
$V_{DC\ MAX}$	1000 V
$V_{DC\ MPP}$	570 V - 800 V
$I_{DC\ MAX}$	140 A
$I_{SC\ PV}$	210 A
Output:	
$V_{AC,r}$	400 V
$P_{AC,r}$	75000 W
$S_{AC\ MAX}$	75000 VA
$f_{AC,r}$	50 / 60 Hz
$I_{AC\ MAX}$	109 A
cos φ	0 ... 1 ... 0 overexcited underexcited
AC-Topology	3~ +PE, transformerless
Degree of protection	IP65
Weight	77 kg
Protective class	I
Overvoltage category	III

Model: STP 60-10

PV input: 565 Vdc - 1000 Vdc
110 A / 150 A max. rated current / Isc

Output: 3P+PE, 380/400 Vac delta
352 - 440 Vac, 87.0 A
cos(Phi): 0.8... 1 ...0.8 over/underexc.
Max. output fault current: 49.8 A over 60 ms

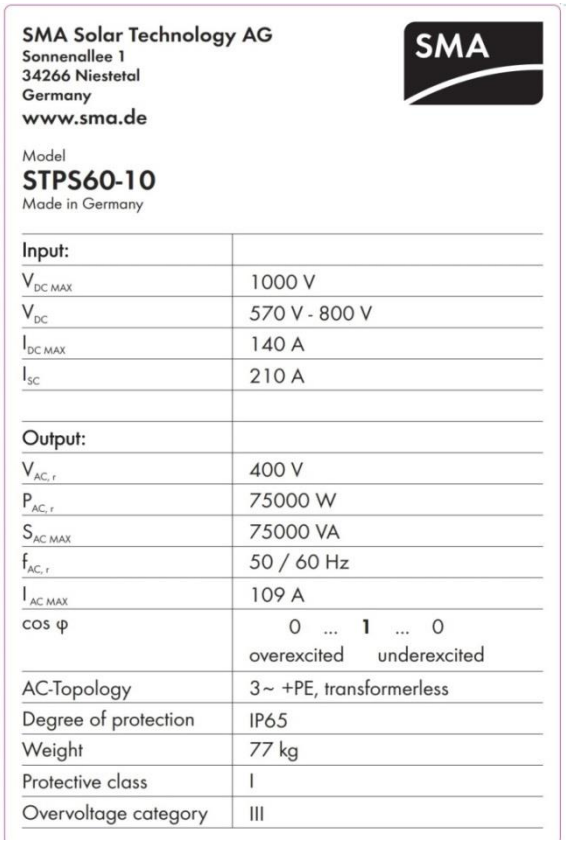
Power: 60 kVA @ 400 Vac, 45°C / 113°F, cos(Phi) = 1
Freq.: 50/60 Hz (45 - 65 Hz)
Chassis: Outdoor IP65, Protective class I
Temp. -25°C to 60°C / -13°F to 140°F

139F5003016401N314

CE

SMA Solar Technology AG Made in Denmark

Battery inverter



SMA Solar Technology AG
Sonnenallee 1
34266 Niestetal
Germany
www.sma.de

Model
STPS60-10
Made in Germany

Input:	
$V_{DC\ MAX}$	1000 V
V_{DC}	570 V - 800 V
$I_{DC\ MAX}$	140 A
I_{SC}	210 A
Output:	
$V_{AC,r}$	400 V
$P_{AC,r}$	75000 W
$S_{AC\ MAX}$	75000 VA
$f_{AC,r}$	50 / 60 Hz
$I_{AC\ MAX}$	109 A
cos φ	0 ... 1 ... 0 overexcited underexcited
AC-Topology	3~ +PE, transformerless
Degree of protection	IP65
Weight	77 kg
Protective class	I
Overvoltage category	III

General product information:

The Solar converter converts DC voltage into AC voltage.

The input and output are protected by varistors to Earth. The unit is providing EMC filtering at the output toward mains. The unit does provide galvanic separation from input to output (transformer). The output is switched off redundant by the high power switching bridge and a relay in series. This assures that the opening of the output circuit will also operate in case of one error.

Description of the power circuit:

The unit is a true three phase boosterless inverter. It is a non-isolated, grid-connected inverter for a neutral-less three phase AC grid. As it is designed as a thin inverter with only one PV-input, an external string combiner and plant manager is required for a given application. Thin is defined as an inverter without booster, string combiner and option connectors.

The photovoltaic input is connected to wiring terminals. The PV input provides an optional surge-/lightning-protection which is monitored by the PSU-board. Afterwards there is the DC-switch. The EMC filtering for the input is realized on the PV RFI filter board where the input current is measured via a current sensor. After that the DC-link is placed on the DC-link board where an active balancing is applied. A three level inverter on the inverter board makes a PWM signal which is smoothed by a LCL filter to a sine wave. The grid current measurement is placed on this board, too. After the grid coil the RCMU is placed on the GRID RFI filter board to monitor fault currents and the EMC filtering at the output is done. The unit does not provide galvanic separation from input to output (transformerless inverter). The output is switched off redundantly by the high power switching bridge and two relay contacts in series, controlled by the FPGA and the FSP. This assures the opening of the output circuit will also occur in case of a single error. An optional surge-/lightning-protection is present on the AC output.

SHP75-10 with serial number 139F5006001501N297 was tested on

Hardware version:

Comm/Ctrl Board	139b3128	Issue 04	Rev. 00	Assy rev. 01
Inverter Board	139b3116	Issue 02	Rev. 01	Assy rev. 02
PSU Board	139b3120	Issue 08	Rev. 00	Assy rev. 00
DC-link Board	139b3124	Issue 05	Rev. 01	Assy rev. 00
IPV/RCMU Board	139b3126	Issue 03	Rev. 00	Assy rev. 04
Grid RFI filter Board	139b3118	Issue 02	Rev. 00	Assy rev. 01
PV RFI filter Board	139b3122	Issue 02	Rev. 00	Assy rev. 01

Software version: 1.90
with a configuration file provided by the manufacturer with the appropiate settings

STPS60-10 with serial number 139F5008010201N118 was tested on

Hardware version:

Comm/Ctrl Board	139b3128	Issue 04	Rev. 00	Assy rev. 01
Inverter Board	139b3116	Issue 02	Rev. 01	Assy rev. 02
PSU Board	139b3120	Issue 08	Rev. 00	Assy rev. 00
DC-link Board	139b3124	Issue 05	Rev. 01	Assy rev. 00
IPV/RCMU Board	139b3126	Issue 03	Rev. 00	Assy rev. 04
Grid RFI filter Board	139b3118	Issue 02	Rev. 00	Assy rev. 01
PV RFI filter Board	139b3122	Issue 02	Rev. 00	Assy rev. 01

Software version: 1.95
with a configuration file provided by the manufacturer with the appropiate settings

STP60-10 with serial number 1234B567891234T123 was tested on

Hardware version:

Comm/Ctrl Board:	139b3128	Issue 03	Rev. 00,	Assy rev. 01
Inverter board:	139b3116	Issue 04	Rev. 00,	Assy rev. 00
PSU board:	139b3120	Issue 04	Rev. 00,	Assy rev. 00
DC-link Board:	139b3124	Issue 03	Rev. 00,	Assy rev. 01
IPV/RCMU Board:	139b3126	Issue 03	Rev. 00,	Assy rev. 04
Grid RFI filter Board:	139b3118	Issue 02	Rev. 00,	Assy rev. 01
PV RFI filter Board:	139b3122	Issue 02	Rev. 00,	Assy rev. 00

Software version: 1.90
with a configuration file provided by the manufacturer with the appropiate settings

Engineering recommendation G99-1			
Clause	**Requirement – Test**	**Result – Remark**	**Verdict**
A.7	**Requirements for Type Testing Power Generating Modules**		
A.7.1	**Power Park Module Requirements**		
A.7.1.1	**Certification & Type Testing Generating Unit Requirements**		
A.7.1.2	Type Verification Functional Testing of the Interface Protection		**P**
A.7.2.1	Disconnection times		**P**
A7.1.2.2	Over / Under Voltage		**P**
A.7.1.2.3	Over / Under Frequency		**P**
A.7.1.2.4	Loss of Mains Protection		**P**
A.7.1.2.5	Re-connection		**P**
A.7.1.2.6	Frequency Drift and Step Change Stability test		**P**
A.7.1.3	Limited Frequency Sensitive Mode – Over (LFSM-O)		**P**
A.7.1.4.1	Harmonics		**P**
A.7.1.4.2	Power Factor		**P**
A.7.1.4.3	Voltage Flicker		**P**
A.7.1.4.4	DC Injection		**P**
A.7.1.5	Short Circuit Current Contribution		**P**
A.7.1.6	Self-Monitoring - Solid State Disconnection		**P**
	Logic Interface (Input port)	Required by paragraph 11.1.3	**P**

G99-1 Test Results:

A.7.1.2 Type Verification Functional Testing of the Interface Protection Functional safety - fault condition tests according DIN V VDE V 0126-1-1								P
component No.	fault	test condition		test time	fuse No.	fault condition		result
		AC	DC			AC	DC	
Relay Contactor 1 defect	short before start-up	0V 0A	0V 0A	5 min.	ext. 32A	230Vp-n 0A	800V 0A	Inverter does not start to feed in. Red “Alarm” LED is blinking. Display says “functional safety test”. No hazard. No defect.
Relay Contactor 2 defect	short before start-up	0V 0A	0V 0A	5 min.	ext. 32A	230Vp-n 0A	800V 0A	Inverter does not start to feed in. Red “Alarm” LED is blinking. Display says “functional safety test”. No hazard. No defect.
Monitoring voltage L1 defect	open R600 PSU-Board	230Vp-n 3x7A	800V 6,9A	5 min	ext. 32A	230Vp-n 0A	800V 0A	Inverter shut down immediately. No reconnection. “Waiting for release to go” is shown on display. No hazard. No defect.
Monitoring voltage L1 defect	open R650 PSU-Board	230Vp-n 3x7A	800V 6,9A	5 min	ext. 32A	230Vp-n 0A	800V 0A	Inverter shut down immediately. No reconnection. “Waiting for release to go” is shown on display. No hazard. No defect.
Monitoring voltage L2 defect	open R615 PSU-Board	230Vp-n 3x7A	800V 6,9A	5 min	ext. 32A	230Vp-n 0A	800V 0A	Inverter shut down immediately. No reconnection. “Waiting for release to go” is shown on display. No hazard. No defect.
Monitoring voltage L2 defect	open R665 PSU-Board	230Vp-n 3x7A	800V 6,9A	5 min	ext. 32A	230Vp-n 0A	800V 0A	Inverter shut down immediately. No reconnection. “Waiting for release to go” is shown on display. No hazard. No defect.
Monitoring voltage L3 defect	open R630 PSU-Board	230Vp-n 3x7A	800V 6,9A	5 min	ext. 32A	230Vp-n 0A	800V 0A	Inverter shut down immediately. No reconnection. “Waiting for release to go” is shown on display. No hazard. No defect.
Monitoring voltage L3 defect	open R680 PSU-Board	230Vp-n 3x7A	800V 6,9A	5 min	ext. 32A	230Vp-n 0A	800V 0A	Inverter shut down immediately. No reconnection. “Waiting for release to go” is shown on display. No hazard. No defect.

Monitoring voltage reference voltage defect	short R646	230Vp-n 3x7A	800V 6,9A	5 min	ext. 32A	230Vp-n 0A	800V 0A	Inverter shut down immediately. No reconnection. “Waiting for release to go” is shown on display. No hazard. No defect.
Voltage Measurement disabled	short C618	230Vp-n 3x7A	800V 6,9A	5 min	ext. 32A	230Vp-n 0A	800V 0A	Inverter shut down immediately. No reconnection. Red “Alarm” LED is blinking. “Functional safety test” is shown on display. No hazard. No defect.
Current sensor IC1501 defect	short C1505 Inverter-Board	230Vp-n 3x7A	800V 6,9A	5 min	ext. 32A	230Vp-n 0Ap-n	800V 0A	Inverter shut down immediately. No reconnection. Red “Alarm” LED is blinking. “Functional safety test” is shown on display. No hazard. No defect.
RCMU Sensor defect	test-winding open	230Vp-n 3x7A	800V 6,9A	5 min	ext. 32A	230Vp-n 0A	800V 0A	Inverter shut down immediately. No reconnection. Red “Alarm” LED is blinking. “Functional safety test” is shown on display. No hazard. No defect.
RCMU Sensor measurement defect IC102	short Pin 5 to Pin 15	230Vp-n 3x7A	800V 6,9A	5 min	ext. 32A	230Vp-n 0A	800V 0A	Inverter shut down immediately. No reconnection. Red “Alarm” LED is blinking. “Waiting for release to go” is shown on display. No hazard. No defect.
Communication Microcontroller defect	Disable RX on FSP short R933 PSU-Board	230Vp-n 3x7A	800V 6,9A	5 min	ext. 32A	230Vp-n 0A	800V 0A	Inverter shut down immediately. No reconnection. “Functional safety test” is shown on display. No hazard. No defect.
Communication Microcontroller defect	Disable RX on MainCPU short R1100	230Vp-n 3x7A	800V 6,9A	5 min	ext. 32A	230Vp-n 0A	800V 0A	Inverter shut down immediately. No reconnection. “Functional safety test” is shown on display. No hazard. No defect.
Loss of control	O1400 Comm./Ctrl.	230Vp-n 3x7A	800V 6,9A	5 min	ext. 32A	230Vp-n 0A	800V 0A	Inverter shut down immediately. No reconnection. “Initializing” is shown on display. No hazard. No defect.
Loss of control 2	O900 PSU-Board	230Vp-n 3x7A	800V 6,9A	5 min	ext. 32A	230Vp-n 0A	800V 0A	Inverter shut down immediately. No reconnection. “Functional safety test” is shown on display. No hazard. No defect.
The errors in the control circuit simulate that the safety is even ensured during single fault.								

Operating Range		**P**
Setting values	Over-voltage [Vp-n], [Vp-p]:	258,9 / 450,3
	Under-voltage [Vp-n], [Vp-p]:	189,2 / 329,1
	Over-frequency [Hz]:	53,0
	Under-frequency [Hz]:	46,0

- Test 1: U = 194,7Vp-n / 338,6Vp-p; f = 47,0 Hz; P = 1,00 Sn; cosφ = 1; at least 20 s
- Test 2: U = 194,7Vp-n / 338,6Vp-p; f = 47,5 Hz; P = 1,00 Sn; cosφ = 1; at least 90 mins
- Test 3: U = 252,0Vp-n / 438,2Vp-p; f = 51,5 Hz; P = 1,00 Sn; cosφ = 1; at least 90 mins
- Test 4: U = 252,0Vp-n / 438,2Vp-p; f = 52,0 Hz; P = 1,00 Sn; cosφ = 1; at least 15 mins
- Test 5: 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.

Test sequence	Voltage [Vp-n] / [Vp-p]	Frequency [Hz]	Output power [W]	Cos φ [1]
1	195,5 / 340,0	47,0	65404,7	1,000
2	194,7 / 338,6	47,5	65091,9	1,000
3	251,8 / 437,9	51,5	76049,7	1,000
4	251,8 / 437,9	52,0	76071,5	1,000
5	Always connected			

Note:

During the tests the interface protection was disabled.

Operation at reduced power is allowed during test 1 and test 2, equal to the maximum power that can be supplied on reaching the maximum output current limit (P ≥ 0,85 Sn).

During the sequence of test 2, automatic adjustment to reduce power in the case of over-frequency was disabled.

Inverter is a three phase inverter without neutral wire. Therefore phase to phase voltages were used.

A.7.1.2.2 Over / Under Voltage

Table 10.1 Setting for long term parallel operation

P

Phase L1 to Phase L3						
Function	Setting		Trip test		No trip test	
	Voltage	Time delay	Voltage	Time delay	Voltage / time	Confirm no trip
U/V	184Vp-n (318,7Vp-p) (0,8 pu)	2,5s	183,3Vp-n (318,7Vp-p)	2,534s	187,2Vp-n (325,6Vp-p) / 5s	No trip
					179,3Vp-n (311,8Vp-p) / 2,45s	No trip
O/V stage 1	261,1Vp-n (454,1Vp-p) (1,14 pu)	1,0s	261,3Vp-n (454,5Vp-p)	1,033s	257,1Vp-n (447,2Vp-p) / 5,0s	No trip
O/V stage 2	272,6Vp-n (474,1Vp-p) (1,19 pu)	0,5s	272,5Vp-n (473,9Vp-p)	0,532s	268,6Vp-n (467,1Vp-p) / 0,95s	No trip
					276,6Vp-n (481,0Vp-p) / 0,45s	No trip

Phase L2 to Phase L3						
Function	Setting		Trip test		No trip test	
	Voltage	Time delay	Voltage	Time delay	Voltage / time	Confirm no trip
U/V	184Vp-n (318,7Vp-p) (0,8 pu)	2,5s	183,4Vp-n (318,9Vp-p)	2,540s	187,2Vp-n (325,6Vp-p) / 5s	No trip
					179,3Vp-n (311,8Vp-p) / 2,45s	No trip
O/V stage 1	261,1Vp-n (454,1Vp-p) (1,14 pu)	1,0s	261,2Vp-n (454,2Vp-p)	1,054s	257,1Vp-n (447,2Vp-p) / 5,0s	No trip
O/V stage 2	272,6Vp-n (474,1Vp-p) (1,19 pu)	0,5s	272,4Vp-n (473,8Vp-p)	0,554s	268,6Vp-n (467,1Vp-p) / 0,95s	No trip
					276,6Vp-n (481,0Vp-p) / 0,45s	No trip

Phase L3 to Phase L1						
Function	Setting		Trip test		No trip test	
	Voltage	Time delay	Voltage	Time delay	Voltage / time	Confirm no trip
U/V	184Vp-n (318,7Vp-p) (0,8 pu)	2,5s	183,3Vp-n (318,7Vp-p)	2,524s	187,2Vp-n (325,6Vp-p) / 5s	No trip
					179,3Vp-n (311,8Vp-p) / 2,45s	No trip
O/V stage 1	261,1Vp-n (454,1Vp-p) (1,14 pu)	1,0s	261,1Vp-n (454,0Vp-p)	1,013s	257,1Vp-n (447,2Vp-p) / 5,0s	No trip
O/V stage 2	272,6Vp-n (474,1Vp-p) (1,19 pu)	0,5s	272,7Vp-n (474,2Vp-p)	0,514s	268,6Vp-n (467,1Vp-p) / 0,95s	No trip
					276,6Vp-n (481,0Vp-p) / 0,45s	No trip

Note:

The total disconnection time for voltage and frequency protection, including the operating time of the disconnection device, shall be the time delay setting with a tolerance of -0,0 s and +0,5 s.

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.

Inverter is a three phase inverter without neutral wire. Therefore phase to phase voltages were used.

A.7.1.2.3 Over / Under Frequency

P

Test:

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	47,50Hz	20,04s	47,7Hz / 30s	No trip
U/F stage 2	47Hz	0,5s	47,00Hz	0,544s	47,2Hz / 19,5s	No trip
					46,8 Hz / 0,45s	No trip
O/F	52Hz	0,5s	52,00Hz	0,542s	51,8Hz / 120s	No trip
					52,2 Hz / 0,45s	No trip

Note:

The total disconnection time for voltage and frequency protection, including the operating time of the disconnection device, shall be the time delay setting with a tolerance of -0,0 s and +0,5 s.

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.

Inverter is a three phase inverter without neutal wire. Therefore phase to phase voltages were used.

A.7.1.2.4 Loss of mains protection according BS EN 62116

P

The requirement is specified in section 10.2, test procedure in Annex A.2.2.4

Load imbalance (real, reactive load) for test condition A (EUT output = 100%)

Test conditions	Frequency: 50+/-0,1Hz U_N=230+/-3Vac Distortion factor of chokes < 2% Quality =1
Disconnection limit	1s

No	P_{EUT} 1) (% of EUT rating)	Reactive load (% of Q_L in 6.1.d) 1)	P_{AC} 2) (% of nominal)	Q_{AC} 3) (% of nominal)	I_{AC} 4) [A]			P_{EUT} [W per phase]	V_{DC} [V]	Q_f [1]	Run on Time [s]	Remarks4)
					L1	L2	L3					
1	100	100	0	0	0,15	0,24	0,04	25000	777	1,00	0,556	Test A at BL
32	100	100	-10	-10	6,38	6,56	6,24	25000	777	0,98	0,256	Test A at IB
33	100	100	-10	-5	6,74	6,91	6,77	25000	777	0,92	0,346	Test A at IB
34	100	100	-10	0	6,59	6,91	6,57	25000	777	0,98	0,316	Test A at IB
35	100	100	-10	+5	11,05	11,88	11,63	25000	777	0,93	0,396	Test A at IB
36	100	100	-10	+10	15,22	14,88	15,11	25000	777	0,91	0,406	Test A at IB
37	100	100	-5	-10	9,94	9,48	9,67	25000	777	0,94	0,336	Test A at IB
4	100	100	-5	-5	6,35	6,65	6,2	25000	777	0,95	0,256	Test A at IB
5	100	100	-5	0	5,14	5,45	5,3	25000	777	1,05	0,496	Test A at IB
6	100	100	-5	+5	5,99	6,15	6,3	25000	777	0,99	0,396	Test A at IB
38	100	100	-5	+10	12,28	12,2	11,93	25000	777	0,90	0,406	Test A at IB
39	100	100	0	-10	6,17	6,03	6	25000	777	1,14	0,266	Test A at IB
7	100	100	0	-5	4,81	5,42	5,45	25000	777	1,08	0,386	Test A at IB
8	100	100	0	+5	5,61	5,19	5,46	25000	777	0,99	0,396	Test A at IB
40	100	100	0	+10	10,68	11,05	10,75	25000	777	0,98	0,416	Test A at IB
41	100	100	+5	-10	7	7,07	7,08	25000	777	1,13	0,356	Test A at IB
9	100	100	+5	-5	7,51	7,08	7,49	25000	777	1,11	0,276	Test A at IB
10	100	100	+5	0	4,81	4,8	5,27	25000	777	1,07	0,466	Test A at IB
11	100	100	+5	+5	6,3	6,57	6,6	25000	777	1,01	0,426	Test A at IB
42	100	100	+5	+10	11,83	12,09	12,01	25000	777	1,02	0,406	Test A at IB
43	100	100	+10	-10	14,92	14,4	15	25000	777	1,14	0,266	Test A at IB
44	100	100	+10	-5	9,33	9,49	9,65	25000	777	1,16	0,276	Test A at IB
45	100	100	+10	0	6,54	6,35	6,29	25000	777	1,12	0,496	Test A at IB
46	100	100	+10	+5	5,28	5,21	5,32	25000	777	0,93	0,436	Test A at IB
47	100	100	+10	+10	7,74	8,01	7,55	25000	777	1,01	0,446	Test A at IB

Parameter at 0%	L= 2,25 mH	R= 0,71 Ω	C= 4512,90 µF

Note:

Note for technologies which have a substantial shut down time this can be added to the 0.5 seconds in establishing that the trip occurred in less than 0.5s. Maximum shut down time could therefore be up to 1.0 seconds for these technologies.

RLC is adjusted to min. +/-1% of the inverter rated output power

[1] P_{EUT}: EUT output power

[2] P_{AC}: Real power flow at S1 in Figure 1. Positive means power from EUT to utility. Nominal is the 0 % test condition value.

[3] Q_{AC}: Reactive power flow at S1 in Figure 1. Positive means power from EUT to utility. Nominal is the 0 % test condition value.

[4] BL: Balance condition, IB: Imbalance condition.

Condition A:

EUT output power PEUT = Maximum [5]

EUT input voltage [6] = >90% of rated input voltage range

[5] Maximum EUT output power condition should be achieved using the maximum allowable input power. Actual output power may exceed nominal rated output.

[6] Based on EUT rated input operating range. For example, If range is between X volts and Y volts, 90 % of range =X + 0,9 × (Y – X). Y shall not exceed 0,8 × EUT maximum system voltage (i.e., maximum allowable array open circuit voltage). In any case, the EUT should not be operated outside of its allowable input voltage range.

A.7.1.2.4 Loss of mains protection according BS EN 62116

The requirement is specified in section 10.2, test procedure in Annex A.2.2.4
Load imbalance (real, reactive load) for test condition A (EUT output = 50 % – 66 %)

P

Test conditions	Frequency: 50+/-0,1Hz U_N=230+/-3Vac Distortion factor of chokes < 2% Quality =1
Disconnection limit	1s

No	P_{EUT} 1) (% of EUT rating)	Reactive load (% of Q_L in 6.1.d) 1)	P_{AC} 2) (% of nominal)	Q_{AC} 3) (% of nominal)	I_{AC} 4) [A]			P_{EUT} [W per phase]	V_{DC} [V]	Q_f [1]	Run on Time [s]	Remarks4)
12	66	66	0	-5	2,81	2	2,26	16500	685	0,96	0,396	Test B at IB
13	66	66	0	-4	2,12	2,33	2,26	16500	685	0,96	0,276	Test B at IB
14	66	66	0	-3	2,22	1,87	2,1	16500	685	0,97	0,406	Test B at IB
15	66	66	0	-2	1,08	1,1	1,11	16500	685	0,98	0,296	Test B at IB
16	66	66	0	-1	0,67	0,32	0,52	16500	685	0,99	0,446	Test B at IB
2	66	66	0	0	0,05	0,47	0,25	16500	685	1,00	0,476	Test B at BL
17	66	66	0	1	0,66	1,79	1,27	16500	685	1,01	0,426	Test B at IB
18	66	66	0	2	1,15	0,74	0,64	16500	685	1,01	0,406	Test B at IB
19	66	66	0	3	1,57	1,84	1,68	16500	685	1,02	0,466	Test B at IB
20	66	66	0	4	1,03	1,1	1,14	16500	685	1,04	0,416	Test B at IB
21	66	66	0	5	3,25	3,12	3,39	16500	685	1,05	0,416	Test B at IB

Parameter at 0%	L= 3,40 mH	R= 1,07 Ω	C= 2978,51 µF

Note:

RLC is adjusted to min. +/-1% of the inverter rated output power

1) P_{EUT}: EUT output power

2) P_{AC}: Real power flow at S1 in Figure 1. Positive means power from EUT to utility. Nominal is the 0 % test condition value.

3) Q_{AC}: Reactive power flow at S1 in Figure 1. Positive means power from EUT to utility. Nominal is the 0 % test condition value.

4) BL: Balance condition, IB: Imbalance condition.

Condition B:

EUT output power PEUT = 50 % – 66 % of maximum

EUT input voltage 5) = 50 % of rated input voltage range, ±10 %

5) Based on EUT rated input operating range. For example, If range is between X volts and Y volts, 90 % of range =X + 0,5 × (Y – X). Y shall not exceed 0,8 × EUT maximum system voltage (i.e., maximum allowable array open circuit voltage). In any case, the EUT should not be operated outside of its allowable input voltage range.

A.7.1.2.4 Loss of mains protection according BS EN 62116

The requirement is specified in section 10.2, test procedure in Annex A.2.2.4
Load imbalance (real, reactive load) for test condition A (EUT output = 25 % – 33 %)

P

Test conditions	Frequency: 50+/-0,1Hz U_N=230+/-3Vac Distortion factor of chokes < 2% Quality =1
Disconnection limit	1s

No	P_{EUT} 1) (% of EUT rating)	Reactive load (% of Q_L in 6.1.d) 1)	P_{AC} 2) (% of nominal)	Q_{AC} 3) (% of nominal)	I_{AC} 4) [A]			P_{EUT} [W per phase]	V_{DC} [V]	Q_f [1]	Run on Time [s]	Remarks4)
22	33	33	0	-5	3,69	3,28	3,49	8250	593	0,96	0,416	Test B at IB
23	33	33	0	-4	2,73	2,85	2,85	8250	593	0,96	0,416	Test B at IB
24	33	33	0	-3	2,27	2,08	2,14	8250	593	0,97	0,406	Test B at IB
25	33	33	0	-2	1,19	1,02	1,22	8250	593	0,98	0,436	Test B at IB
26	33	33	0	-1	0,8	0,89	0,75	8250	593	0,99	0,336	Test B at IB
3	33	33	0	0	0,02	0,45	0,14	8250	593	1,00	0,386	Test B at BL
27	33	33	0	1	0,35	0,69	0,39	8250	593	1,01	0,486	Test B at IB
28	33	33	0	2	0,58	0,85	0,77	8250	593	1,01	0,456	Test B at IB
29	33	33	0	3	0,45	0,54	0,48	8250	593	1,02	0,446	Test B at IB
30	33	33	0	4	1,7	1,05	1,38	8250	593	1,04	0,426	Test B at IB
31	33	33	0	5	0,76	0,68	0,73	8250	593	1,05	0,426	Test B at IB

Parameter at 0%	L= 6,80 mH	R= 2,14 Ω	C= 1489,26 µF

Note:

RLC is adjusted to min. +/-1% of the inverter rated output power

1) P_{EUT}: EUT output power

2) P_{AC}: Real power flow at S1 in Figure 1. Positive means power from EUT to utility. Nominal is the 0 % test condition value.

3) Q_{AC}: Reactive power flow at S1 in Figure 1. Positive means power from EUT to utility. Nominal is the 0 % test condition value.

4) BL: Balance condition, IB: Imbalance condition.

Condition C:

EUT output power PEUT = 25 % – 33 % 5) of maximum

EUT input voltage 6) = <10 % of rated input voltage range

5) Or minimum allowable EUT output level if greater than 33 %.

6) Based on EUT rated input operating range. For example, If range is between X volts and Y volts, 90 % of range =X + 0,1 × (Y – X). Y shall not exceed 0,8 × EUT maximum system voltage (i.e., maximum allowable array open circuit voltage). In any case, the EUT should not be operated outside of its allowable input voltage range.

A.7.1.2.5 Reconnection	**P**

Test:

Test should prove that the reconnection sequence starts after a minimum delay of 20 seconds for restoration of voltage and frequency to within the stage 1 settings of table 1.

Under Voltage	
Time delay setting	Measured delay
20s	21,14s
Over Voltage	
Time delay setting	Measured delay
20s	21,16s
Under Frequency	
Time delay setting	Measured delay
20s	21,33s
Over Frequency	
Time delay setting	Measured delay
20s	21,37s

	Checks on no reconnection when voltage or frequency is brought to just outside stage 1 limits of table 1.			
	At 266,2Vp-n (461,1Vp-p)	At 180,0Vp-n (339,7Vp-p)	At 47,4Hz	At 52,1Hz
Confirmation that the SSEG does not re-connect.	No reconnection	No reconnection	No reconnection	No reconnection

Note:
Inverter is a three phase inverter without neutal wire. Therefore phase to phase voltages were used.

A7.1.2.6 Frequency Drift and Step Change Stability test

P

Test:

	Frequency Ramp	Change	Test Duration	Confirm no trip
Positive Vector Shift	49,5Hz	+50 degrees		No trip
Negative Vector Shift	50,5Hz	-50 degrees		No trip
Positive Frequency drift	49,0Hz to 51,0Hz	+0,95Hz/sec	2,1s	No trip
Negative Frequency drift	51,0Hz to 49,0Hz	-0,95Hz/sec	2,1s	No trip

Note:

Manufacturers considering new designs should allow for the RoCoF where stability is required to be increased to, up to 2Hz per second, as proposed in the new European network codes, which are expected to come into force over the period 2014/2015. Under these conditions RoCoF will cease to be an effective loss of mains protection and is unlikely to be permitted in future revisions of this document.

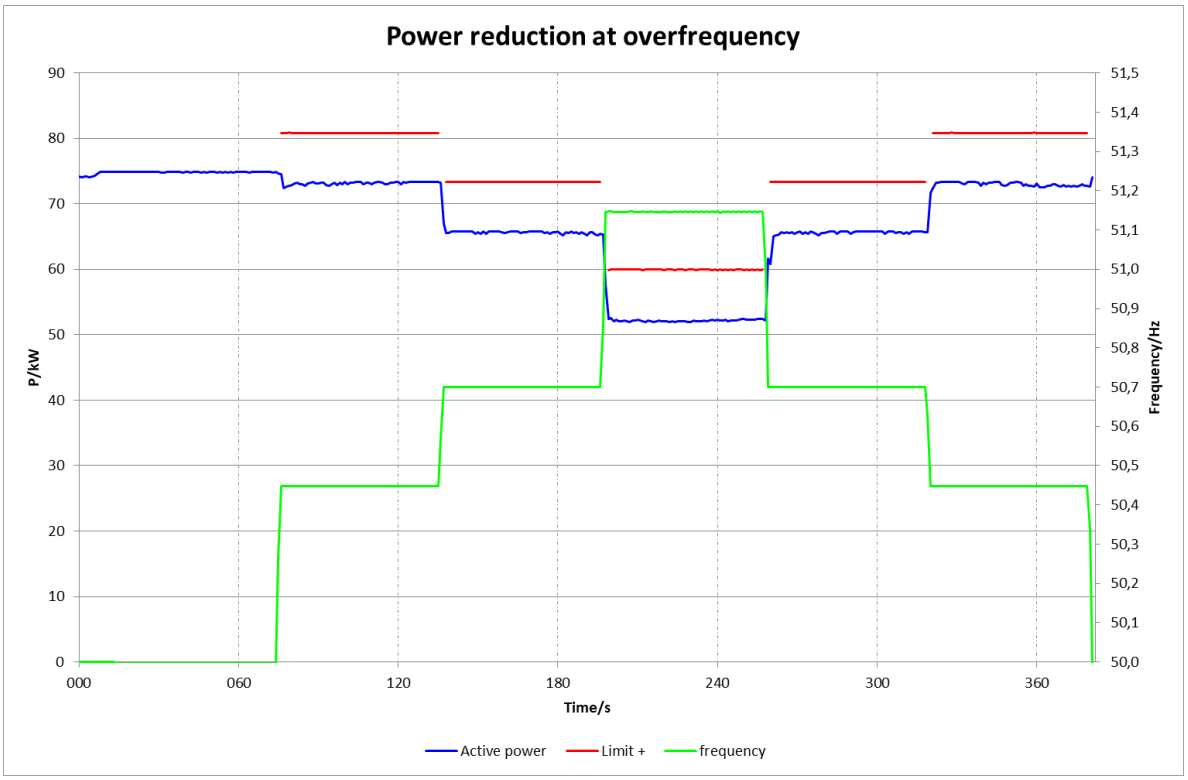
For the step change test the SSEG should be operated with a measureable output at the start frequency and then a vector shift should be applied by extending or reducing the time of a single cycle with subsequent cycles returning to the start frequency. The start frequency should then be maintained for a period of at least 10 seconds to complete the test. The SSEG should not trip during this test.

For frequency drift tests the SSEG should be operated with a measureable output at the start frequency and then the frequency changed in a ramp function at 0,95Hz per second to the end frequency. On reaching the end frequency it should be maintained for a period of at least 10 seconds. The SSEG should not trip during this test.

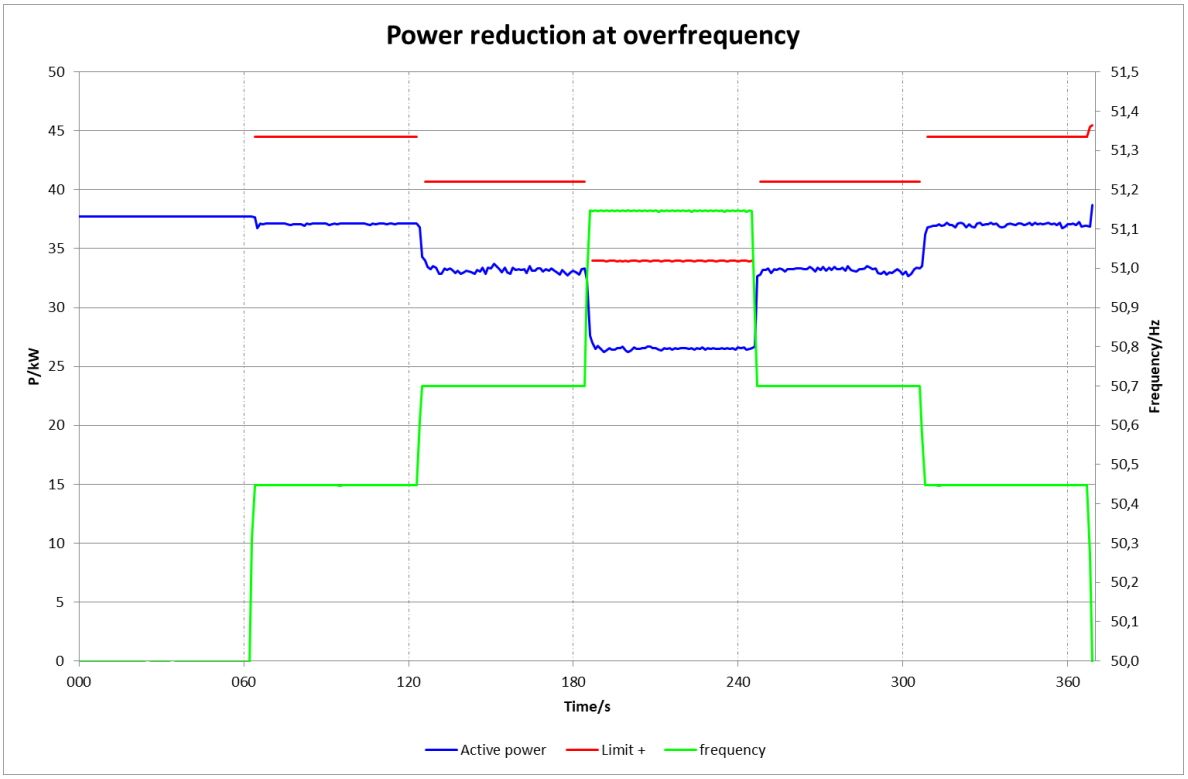
A7.1.3 Power response to over-frequency	P

Test:							
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% P_n							
Frequency [Hz]:	50,00	50,45	50,70	51,14	50,70	50,45	50,00
$P_{expected}$ [W]:	N/A	74,75	67,08	53,52	67,08	74,75	N/A
$P_{measured}$ [W]:	76,20	74,15	66,39	53,13	66,15	74,04	76,18
2. Measurement a) to g): Active power output 40% and 60% after freezing > 80% P_n							
Frequency [Hz]:	50,00	50,45	50,70	51,15	50,70	50,45	50,00
$P_{expected}$ [W]:	N/A	37,80	33,92	27,05	33,92	37,80	N/A
$P_{measured}$ [W]:	38,53	37,75	33,95	27,05	33,75	37,80	38,54

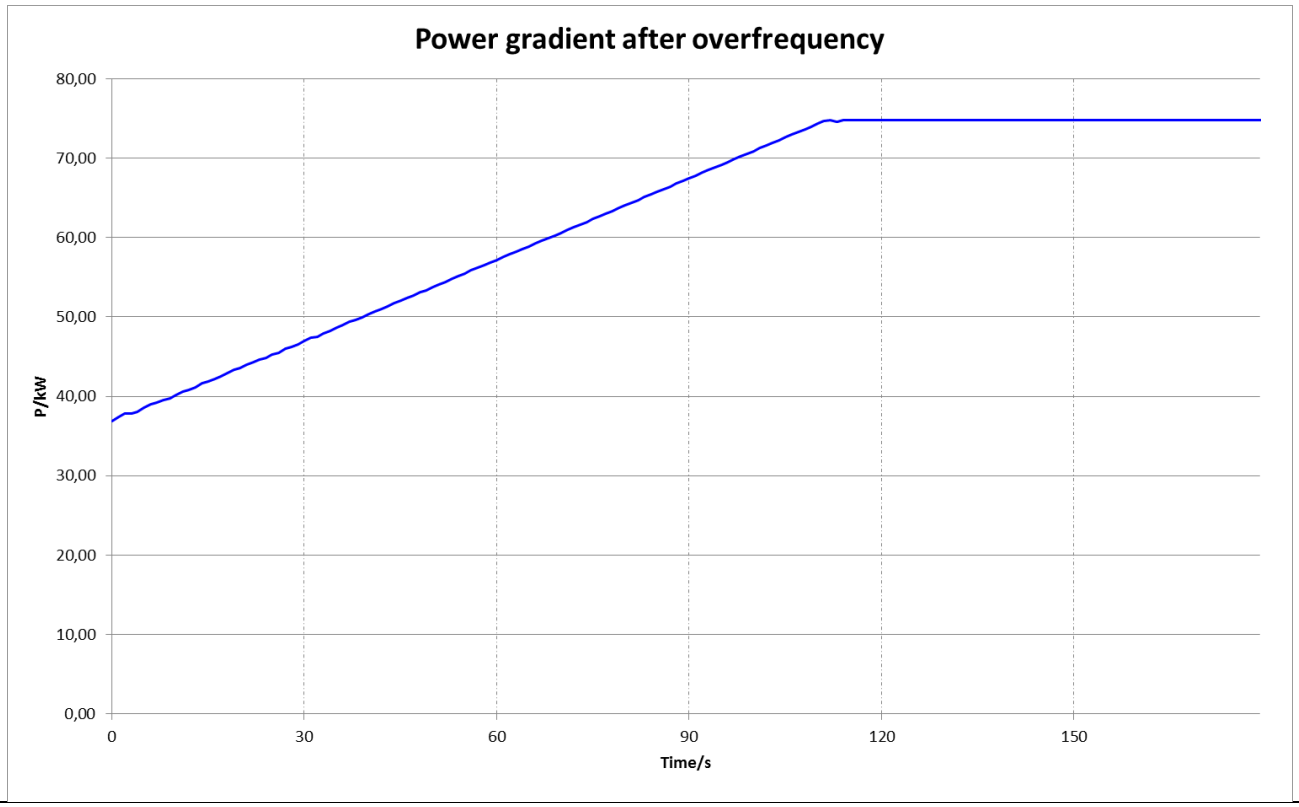
Graph of Measurement 1.: Active power output > 80% P_n



Graph of Measurement 2.:Active power output 40% and 60% after freezing > 80% P_n



Graph of power gradient:



Test:

The test is conducted for two powers. First, the test must start at a power > 80% Pn ("Measurement 1"), and in a second test, for a power between 40% to 60% Pn ("Measurement 2").

Point g) must be held until the micro-generator is again feeding in with the active power output available.

Note.

The test was performed with a droop 2% of Pn. The droop is settable in the range of 0% - 12% of Pn.

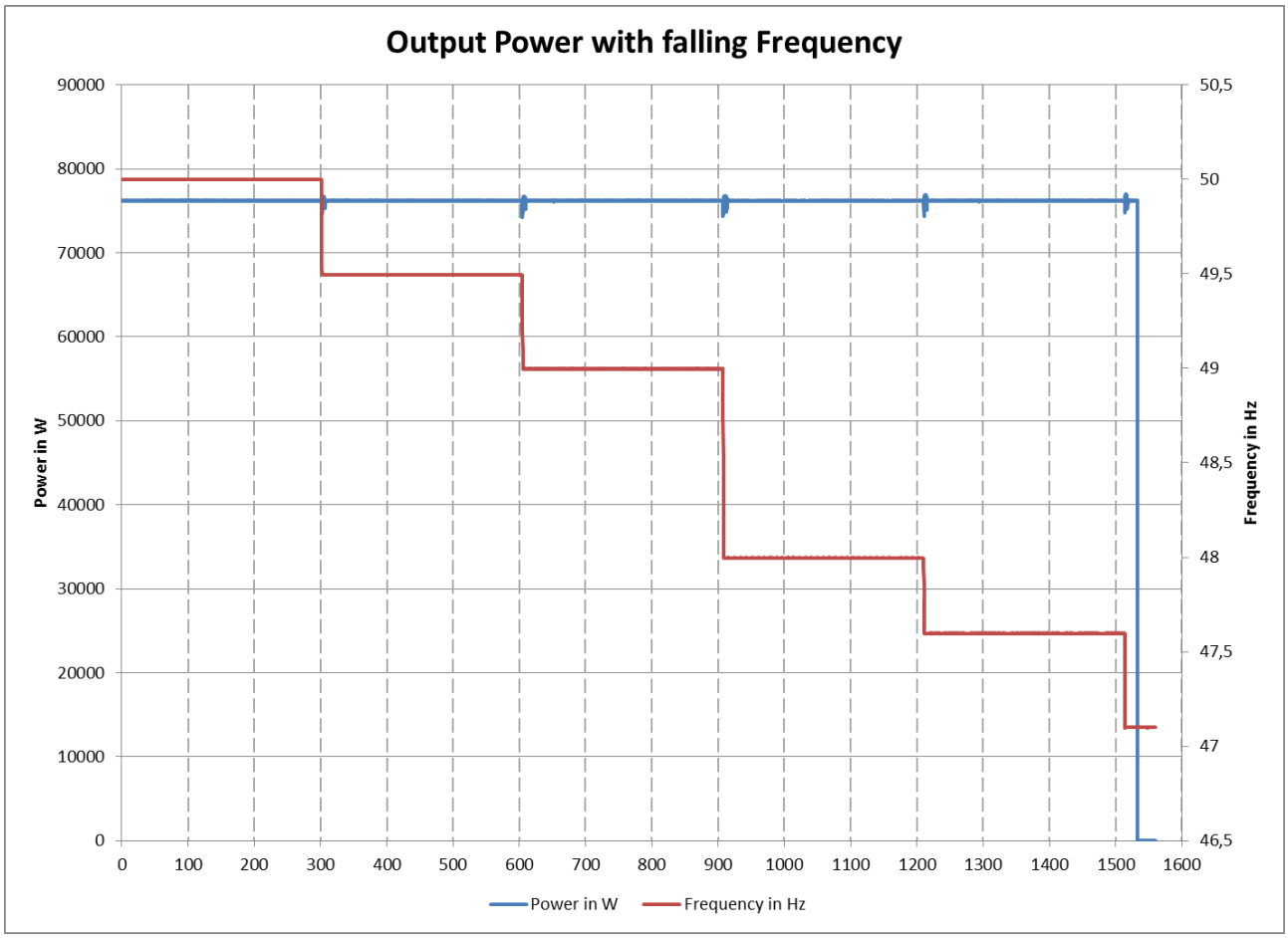
The test was performed without default dealy setting 0s. A delay can be set from 0s – 60s (in 0,001s steps).

A.7.2.3 Power Output with Falling Frequency

P

Setting values	Over voltage [Vp-n] / [Vp-p] ..... :	261,1 / 454,1
	Under voltage [Vp-n] / [Vp-p] ..... :	183,3 / 318,7
	Over frequency [Hz] ..... :	52,00
	Under frequency [Hz] ..... :	47,50
	Derating power frequency point [Hz] .....:	N/A

Frequency set point[Hz]:	50,00	49,50	49,00	48,00	47,60	47,10
Frequency [Hz]:	50,00	49,50	49,00	48,00	47,60	47,10
Active power [kW]:	76,2	76,2	76,2	76,2	76,2	0,0



Criteria:

The frequency should then be set to 49,5 Hz for 5 minutes. The output should remain at 100% of Registered Capacity.

The frequency should then be set to 49,0 Hz and once the output has stabilised, held at this frequency for 5 minutes. The Active Power output must not be below 99% of Registered Capacity.

The frequency should then be set to 48,0 Hz and once the output has stabilised, held at this frequency for 5 minutes. The Active Power output must not be below 97% of Registered Capacity.

The frequency should then be set to 47,6 Hz and once the output has stabilised, held at this frequency for 5 minutes. The Active Power output must not be below 96,2% of Registered Capacity.

The frequency should then be set to 47,1 Hz and held at this frequency for 20 s. The Active Power output must not be below 95,0% of Registered Capacity and the Synchronous Power Generating Module must not trip in less than the 20s of the test.

A.7.1.4.1 Harmonic Current Emissions	P

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Phase1

Generating Unit tested to BS EN 61000-3-12

Generating Unit rating per phase (rpp)						
	At 45-55% of rated ouput 12,44kW		100% of rated output 24,82kW			
Harmonic	Measured Value (MV) in Amps	Measured Value (MV) in %	Measured Value (MV) in Amps	Measured Value (MV) in %	Limit in BS EN 61000-3-12 in %	
					1 phase	3 phase
2nd	0,490	0,454	0,515	0,477	8%	8%
3rd	0,285	0,265	0,359	0,333	21,6%	N/A
4th	0,146	0,135	0,236	0,219	4%	4%
5th	0,120	0,111	0,218	0,202	10,7%	10,7%
6th	0,095	0,088	0,169	0,157	2,67%	2,67%
7th	0,106	0,099	0,208	0,193	7,2%	7,2%
8th	0,084	0,078	0,132	0,123	2%	2%
9th	0,132	0,123	0,227	0,210	3,8%	N/A
10th	0,034	0,032	0,067	0,062	1,6%	1,6%
11th	0,154	0,142	0,093	0,086	3,1%	3,1%
12th	0,032	0,029	0,069	0,064	1,33%	1,33%
13th	0,167	0,155	0,127	0,118	2%	2%
14th	0,023	0,021	0,035	0,032	N/A	N/A
15th	0,018	0,017	0,037	0,034	N/A	N/A
16th	0,030	0,027	0,051	0,047	N/A	N/A
17th	0,167	0,154	0,166	0,154	N/A	N/A
18th	0,015	0,014	0,026	0,024	N/A	N/A
19th	0,106	0,098	0,111	0,103	N/A	N/A
20th	0,014	0,013	0,023	0,022	N/A	N/A
21th	0,012	0,011	0,021	0,020	N/A	N/A
22th	0,010	0,010	0,019	0,017	N/A	N/A
23th	0,055	0,051	0,090	0,083	N/A	N/A
24th	0,012	0,011	0,022	0,021	N/A	N/A
25th	0,050	0,046	0,076	0,071	N/A	N/A
26th	0,008	0,008	0,015	0,014	N/A	N/A
27th	0,009	0,008	0,017	0,016	N/A	N/A
28th	0,011	0,011	0,019	0,017	N/A	N/A

29th	0,039	0,036	0,060	0,056	N/A	N/A
30th	0,011	0,010	0,018	0,017	N/A	N/A
31th	0,036	0,033	0,047	0,044	N/A	N/A
32th	0,016	0,015	0,023	0,022	N/A	N/A
33th	0,019	0,018	0,035	0,032	N/A	N/A
34th	0,019	0,018	0,034	0,032	N/A	N/A
35th	0,029	0,027	0,040	0,037	N/A	N/A
36th	0,009	0,009	0,020	0,018	N/A	N/A
37th	0,038	0,035	0,059	0,055	N/A	N/A
38th	0,041	0,038	0,061	0,056	N/A	N/A
39th	0,033	0,030	0,054	0,050	N/A	N/A
40th	0,038	0,035	0,062	0,058	N/A	N/A
THD	1,33		0,81		23%	13%
PWHD	0,004		0,001		23%	22%

A.7.1.4.1 Harmonic Current Emissions	P

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Phase2

Generating Unit tested to BS EN 61000-3-12

Generating Unit rating per phase (rpp)						
	At 45-55% of rated ouput 12,45kW		100% of rated output 24,84kW			
Harmonic	Measured Value (MV) in Amps	Measured Value (MV) in %	Measured Value (MV) in Amps	Measured Value (MV) in %	Limit in BS EN 61000-3-12 in %	
					1 phase	3 phase
2nd	0,532	0,493	0,671	0,622	8%	8%
3rd	0,228	0,211	0,225	0,208	21,6%	N/A
4th	0,157	0,146	0,169	0,157	4%	4%
5th	0,061	0,057	0,092	0,085	10,7%	10,7%
6th	0,060	0,055	0,129	0,120	2,67%	2,67%
7th	0,061	0,056	0,111	0,103	7,2%	7,2%
8th	0,049	0,046	0,071	0,066	2%	2%
9th	0,107	0,099	0,165	0,153	3,8%	N/A
10th	0,055	0,051	0,105	0,097	1,6%	1,6%
11th	0,159	0,147	0,151	0,140	3,1%	3,1%
12th	0,041	0,038	0,094	0,087	1,33%	1,33%
13th	0,177	0,164	0,155	0,143	2%	2%
14th	0,032	0,030	0,048	0,044	N/A	N/A
15th	0,024	0,022	0,038	0,035	N/A	N/A
16th	0,024	0,022	0,031	0,029	N/A	N/A
17th	0,177	0,164	0,174	0,161	N/A	N/A
18th	0,017	0,015	0,028	0,026	N/A	N/A
19th	0,119	0,110	0,120	0,111	N/A	N/A
20th	0,015	0,014	0,019	0,018	N/A	N/A
21th	0,011	0,010	0,017	0,016	N/A	N/A
22th	0,014	0,013	0,024	0,022	N/A	N/A
23th	0,054	0,050	0,090	0,084	N/A	N/A
24th	0,015	0,014	0,027	0,025	N/A	N/A
25th	0,050	0,047	0,077	0,071	N/A	N/A
26th	0,014	0,013	0,022	0,020	N/A	N/A
27th	0,012	0,011	0,020	0,018	N/A	N/A
28th	0,010	0,009	0,014	0,013	N/A	N/A

29th	0,040	0,037	0,060	0,055	N/A	N/A
30th	0,009	0,008	0,015	0,014	N/A	N/A
31th	0,037	0,034	0,051	0,047	N/A	N/A
32th	0,016	0,015	0,028	0,026	N/A	N/A
33th	0,028	0,026	0,048	0,045	N/A	N/A
34th	0,031	0,028	0,061	0,057	N/A	N/A
35th	0,040	0,037	0,060	0,056	N/A	N/A
36th	0,040	0,037	0,060	0,055	N/A	N/A
37th	0,030	0,027	0,044	0,041	N/A	N/A
38th	0,019	0,017	0,022	0,021	N/A	N/A
39th	0,018	0,017	0,030	0,027	N/A	N/A
40th	0,020	0,018	0,033	0,030	N/A	N/A
THD	1,32		0,81		23%	13%
PWHD	0,005		0,001		23%	22%

A.7.1.4.1 Harmonic Current Emissions	P

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Phase3

Generating Unit tested to BS EN 61000-3-12

Generating Unit rating per phase (rpp)						
	At 45-55% of rated ouput 12,45kW		100% of rated output 24,84kW			
Harmonic	Measured Value (MV) in Amps	Measured Value (MV) in %	Measured Value (MV) in Amps	Measured Value (MV) in %	Limit in BS EN 61000-3-12 in %	
					1 phase	3 phase
2nd	0,259	0,240	0,357	0,330	8%	8%
3rd	0,211	0,195	0,244	0,226	21,6%	N/A
4th	0,160	0,148	0,237	0,220	4%	4%
5th	0,089	0,083	0,163	0,151	10,7%	10,7%
6th	0,067	0,062	0,111	0,103	2,67%	2,67%
7th	0,069	0,064	0,109	0,101	7,2%	7,2%
8th	0,064	0,059	0,131	0,122	2%	2%
9th	0,065	0,060	0,161	0,150	3,8%	N/A
10th	0,046	0,042	0,102	0,094	1,6%	1,6%
11th	0,155	0,144	0,125	0,116	3,1%	3,1%
12th	0,040	0,037	0,063	0,058	1,33%	1,33%
13th	0,171	0,159	0,137	0,127	2%	2%
14th	0,024	0,022	0,037	0,035	N/A	N/A
15th	0,019	0,018	0,038	0,035	N/A	N/A
16th	0,023	0,021	0,037	0,034	N/A	N/A
17th	0,176	0,163	0,178	0,165	N/A	N/A
18th	0,019	0,018	0,034	0,032	N/A	N/A
19th	0,106	0,098	0,115	0,106	N/A	N/A
20th	0,012	0,011	0,019	0,017	N/A	N/A
21th	0,011	0,010	0,018	0,016	N/A	N/A
22th	0,013	0,012	0,021	0,020	N/A	N/A
23th	0,057	0,053	0,091	0,085	N/A	N/A
24th	0,013	0,012	0,021	0,019	N/A	N/A
25th	0,049	0,046	0,073	0,068	N/A	N/A
26th	0,013	0,012	0,021	0,020	N/A	N/A
27th	0,011	0,010	0,019	0,018	N/A	N/A
28th	0,010	0,009	0,015	0,014	N/A	N/A

29th	0,039	0,036	0,057	0,053	N/A	N/A
30th	0,010	0,009	0,015	0,014	N/A	N/A
31th	0,034	0,032	0,050	0,047	N/A	N/A
32th	0,012	0,011	0,022	0,020	N/A	N/A
33th	0,026	0,024	0,037	0,034	N/A	N/A
34th	0,027	0,025	0,045	0,042	N/A	N/A
35th	0,039	0,036	0,064	0,060	N/A	N/A
36th	0,037	0,034	0,063	0,058	N/A	N/A
37th	0,032	0,030	0,060	0,056	N/A	N/A
38th	0,024	0,022	0,043	0,040	N/A	N/A
39th	0,018	0,017	0,028	0,026	N/A	N/A
40th	0,021	0,020	0,033	0,031	N/A	N/A
THD	0,98		0,64		23%	13%
PWHD	0,005		0,001		23%	22%

A.7.1.4.1 Harmonic Current Emissions	P

STPS60-10

Phase1

Generating Unit tested to BS EN 61000-3-12

Generating Unit rating per phase (rpp)						
	At 45-55% of rated ouput 12,44kW		100% of rated output 24,82kW			
Harmonic	Measured Value (MV) in Amps	Measured Value (MV) in %	Measured Value (MV) in Amps	Measured Value (MV) in %	Limit in BS EN 61000-3-12 in %	
					1 phase	3 phase
2nd	0,337	0,315	0,112	0,105	8%	8%
3rd	0,212	0,198	0,043	0,040	21,6%	N/A
4th	0,128	0,120	0,072	0,067	4%	4%
5th	0,156	0,146	0,062	0,058	10,7%	10,7%
6th	0,092	0,086	0,045	0,042	2,67%	2,67%
7th	0,098	0,091	0,044	0,041	7,2%	7,2%
8th	0,032	0,030	0,039	0,037	2%	2%
9th	0,041	0,039	0,159	0,149	3,8%	N/A
10th	0,061	0,057	0,050	0,047	1,6%	1,6%
11th	0,162	0,152	0,100	0,094	3,1%	3,1%
12th	0,026	0,024	0,034	0,032	1,33%	1,33%
13th	0,157	0,147	0,123	0,115	2%	2%
14th	0,027	0,025	0,028	0,026	N/A	N/A
15th	0,029	0,027	0,033	0,031	N/A	N/A
16th	0,029	0,028	0,043	0,040	N/A	N/A
17th	0,182	0,170	0,194	0,181	N/A	N/A
18th	0,014	0,013	0,024	0,022	N/A	N/A
19th	0,122	0,114	0,131	0,122	N/A	N/A
20th	0,014	0,013	0,021	0,019	N/A	N/A
21th	0,014	0,013	0,022	0,020	N/A	N/A
22th	0,013	0,012	0,013	0,012	N/A	N/A
23th	0,067	0,062	0,107	0,100	N/A	N/A
24th	0,010	0,009	0,014	0,013	N/A	N/A
25th	0,058	0,054	0,088	0,083	N/A	N/A
26th	0,015	0,014	0,013	0,012	N/A	N/A
27th	0,019	0,017	0,024	0,023	N/A	N/A
28th	0,009	0,009	0,013	0,012	N/A	N/A

29th	0,042	0,039	0,066	0,062	N/A	N/A
30th	0,013	0,012	0,013	0,012	N/A	N/A
31th	0,042	0,039	0,054	0,050	N/A	N/A
32th	0,021	0,019	0,022	0,021	N/A	N/A
33th	0,018	0,017	0,037	0,035	N/A	N/A
34th	0,012	0,011	0,036	0,033	N/A	N/A
35th	0,039	0,036	0,043	0,040	N/A	N/A
36th	0,036	0,034	0,017	0,016	N/A	N/A
37th	0,024	0,023	0,060	0,057	N/A	N/A
38th	0,008	0,008	0,067	0,063	N/A	N/A
39th	0,021	0,020	0,055	0,051	N/A	N/A
40th	0,027	0,025	0,065	0,061	N/A	N/A
THD	1,079		0,500		23%	13%
PWHD	0,005		0,002		23%	22%

A.7.1.4.1 Harmonic Current Emissions	P

STPS60-10

Phase2

Generating Unit tested to BS EN 61000-3-12

Generating Unit rating per phase (rpp)						
	At 45-55% of rated ouput 12,45kW		100% of rated output 24,84kW			
Harmonic	Measured Value (MV) in Amps	Measured Value (MV) in %	Measured Value (MV) in Amps	Measured Value (MV) in %	Limit in BS EN 61000-3-12 in %	
					1 phase	3 phase
2nd	0,303	0,283	0,293	0,274	8%	8%
3rd	0,221	0,207	0,036	0,034	21,6%	N/A
4th	0,176	0,165	0,094	0,088	4%	4%
5th	0,113	0,106	0,046	0,043	10,7%	10,7%
6th	0,080	0,074	0,063	0,059	2,67%	2,67%
7th	0,064	0,059	0,029	0,027	7,2%	7,2%
8th	0,058	0,054	0,041	0,038	2%	2%
9th	0,066	0,062	0,176	0,165	3,8%	N/A
10th	0,041	0,038	0,061	0,057	1,6%	1,6%
11th	0,129	0,121	0,110	0,103	3,1%	3,1%
12th	0,066	0,062	0,038	0,036	1,33%	1,33%
13th	0,160	0,150	0,132	0,124	2%	2%
14th	0,042	0,039	0,036	0,033	N/A	N/A
15th	0,043	0,040	0,032	0,030	N/A	N/A
16th	0,023	0,021	0,028	0,027	N/A	N/A
17th	0,196	0,183	0,217	0,203	N/A	N/A
18th	0,019	0,017	0,022	0,021	N/A	N/A
19th	0,126	0,118	0,135	0,127	N/A	N/A
20th	0,017	0,016	0,017	0,016	N/A	N/A
21th	0,014	0,013	0,019	0,018	N/A	N/A
22th	0,020	0,019	0,019	0,018	N/A	N/A
23th	0,066	0,062	0,107	0,100	N/A	N/A
24th	0,022	0,021	0,017	0,016	N/A	N/A
25th	0,060	0,056	0,083	0,078	N/A	N/A
26th	0,013	0,012	0,011	0,011	N/A	N/A
27th	0,017	0,016	0,024	0,022	N/A	N/A
28th	0,010	0,009	0,013	0,012	N/A	N/A

29th	0,043	0,040	0,064	0,060	N/A	N/A
30th	0,012	0,012	0,013	0,012	N/A	N/A
31th	0,043	0,041	0,053	0,049	N/A	N/A
32th	0,029	0,027	0,031	0,029	N/A	N/A
33th	0,037	0,035	0,050	0,046	N/A	N/A
34th	0,043	0,040	0,064	0,060	N/A	N/A
35th	0,031	0,029	0,065	0,061	N/A	N/A
36th	0,024	0,022	0,066	0,061	N/A	N/A
37th	0,029	0,028	0,046	0,043	N/A	N/A
38th	0,021	0,019	0,027	0,025	N/A	N/A
39th	0,017	0,016	0,033	0,031	N/A	N/A
40th	0,015	0,014	0,034	0,032	N/A	N/A
THD	1,056		0,502		23%	13%
PWHD	0,006		0,002		23%	22%

A.7.1.4.1 Harmonic Current Emissions	P

STPS60-10

Phase3

Generating Unit tested to BS EN 61000-3-12

Generating Unit rating per phase (rpp)						
	At 45-55% of rated ouput 12,45kW		100% of rated output 24,84kW			
Harmonic	Measured Value (MV) in Amps	Measured Value (MV) in %	Measured Value (MV) in Amps	Measured Value (MV) in %	Limit in BS EN 61000-3-12 in %	
					1 phase	3 phase
2nd	0,160	0,149	0,195	0,183	8%	8%
3rd	0,204	0,191	0,034	0,032	21,6%	N/A
4th	0,155	0,145	0,072	0,067	4%	4%
5th	0,121	0,113	0,032	0,030	10,7%	10,7%
6th	0,086	0,080	0,057	0,053	2,67%	2,67%
7th	0,072	0,067	0,034	0,032	7,2%	7,2%
8th	0,050	0,046	0,038	0,036	2%	2%
9th	0,058	0,054	0,046	0,043	3,8%	N/A
10th	0,050	0,047	0,058	0,054	1,6%	1,6%
11th	0,138	0,129	0,093	0,087	3,1%	3,1%
12th	0,056	0,052	0,039	0,036	1,33%	1,33%
13th	0,168	0,157	0,132	0,124	2%	2%
14th	0,034	0,031	0,026	0,024	N/A	N/A
15th	0,037	0,035	0,027	0,025	N/A	N/A
16th	0,023	0,021	0,033	0,031	N/A	N/A
17th	0,194	0,182	0,216	0,202	N/A	N/A
18th	0,021	0,019	0,032	0,030	N/A	N/A
19th	0,123	0,115	0,139	0,130	N/A	N/A
20th	0,016	0,015	0,015	0,014	N/A	N/A
21th	0,015	0,014	0,017	0,016	N/A	N/A
22th	0,018	0,017	0,019	0,018	N/A	N/A
23th	0,072	0,068	0,113	0,105	N/A	N/A
24th	0,020	0,018	0,016	0,015	N/A	N/A
25th	0,057	0,053	0,082	0,077	N/A	N/A
26th	0,014	0,013	0,012	0,011	N/A	N/A
27th	0,017	0,016	0,022	0,021	N/A	N/A
28th	0,010	0,010	0,013	0,012	N/A	N/A

29th	0,044	0,041	0,066	0,062	N/A	N/A
30th	0,015	0,014	0,013	0,012	N/A	N/A
31th	0,043	0,040	0,055	0,051	N/A	N/A
32th	0,026	0,024	0,024	0,022	N/A	N/A
33th	0,033	0,031	0,039	0,037	N/A	N/A
34th	0,040	0,037	0,048	0,045	N/A	N/A
35th	0,036	0,034	0,065	0,061	N/A	N/A
36th	0,029	0,027	0,065	0,061	N/A	N/A
37th	0,030	0,028	0,060	0,056	N/A	N/A
38th	0,022	0,020	0,044	0,042	N/A	N/A
39th	0,017	0,016	0,027	0,025	N/A	N/A
40th	0,017	0,016	0,036	0,033	N/A	N/A
THD	0,928		0,422		23%	13%
PWHD	0,006		0,002		23%	22%

A.7.1.4.1 Harmonic Current Emissions	P

STP60-10

Phase1

Generating Unit tested to BS EN 61000-3-12

Generating Unit rating per phase (rpp)						
	At 45-55% of rated ouput 10,04kW		100% of rated output 19,90kW			
Harmonic	Measured Value (MV) in Amps	Measured Value (MV) in %	Measured Value (MV) in Amps	Measured Value (MV) in %	Limit in BS EN 61000-3-12 in %	
					1 phase	3 phase
2nd	0,171	0,199	0,242	0,281	8%	8%
3rd	0,193	0,223	0,084	0,097	21,6%	N/A
4th	0,070	0,081	0,053	0,062	4%	4%
5th	0,155	0,180	0,049	0,057	10,7%	10,7%
6th	0,040	0,047	0,033	0,039	2,67%	2,67%
7th	0,049	0,057	0,052	0,060	7,2%	7,2%
8th	0,030	0,035	0,025	0,028	2%	2%
9th	0,053	0,061	0,031	0,036	3,8%	N/A
10th	0,028	0,033	0,025	0,029	1,6%	1,6%
11th	0,098	0,113	0,159	0,185	3,1%	3,1%
12th	0,024	0,027	0,019	0,022	1,33%	1,33%
13th	0,101	0,118	0,166	0,192	2%	2%
14th	0,014	0,016	0,014	0,017	N/A	N/A
15th	0,013	0,016	0,012	0,014	N/A	N/A
16th	0,013	0,015	0,013	0,015	N/A	N/A
17th	0,127	0,147	0,155	0,179	N/A	N/A
18th	0,008	0,009	0,009	0,011	N/A	N/A
19th	0,097	0,112	0,113	0,131	N/A	N/A
20th	0,007	0,008	0,009	0,011	N/A	N/A
21th	0,009	0,011	0,010	0,012	N/A	N/A
22th	0,006	0,007	0,008	0,009	N/A	N/A
23th	0,074	0,086	0,062	0,072	N/A	N/A
24th	0,008	0,010	0,010	0,011	N/A	N/A
25th	0,073	0,084	0,064	0,074	N/A	N/A
26th	0,008	0,009	0,009	0,010	N/A	N/A
27th	0,033	0,039	0,033	0,039	N/A	N/A
28th	0,006	0,007	0,007	0,008	N/A	N/A

29th	0,041	0,048	0,037	0,043	N/A	N/A
30th	0,006	0,007	0,006	0,007	N/A	N/A
31th	0,034	0,040	0,032	0,037	N/A	N/A
32th	0,007	0,008	0,006	0,007	N/A	N/A
33th	0,008	0,009	0,006	0,007	N/A	N/A
34th	0,006	0,007	0,005	0,006	N/A	N/A
35th	0,019	0,022	0,014	0,017	N/A	N/A
36th	0,016	0,019	0,012	0,014	N/A	N/A
37th	0,015	0,018	0,011	0,013	N/A	N/A
38th	0,013	0,015	0,010	0,011	N/A	N/A
39th	0,007	0,008	0,005	0,006	N/A	N/A
40th	0,008	0,009	0,005	0,006	N/A	N/A
THD	0,47		0,98		23%	13%
PWHD	0,0012		0,0062		23%	22%

A.7.1.4.1 Harmonic Current Emissions	P

STP60-10

Phase2

Generating Unit tested to BS EN 61000-3-12

Generating Unit rating per phase (rpp)						
	At 45-55% of rated ouput 10,04kW		100% of rated output 19,90kW			
Harmonic	Measured Value (MV) in Amps	Measured Value (MV) in %	Measured Value (MV) in Amps	Measured Value (MV) in %	Limit in BS EN 61000-3-12 in %	
					1 phase	3 phase
2nd	0,234	0,271	0,238	0,276	8%	8%
3rd	0,073	0,084	0,129	0,149	21,6%	N/A
4th	0,058	0,068	0,071	0,082	4%	4%
5th	0,034	0,040	0,074	0,086	10,7%	10,7%
6th	0,031	0,036	0,035	0,041	2,67%	2,67%
7th	0,045	0,052	0,029	0,033	7,2%	7,2%
8th	0,022	0,025	0,025	0,029	2%	2%
9th	0,022	0,026	0,059	0,068	3,8%	N/A
10th	0,025	0,029	0,030	0,034	1,6%	1,6%
11th	0,153	0,177	0,100	0,115	3,1%	3,1%
12th	0,022	0,025	0,024	0,028	1,33%	1,33%
13th	0,164	0,189	0,096	0,111	2%	2%
14th	0,017	0,019	0,016	0,019	N/A	N/A
15th	0,012	0,013	0,016	0,018	N/A	N/A
16th	0,012	0,014	0,012	0,014	N/A	N/A
17th	0,154	0,178	0,128	0,148	N/A	N/A
18th	0,011	0,013	0,009	0,011	N/A	N/A
19th	0,117	0,135	0,095	0,110	N/A	N/A
20th	0,009	0,010	0,007	0,008	N/A	N/A
21th	0,009	0,011	0,009	0,010	N/A	N/A
22th	0,009	0,010	0,007	0,008	N/A	N/A
23th	0,058	0,067	0,073	0,085	N/A	N/A
24th	0,010	0,012	0,010	0,011	N/A	N/A
25th	0,064	0,074	0,071	0,082	N/A	N/A
26th	0,009	0,011	0,008	0,009	N/A	N/A
27th	0,033	0,039	0,032	0,037	N/A	N/A
28th	0,006	0,007	0,006	0,007	N/A	N/A

29th	0,035	0,040	0,040	0,046	N/A	N/A
30th	0,006	0,006	0,006	0,007	N/A	N/A
31th	0,032	0,037	0,033	0,039	N/A	N/A
32th	0,007	0,008	0,007	0,009	N/A	N/A
33th	0,007	0,008	0,008	0,009	N/A	N/A
34th	0,007	0,008	0,009	0,010	N/A	N/A
35th	0,013	0,016	0,019	0,022	N/A	N/A
36th	0,013	0,015	0,017	0,020	N/A	N/A
37th	0,012	0,014	0,014	0,017	N/A	N/A
38th	0,009	0,011	0,012	0,014	N/A	N/A
39th	0,004	0,004	0,006	0,007	N/A	N/A
40th	0,003	0,004	0,004	0,004	N/A	N/A
THD	0,45		0,95		23%	13%
PWHD	0,0012		0,006		23%	22%

A.7.1.4.1 Harmonic Current Emissions	P

STP60-10

Phase3

Generating Unit tested to BS EN 61000-3-12

Generating Unit rating per phase (rpp)						
	At 45-55% of rated ouput 10,04kW		100% of rated output 19,90kW			
Harmonic	Measured Value (MV) in Amps	Measured Value (MV) in %	Measured Value (MV) in Amps	Measured Value (MV) in %	Limit in BS EN 61000-3-12 in %	
					1 phase	3 phase
2nd	0,171	0,197	0,108	0,125	8%	8%
3rd	0,068	0,079	0,096	0,111	21,6%	N/A
4th	0,055	0,064	0,071	0,082	4%	4%
5th	0,038	0,044	0,129	0,149	10,7%	10,7%
6th	0,031	0,035	0,033	0,039	2,67%	2,67%
7th	0,042	0,049	0,036	0,041	7,2%	7,2%
8th	0,022	0,025	0,027	0,031	2%	2%
9th	0,026	0,030	0,042	0,049	3,8%	N/A
10th	0,024	0,028	0,029	0,034	1,6%	1,6%
11th	0,153	0,177	0,094	0,108	3,1%	3,1%
12th	0,021	0,024	0,024	0,027	1,33%	1,33%
13th	0,164	0,190	0,099	0,115	2%	2%
14th	0,015	0,017	0,015	0,018	N/A	N/A
15th	0,011	0,013	0,014	0,016	N/A	N/A
16th	0,012	0,014	0,013	0,015	N/A	N/A
17th	0,159	0,184	0,133	0,153	N/A	N/A
18th	0,011	0,012	0,009	0,011	N/A	N/A
19th	0,115	0,132	0,095	0,109	N/A	N/A
20th	0,008	0,009	0,008	0,009	N/A	N/A
21th	0,010	0,011	0,010	0,012	N/A	N/A
22th	0,009	0,010	0,007	0,008	N/A	N/A
23th	0,062	0,072	0,078	0,090	N/A	N/A
24th	0,010	0,011	0,009	0,010	N/A	N/A
25th	0,061	0,071	0,071	0,082	N/A	N/A
26th	0,008	0,010	0,009	0,011	N/A	N/A
27th	0,033	0,038	0,034	0,039	N/A	N/A
28th	0,006	0,007	0,006	0,007	N/A	N/A

29th	0,038	0,044	0,043	0,050	N/A	N/A
30th	0,006	0,007	0,006	0,007	N/A	N/A
31th	0,031	0,035	0,033	0,038	N/A	N/A
32th	0,006	0,007	0,007	0,008	N/A	N/A
33th	0,006	0,007	0,007	0,008	N/A	N/A
34th	0,007	0,008	0,007	0,008	N/A	N/A
35th	0,016	0,018	0,020	0,023	N/A	N/A
36th	0,013	0,015	0,017	0,019	N/A	N/A
37th	0,011	0,013	0,016	0,018	N/A	N/A
38th	0,010	0,011	0,012	0,014	N/A	N/A
39th	0,003	0,004	0,004	0,004	N/A	N/A
40th	0,003	0,004	0,005	0,006	N/A	N/A
THD	0,39		0,87		23%	13%
PWHD	0,0012		0,006		23%	22%

A.7.1.4.2 Power factor				P
Test:				
Output power	215,3Vp-n (374,5Vp-p)	230Vp-n (400Vp-p)	252,0Vp-n (438,2Vp-p)	Measured at three voltage levels and at full output. Voltage to be maintained within ±1,5% of the stated level during the test.
20%	1,000	1,000	1,000	
50%	1,000	1,000	1,000	
75%	1,000	1,000	1,000	
100%	1,000	1,000	1,000	
Limit	>0,95	>0,95	>0,95	

Note:

The power factor capability of the SSEG shall conform to EN 50438. When operating at Registered Capacity the SSEGshall operate at a power factor within the range 0,95 lagging to 0,95 leading relative to the voltage waveform unless otherwise agreed with the DNO eg for power factor improvement.

The test set up shall be such that the Inverter supplies full load to the DNO's Distribution System via the power factor (pf) meter and the variac as shown below in figure A5. The Inverter pf should be within the limits given in 5.6, for three test voltages 230 V -6%, 230V and 230 V +10%.

Inverter is a three phase inverter without neutal wire. Therefore phase to phase voltages were used.

A.7.1.4.3 Voltage Flicker

P

	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	0,33%	3,3%	0,0ms	0,33%	3,3%	0,0ms	0,42	0,42
Values at standard impedance	1,06%	10,6%	0,0ms	1,06%	10,6%	0,0ms	1,35	1,35
Values at maximum impedance	0,33%	3,3%	0,0ms	0,33%	3,3%	0,0ms	0,42	0,42
Limits set under BS EN 61000-3-11	4%	3,3%	3,3% 500ms	4%	3,3%	3,3% 500ms	1,0	0,65

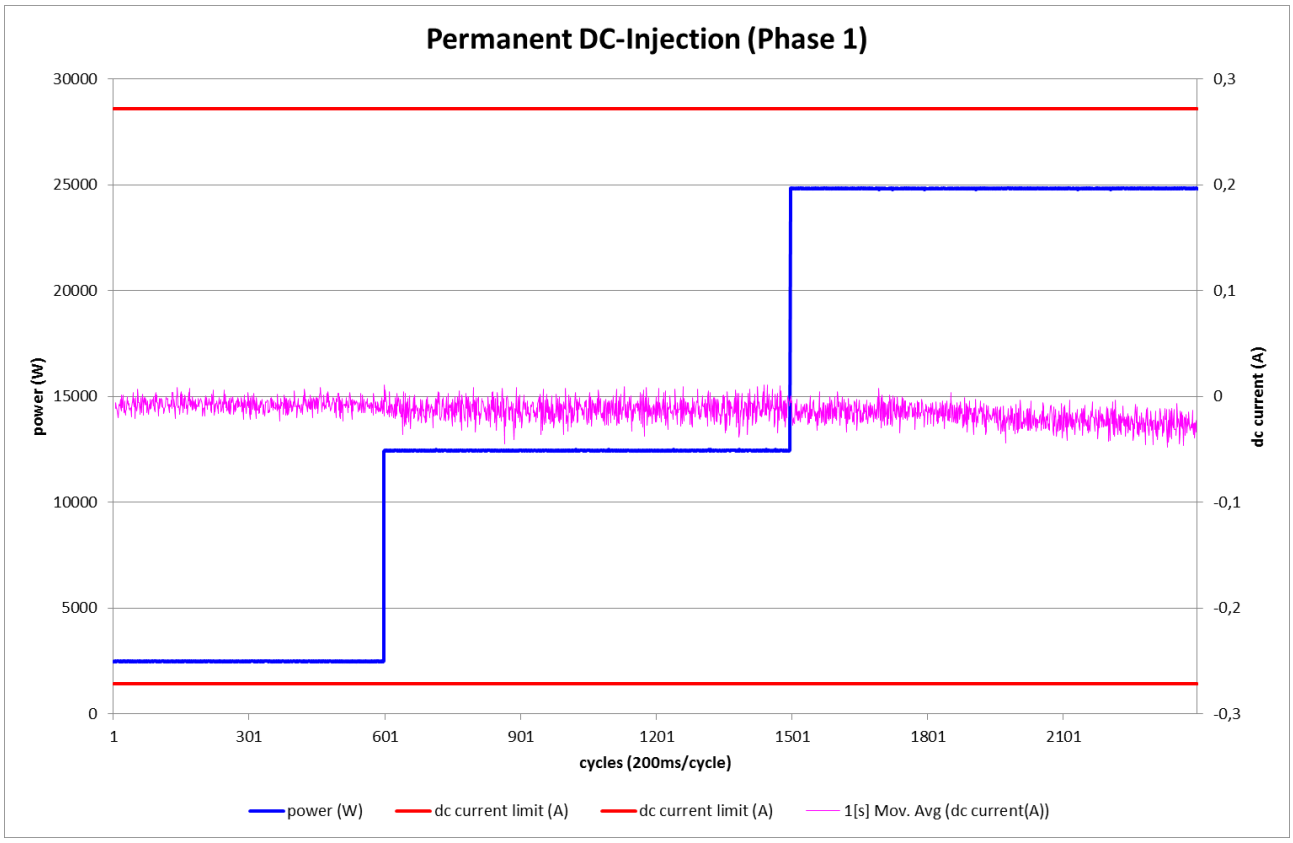
Test impedance	R	0,074	Ω	Xl	0,046	Ω
	Z	0,088	Ω			
Standard impedance	R	0,24	Ω	Xl	0,15	Ω
	Z	0,283	Ω			
Maximum impedance	R	0,074	Ω	Xl	0,046	Ω
	Z	0,088	Ω			

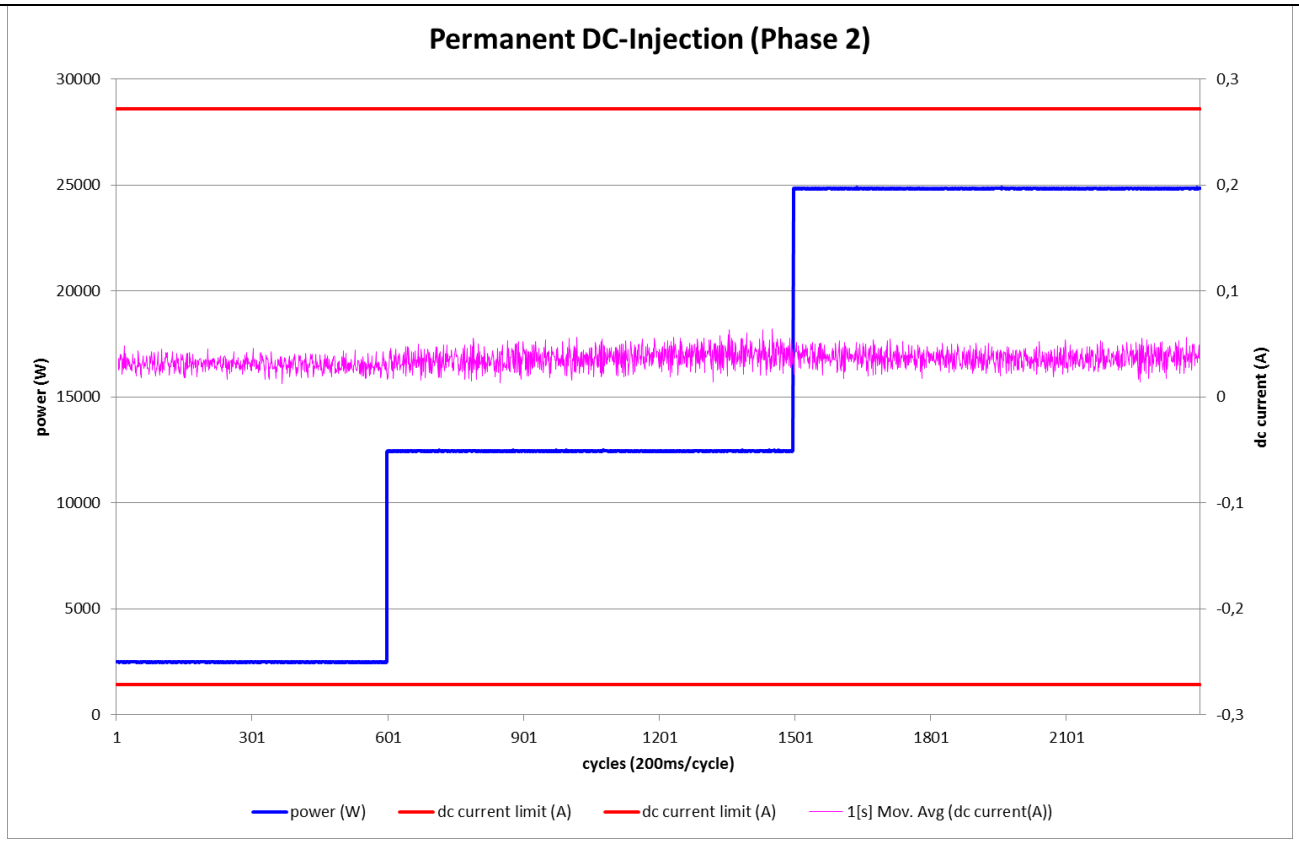
Note:

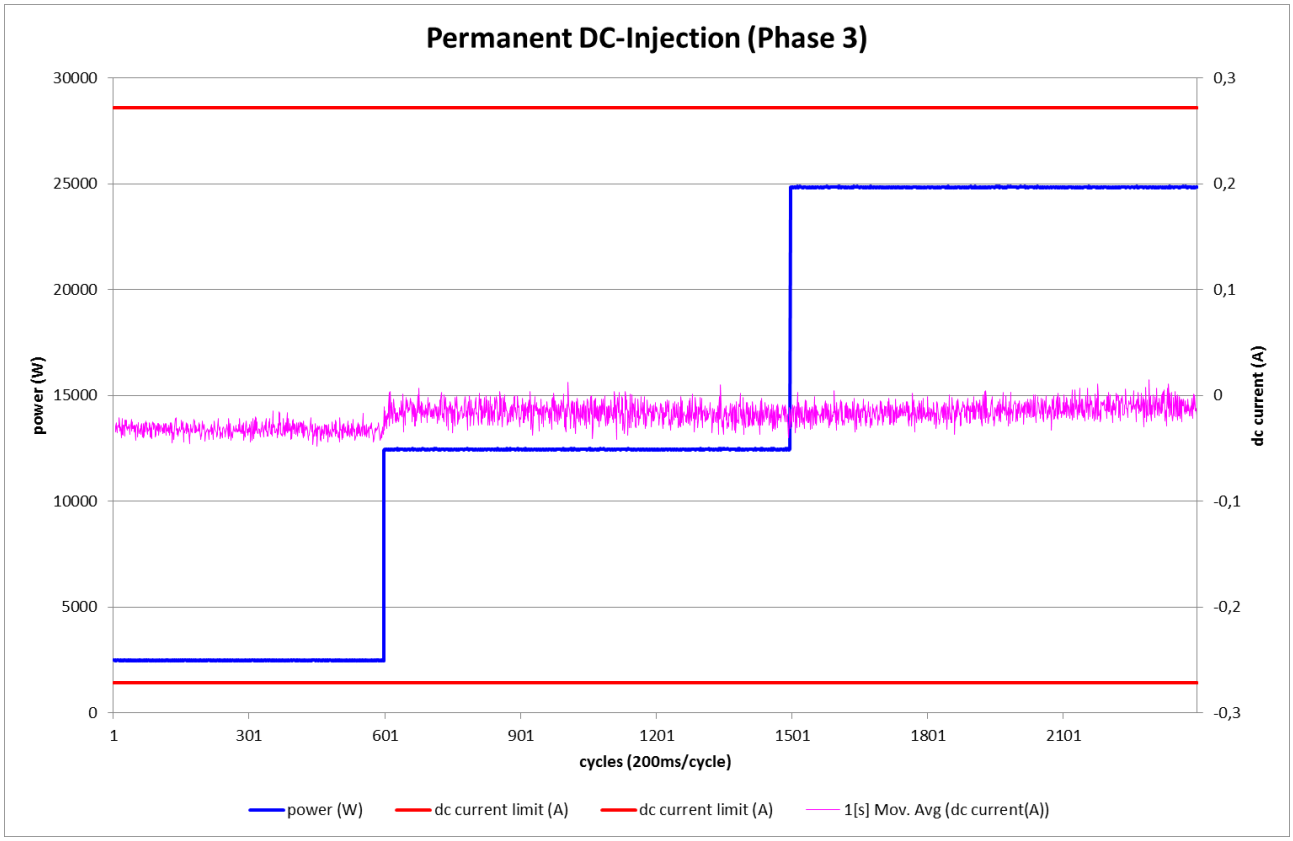
Inverter has a current above 75A per phase and is above 50kW therefore following evaluation method according to EN 61000-3-11 was used.

The device reacts with a current slope of 774 A/sec upwards and 1115 A/sec downwards. Taking into account the form factors given in figure 5 of EN 610003-11 the resulting values are as given above.

13.8.4.4 DC injection SHP75-10			P
Phase1			
Test level power	10%	55%	100%
Recorded value	7,46mA	12,10mA	14,40mA
As % of rated AC current	0,01%	0,01%	0,01%
Limit	0,25%	0,25%	0,25%
Phase2			
Test level power	10%	55%	100%
Recorded value	31,27mA	33,96mA	37,68mA
As % of rated AC current	0,03 %	0,03%	0,03%
Limit	0,25%	0,25%	0,25%
Phase3			
Test level power	10%	55%	100%
Recorded value	32,10mA	14,96mA	16,97mA
As % of rated AC current	0,03%	0,01%	0,02%
Limit	0,25%	0,25%	0,25%
Graph			







Note:

DC-injection is tested at each phase of the inverter and a limit of 0,25% per phase was used as pass criteria.

A.7.1.5 Short Circuit Current Contribution for Inverters

P

For a directly coupled SSEG			For a Inverter SSEG		
Parameter	Symbol	Value	Time after fault	Volts	Amps
Peak Short Circuit current	i_p	N/A	20ms	50,8	38,7
Initial Value of aperiodic current	A	N/A	100ms	50,6	36,3
Initial symmetrical short-circuit current	I_k	N/A	250ms	50,3	57,3
Decaying (aperiodic) component of short circuit current	i_{DC}	N/A	500ms	50,3	64,6
Reactance/Resistance Ratio of source	X/R	N/A	Time to trip	2,526	In seconds

Note:

The values of voltage and current should be recorded for a period of up to 1 second when the changeover switch should be returned to the normal position. The voltage and current at relevant times shall be recorded in the type test report (Appendix 4) including the time taken for the Inverter to trip.

A7.1.6 Self Monitoring – Solid state Disconnection.	**N/A**
It has been verified that in the event of the solid state switching device failing to disconnect the SSEG, 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 does 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).

Logic Interface (input port). Required by paragraph 11.1.3	**P**
Confirm that an input port is provided and can be used to shut down the module.	Yes
Note: A Modbus signal can be used to cease Active Power output within 5 s	

Annex No. 1

EMC test report

The complete EMC test report is stored at Bureau Veritas Consumer Products Services Germany GmbH Türkheim in project 14TH0075.

Prüfbericht template

PB_BAT_SMA

Creator: Berger Niels | Released by: Irmer Soeren | ID: 790459 | 12.07.2017 | Version 10

BAT-EMC Report

Title: ClonePowerUP_2016-12-21

Created automatically by NEXIO EMC testing software BAT-EMC

Table of Contents

1 ClonePowerUP_2016-12-21
BAT-EMC Project Information

Customer:	SMA Solar Technology AG
Manufacturer:	SMA Solar Technology AG
Client:	Vorname Nachname
Test Site:	SMA Solar Technology AG Testcenter EMC-lab
Comments:	

1.1.1 Radiated Electric Emissions Overview:

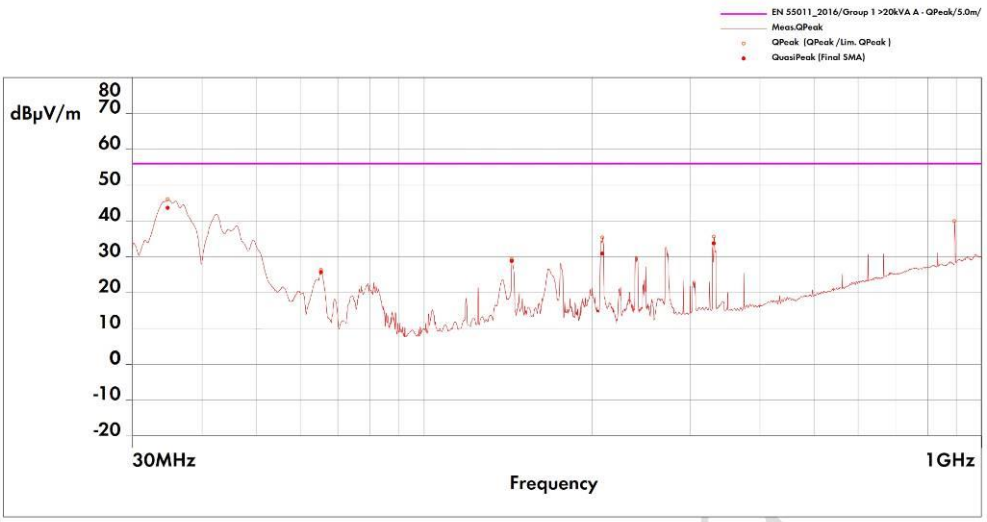
Test No. and Interface Name	Result	Condition	Required for Standard (S) / Additional (A)
EUT: 2920 Operational Mode:M1: 575 VDV @ P max with Modification: ?			
169: 30MHz - 1 GHz	Passed	-	S
EUT: 2920 Operational Mode:M2: 630 VDV @ P max with Modification: ?			
167: 30MHz - 1 GHz	Passed	-	S
EUT: 2920 Operational Mode:M2: 800 VDV @ P max with Modification: ?			
168: 30MHz - 1 GHz	Passed	-	S

1.1.2 EUT: 2920 M1: 575 VDV @ P max with Modif.No.: ?

EUT:	2920
Modif. No.:	?
Remarks:	-
BAT-EMC Details	project: ClonePowerUP_2016-12-21 campaign: 2017-12-05_EMCF equipment label: STP75-EUT2920-Mode1-Modi?mode: M1: 575 VDV @ P maxmodif.no. : ?

1.1.2.1 Radiated Electric emissions: No.: 169 for 30MHz - 1 GHz

EUT:	2920 in mode:M1: 575 VDV @ P max and modif. ?
BAT-EMC Details:	test-no.: 169 test-name: 30MHz-1GHz for: STP75-EUT2920-Mode1-Modi?
Date Of Test:	06.12.2017 08:40:11
Limit Line: Class:	EN 55011_2016 5m A (> 20 kW)
Tested by:	TM
Remarks:	-
Partial Test Result:	**Passed**

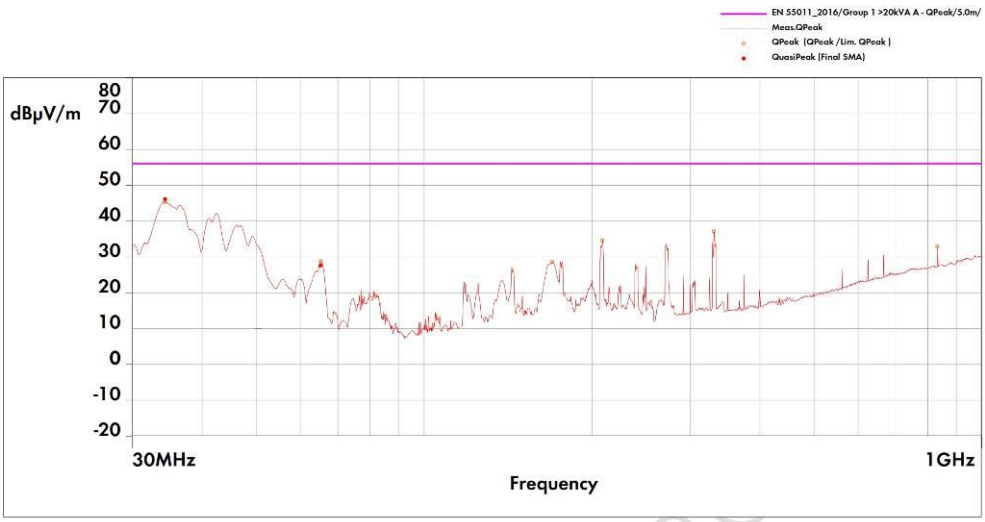


1.1.3 EUT: 2920 M2: 630 VDV @ P max with Modif.No.: ?

EUT:	2920
Modif. No.:	?
Remarks:	-
BAT-EMC Details	project: ClonePowerUP_2016-12-21 campaign: 2017-12-05_EMCF equipment label: STP75-EUT2920-Mode2-Modi?mode: M2: 630 VDV @ P maxmodif.no. : ?

1.1.3.1 Radiated Electric emissions: No.: 167 for 30MHz - 1 GHz

EUT:	2920 in mode:M2: 630 VDV @ P max and modif. ?
BAT-EMC Details:	test-no.: 167 test-name: 30MHz-1GHz for: STP75-EUT2920-Mode2-Modi?
Date Of Test:	05.12.2017 16:09:59
Limit Line:	EN 55011_2016 5m
Class:	A (> 20 kW)
Tested by:	TM
Remarks:	-
Partial Test Result:	**Passsed**

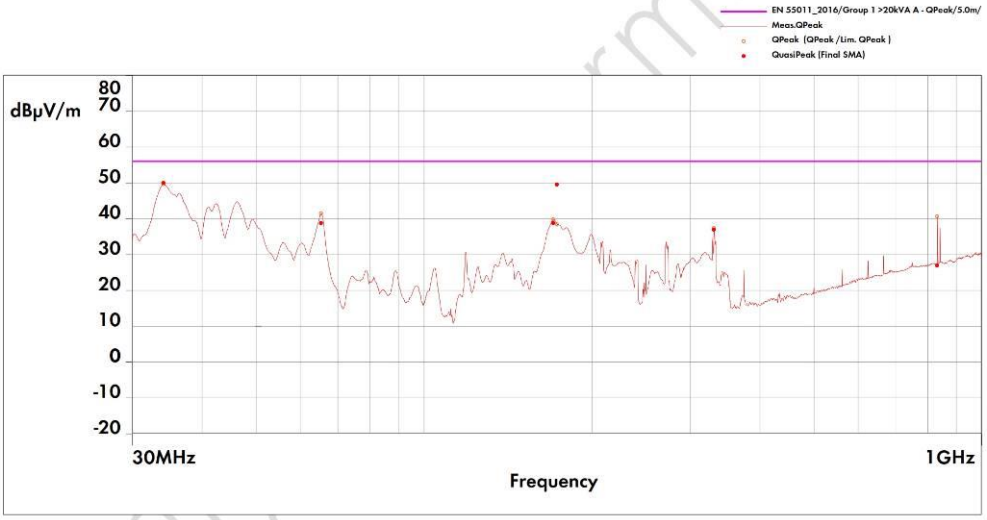


1.1.4 EUT: 2920 M2: 800 VDV @ P max with Modif.No.: ?

EUT:	2920
Modif. No.:	?
Remarks:	-
BAT-EMC Details	project: ClonePowerUP_2016-12-21 campaign: 2017-12-05_EMCF equipment label: STP75-EUT2920-Mode3-Modi?mode: M2: 800 VDV @ P maxmodif.no. : ?

1.1.4.1 Radiated Electric emissions: No.: 168 for 30MHz - 1 GHz

EUT:	2920 in mode:M2: 800 VDV @ P max and modif. ?
BAT-EMC Details:	test-no.: 168 test-name: 30MHz-1GHz for: STP75-EUT2920-Mode3-Modi?
Date Of Test:	05.12.2017 16:57:27
Limit Line:	EN 55011_2016 5m
Class:	A
Tested by:	TM
Remarks:	-
Partial Test Result:	**Passed**



Prüfbericht template

PB_BAT_SMA

Creator: Berger Niels | Released by: Irmer Soeren | ID: 790459 | 12.07.2017 | Version 10

BAT-EMC Report

Title: ClonePowerUP_2016-12-21

Created automatically by NEXIO EMC testing software BAT-EMC

Table of Contents

1 ClonePowerUP_2016-12-21
BAT-EMC Project Information

Customer:	SMA Solar Technology AG
Manufacturer:	SMA Solar Technology AG
Client:	Vorname Nachname
Test Site:	SMA Solar Technology AG Testcenter EMC-lab
Comments:	

1.1.1 Conductive Voltage and Current Emissions Overview:

Test No. and Interface Name	Result	Condition	Required for Standard (S) / Additional (A)
Conducted Voltage Emissions:			
EUT: 2920 Operational Mode:M3: 800 Vdc @ P max with Modification: 0			
158: AC-mains	Passed	-	S
EUT: 2920 Operational Mode:M3: 800 Vdc @ P max with Modification: 0			
162: PV-String A	Passed	-	A
Conducted Current Emissions:			
EUT: 2920 Operational Mode:M3: 800 Vdc @ P max with Modification: 0			
156: LAN	Passed	-	A
Total Result of this Test*	**Passed**		

* under consideration of the listed conditions in the table above

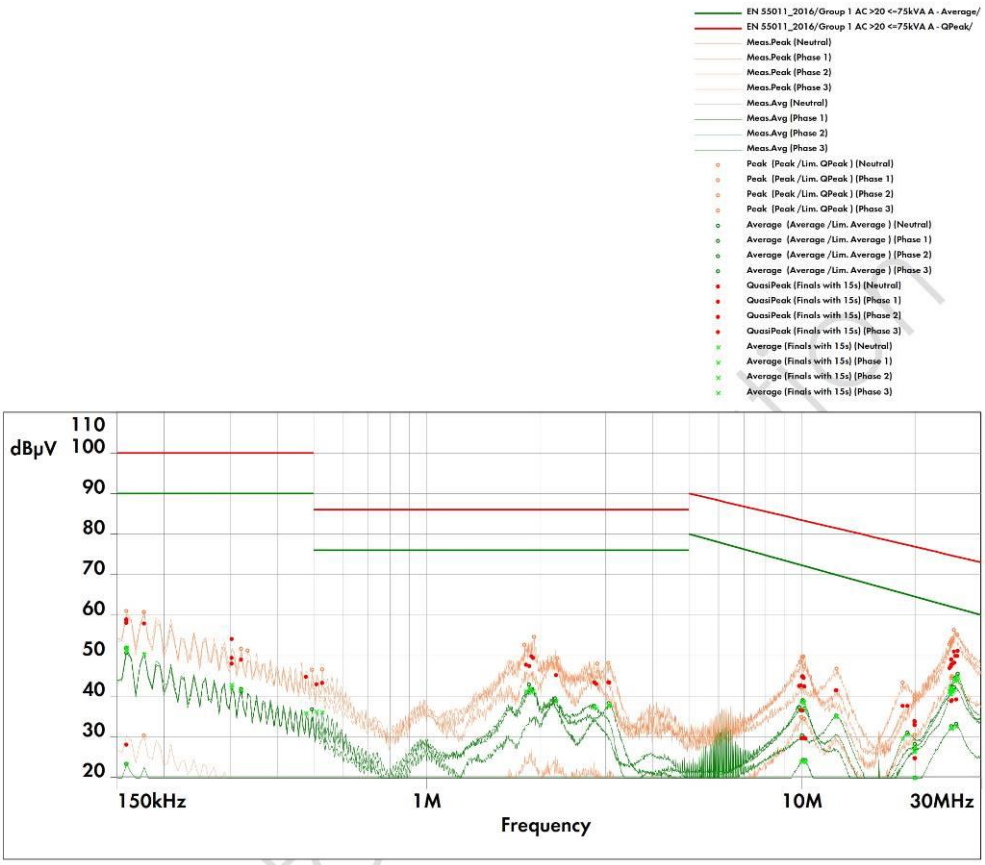
1.1.1.1 EUT:2920 M3: 800 Vdc @ P max with Modif.No.: 0

EUT:	2920
Modif. No.:	0
Remarks:	-
BAT-EMC Details	project: ClonePowerUP_2016-12-21 campaign: 2017-09-27_EMCL_277VAC-50Hz equipment label: STP75-EUT2920-Mode3-Modif0_277V_800VDCmode: M3: 800 Vdc @ P maxmodif.no. : 0

1.1.1.1.1 Conducted voltage emissions: No.:158 for Port: AC-mains

EUT:	2920 in mode:M3: 800 Vdc @ P max and modif. 0
BAT-EMC Details:	test no.: 158 test name: AC 150kHz-30MHz for: STP75-EUT2920-Mode3-Modif0_277V_800VDC
Date Of Test:	27.09.2017 16:03:46
Warm Up Time	35 min
Limit Line: Class:	Group 1 AC A > 20 KVA ≤ 75 kVA
Tested by:	NB
Remarks:	-
Partial Test Result:	**Passed**

Result Graph



EMI Receiver and BAT-EMC Settings

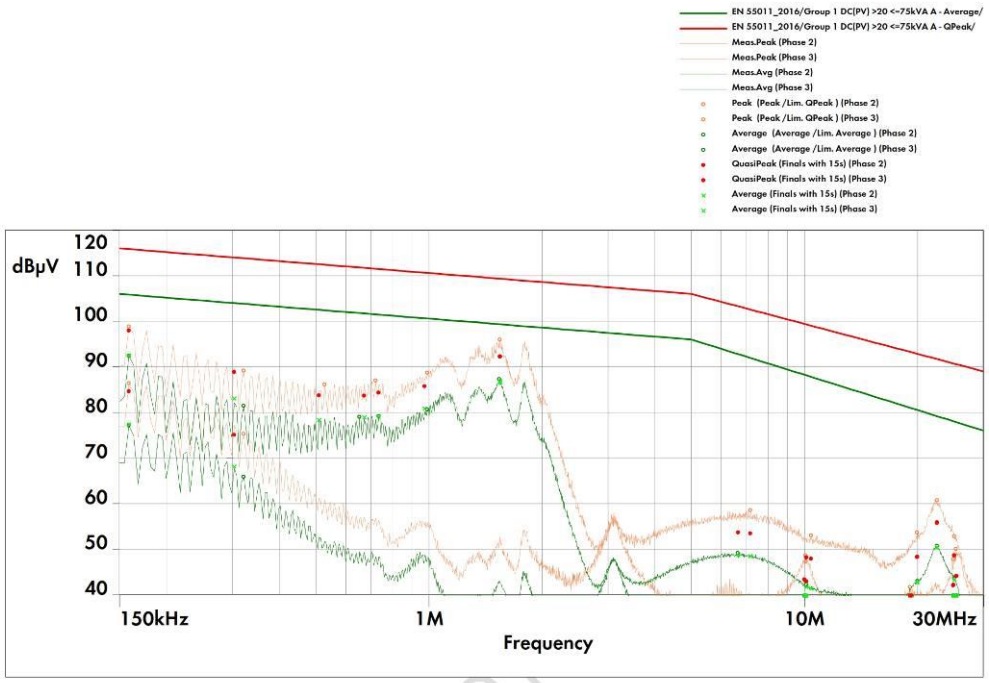
BAT-EMC Version	3.17.0.4
Equipment Version	V.750 25.09.2017
Limits Version	V.133 07.07.2017
BAT-EMC Equipment Setup:	EMCL LISN SR
Prescan:	Prescan: Meas.Peak; Meas.Avg;
Suspect Selection:	Advanced suspects
Final Measurement:	Advanced finals
Frequency Range:	150kHz-30MHz with Start: 150kHz and Stop: 30MHz
Frequency Stepping:	4.5kHz

Sweep Time: (Prescan)	20 ms/Pts
Dynamic Range:	80 dB
Reference Level:	70 dBµV
Resolution BW:	9kHz
Video BW:	Auto
Attenuation:	10 dB
Preamplifier:	OFF
Preselector:	ON

1.1.1.1.2 Conducted voltage emissions: No.:162 for Port: PV-String A

EUT:	2920 in mode:M3: 800 Vdc @ P max and modif. 0
BAT-EMC Details:	test no.: 162 test name: PV String A (CM = Phase 2 / DM = Phase 3) for: STP75-EUT2920-Mode3-Modif0_277V_800VDC
Date Of Test:	27.09.2017 15:44:13
Warm Up Time	15 min
Limit Line: Class:	Group 1 AC A > 20 KVA ≤ 75 kVA
Tested by:	NB
Remarks:	-
Partial Test Result:	**Passed**

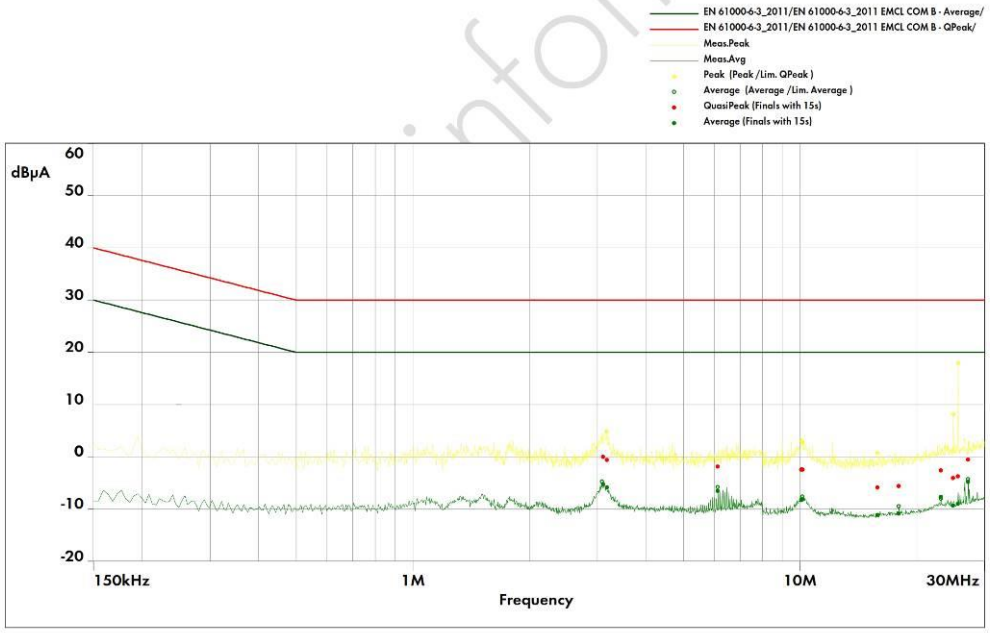
Result Graph



1.1.1.1.3 Conducted current emissions: No.:156 for Port: LAN

EUT:	2920 in mode:M3: 800 Vdc @ P max and modif. 0
BAT-EMC Details:	test no.: 156 test name: LAN for: STP75-EUT2920-Mode3-Modif0_277V_800VDC
Date Of Test:	27.09.2017 15:35:34
Warm Up Time	5 min
Limit Line:	EN 61000-6-3_2011 EMCL COM
Class:	B
Tested by:	NB
Remarks:	-
Partial Test Result:	**Passed**

Result Graph



Result Table

Frequency [MHz]	SR	Quasi -Peak [dBµV]	Average [dBµV]	Quasi-Peak Limit [dBµV]	Quasi-Peak Margin [dB]	Average Limit [dBµV]	Average Margin [dB]	Band Width [kHz]	Sweep Time [s]	Corr [dB]
3.102	1	-0.04	-5.33	30.00	30.04	20.00	25.33	9.00	0.10	9.90
3.1776	1	-0.66	-5.95	30.00	30.66	20.00	25.95	9.00	0.10	9.91
6.1287	1	-1.95	-6.61	30.00	31.95	20.00	26.61	9.00	0.10	10.04
10.0716	1	-2.51	-8.32	30.00	32.51	20.00	28.32	9.00	0.10	10.24
10.1301	1	-2.45	-8.27	30.00	32.45	20.00	28.27	9.00	0.10	10.24
10.1598	1	-2.55	-8.21	30.00	32.55	20.00	28.21	9.00	0.10	10.25
15.846	1	-5.92	-11.19	30.00	35.92	20.00	31.19	9.00	0.10	10.69
17.9871	1	-5.64	-10.90	30.00	35.64	20.00	30.90	9.00	0.10	10.89
23.1297	1	-2.64	-7.76	30.00	32.64	20.00	27.76	9.00	0.10	11.74
24.8496	1	-4.14	-9.42	30.00	34.14	20.00	29.42	9.00	0.10	12.11
25.5687	1	-3.78	-9.04	30.00	33.78	20.00	29.04	9.00	0.10	12.27
27.1572	1	-0.60	-4.89	30.00	30.60	20.00	24.89	9.00	0.10	12.63

EMI Receiver and BAT-EMC Settings

BAT-EMC Version	3.17.0.4
Equipment Version	V.750 25.09.2017
Limits Version	V.133 07.07.2017
BAT-EMC Equipment Setup:	EMCL Stromzange SR
Prescan:	Prescan: Meas.Peak; Meas.Avg;
Suspect Selection:	Advanced suspects
Final Measurement:	Advanced finals
Frequency Range:	150kHz-30MHz with Start: 150kHz and Stop: 30MHz
Frequency Stepping:	4.5kHz
Sweep Time:(Prescan)	20 ms/Pts
Dynamic Range:	80 dB
Reference Level:	40 dBµV
Resolution BW:	9kHz
Video BW:	Auto
Attenuation:	0 dB
Preamplifier:	ON
Preselector:	ON

Active Test Equipment Used

Equipment	Type	Manufacturer	Cal. Date / Next Cal.	Serial / Inventory Number
Commutation relay	RT6-5201-G	MTS		0053372-001-0011 6001480
Current probe	9208-1	Solar Electronics	23.05.2017 23.05.2018	114507 6001069
LISN	NNLLK8130	Schwarzbeck	20.09.2017 20.09.2019	8130-133 6001060
LISN	PVDC 8300	Schwarzbeck	28.04.2017 28.04.2018	38 6001578
Limitor	ESH3-Z2	Rohde & Schwarz	24.11.2016 24.11.2017	101525 6001117
Receiver	ESCI-3	Rohde & Schwarz	04.04.2017 04.04.2018	1166.5950K03-101115-TG 6001017
test site	shielded room	Albatross Projects GmbH		6001461

Prüfbericht template

PB_BAT_SMA

Creator: Berger Niels | Released by: Irmer Soeren | ID: 790459 | 12.07.2017 | Version 10

BAT-EMC Report

Title: ClonePowerUP_2016-12-21

Created automatically by NEXIO EMC testing software BAT-EMC

Table of Contents

1 ClonePowerUP_2016-12-21
BAT-EMC Project Information

Customer:	SMA Solar Technology AG
Manufacturer:	SMA Solar Technology AG
Client:	Vorname Nachname
Test Site:	SMA Solar Technology AG Testcenter EMC-lab
Comments:	

1.1.1 Conductive Voltage and Current Emissions Overview:

Test No. and Interface Name	Result	Condition	Required for Standard (S) / Additional (A)
Conducted Voltage Emissions:			
EUT: 2920 Operational Mode:M3: 800 Vdc @ P max with Modification: 0			
164: AC-mains	Passed	-	S
EUT: 2920 Operational Mode:M3: 800 Vdc @ P max with Modification: 0			
166: AC-mains	Passed	-	S
Conducted Current Emissions:			
Total Result of this Test*	**Passed**		

* under consideration of the listed conditions in the table above

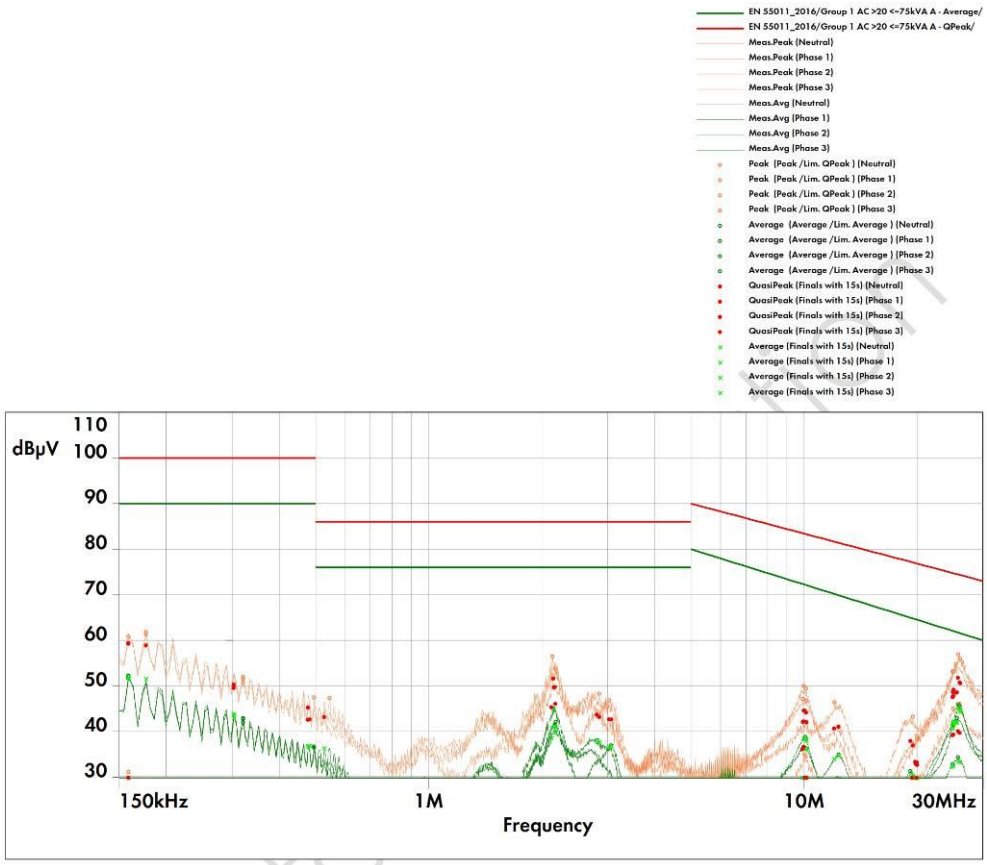
1.1.1.1 EUT:2920 M3: 800 Vdc @ P max with Modif.No.: 0

EUT:	2920
Modif. No.:	0
Remarks:	-
BAT-EMC Details	project: ClonePowerUP_2016-12-21 campaign: 2017-09-28_EMCL_277VAC-50Hz equipment label: STP75-EUT2920-Mode3-Modif0_277V_800VDC_ 165nF X-Kond P1 nach P3mode: M3: 800 Vdc @ P maxmodif.no. : 0

1.1.1.1.1 Conducted voltage emissions: No.:164 for Port: AC-mains

EUT:	2920 in mode:M3: 800 Vdc @ P max and modif. 0
BAT-EMC Details:	test no.: 164 test name: AC 150kHz-30MHz 2Min Warmlaufzeit for: STP75-EUT2920-Mode3-Modif0_277V_800VDC_ 165nF X-Kond P1 nach P3
Date Of Test:	28.09.2017 13:56:58
Warm Up Time	2 min
Limit Line: Class:	Group 1 AC A > 20 kVA ≤ 75 kVA
Tested by:	PT
Remarks:	-
Partial Test Result:	**Passed**

Result Graph



EMI Receiver and BAT-EMC Settings

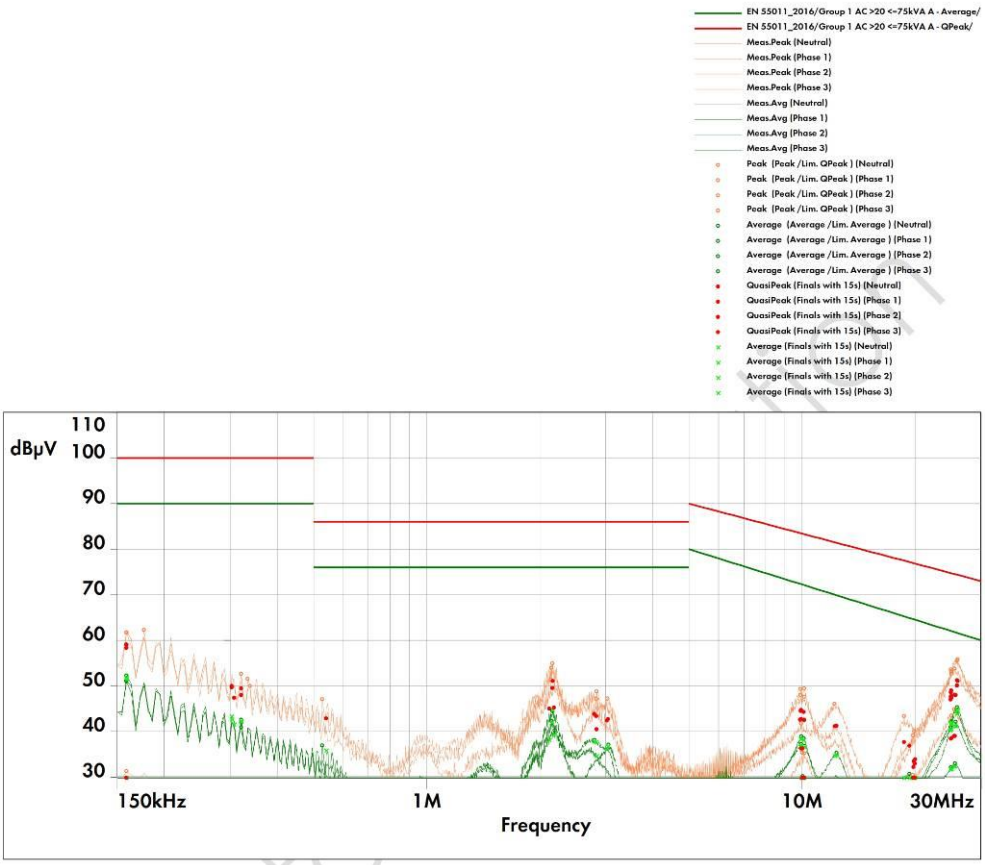
BAT-EMC Version	3.17.0.4
Equipment Version	V.750 25.09.2017
Limits Version	V.134 28.09.2017
BAT-EMC Equipment Setup:	EMCL LISN SR
Prescan:	Prescan: Meas.Peak; Meas.Avg;
Suspect Selection:	Advanced suspects
Final Measurement:	Advanced finals
Frequency Range:	150kHz-30MHz with Start: 150kHz and Stop: 30MHz
Frequency Stepping:	4.5kHz

Sweep Time: (Prescan)	20 ms/Pts
Dynamic Range:	80 dB
Reference Level:	70 dBµV
Resolution BW:	9kHz
Video BW:	Auto
Attenuation:	10 dB
Preamplifier:	OFF
Preselector:	ON

1.1.1.1.2 Conducted voltage emissions: No.:166 for Port: AC-mains

EUT:	2920 in mode:M3: 800 Vdc @ P max and modif. 0
BAT-EMC Details:	test no.: 166 test name: AC 150kHz-30MHz 35Min Warmlaufzeit for: STP75-EUT2920-Mode3-Modif0_277V_800VDC_ 165nF X-Kond P1 nach P3
Date Of Test:	28.09.2017 14:37:07
Warm Up Time	35 min
Limit Line: Class:	Group 1 AC A > 20 kVA ≤ 75 kVA
Tested by:	PT
Remarks:	-
Partial Test Result:	**Passed**

Result Graph



EMI Receiver and BAT-EMC Settings

BAT-EMC Version	3.17.0.4
Equipment Version	V.750 25.09.2017
Limits Version	V.134 28.09.2017
BAT-EMC Equipment Setup:	EMCL LISN SR
Prescan:	Prescan: Meas.Peak; Meas.Avg;
Suspect Selection:	Advanced suspects
Final Measurement:	Advanced finals
Frequency Range:	150kHz-30MHz with Start: 150kHz and Stop: 30MHz
Frequency Stepping:	4.5kHz

Sweep Time: (Prescan)	20 ms/Pts
Dynamic Range:	80 dB
Reference Level:	70 dBµV
Resolution BW:	9kHz
Video BW:	Auto
Attenuation:	10 dB
Preamplifier:	OFF
Preselector:	ON

Active Test Equipment Used

Equipment	Type	Manufacturer	Cal. Date / Next Cal.	Serial / Inventory Number
Commutation relay	RT6-5201-G	MTS		0053372-001-0011 6001480
LISN	NNLLK8130	Schwarzbeck	20.09.2017 20.09.2019	8130-133 6001060
Limitor	ESH3-Z2	Rohde & Schwarz	24.11.2016 24.11.2017	101525 6001117
Receiver	ESCI-3	Rohde & Schwarz	04.04.2017 04.04.2018	1166.5950K03- 101115-TG 6001017
test site	shielded room	Albatross Projects GmbH		 6001461

Bureau Veritas Consumer Products Services Germany GmbH

TEST REPORT
EN 61000-6-2 + EN 61000-6-3

Emissions for residential, commercial and light-industrial environments + Immunity for industrial environments

Report Reference No.....:	14TH0075_EN61000-6-x_2
Compiled by (+ signature) .....:	A. Taubert Digital unterschrieben von Anton Taubert DN: cn=Anton Taubert, o=Bureau Veritas CPS Germany GmbH, ou=EMC, email=Anton.Taubert@de.bureauveritas.com, c=DE Datum: 2016.06.07 16:20:11 +02'00'
Approved by (+ signature) .....:	F. Mayer DN: cn=Franz Mayer, o=Bureau Veritas, ou=EMC-Manager, email=franz.mayer@de.bureauveritas.com, c=DE Datum: 2016.06.08 16:41:26 +02'00'
Date of issue.....:	8 December 2014
Total number of pages.....:	79
Testing Laboratory.....:	Bureau Veritas Consumer Products Services Germany GmbH
Address.....:	Businesspark A96 86842 Türkheim
	DAkkS Deutsche Akkreditierungsstelle D-PL-12024-03-00
Applicant's name.....:	**SMA Solar Technology AG**
Address.....:	Sonnenallee 1, 34266 Niestetal, Germany
Test specification:	
Standard .....:	EN 61000-6-2:2005 EN 61000-6-3:2007 + A1:2011 *with reference to the following basic standards:* EN61000-3-11:2000 EN 610003-12:2011
Test procedure.....:	
Non-standard test method.....:	
Test Report Form No.....:	EN61000-6-2_6-3_G
Test Report Form(s) Originator .....:	Bureau Veritas Consumer Products Services Germany GmbH
Master TRF.....:	Date 10-April-2014
Test item description	**Grid connected photovoltaic inverter**
Trade Mark	SMA
Manufacturer.....	Danfoss / SMA
Model/Type reference.....	MLX 60 / STP 60-10
Ratings.....	Input: 565 – 1000 V DC Output: 3 x 400V 60 kVA

History Sheet			
A Taubert	28. November 2014	Report was written	Rev_0
A Taubert	8 December 2014	Editorial changes Type label replaced	Rev_1
A Taubert	6 June 2016	Brand and Type changed	Rev_2

Summary of testing:

1. One device MLX 60 and an inverter manager (control box V2100) with the at the end of this report showed power supply were tested according to the applicable EMC standards.

   Software version: 1.32
   Hardware version:

   Hardware ID. Comm/Ctrl Board: 139b3128 Issue 03, Rev. 00, Assy rev. 01
   Hardware ID. Inverter board: 139b3116 Issue 04, Rev. 00, Assy rev. 00
   Hardware ID. PSU board: 139b3120 Issue 04, Rev. 00, Assy rev. 00
   Hardware ID. DC-link Board: 139b3124 Issue 03, Rev. 00, Assy rev. 01
   Hardware ID. IPV/RCMU Board: 139b3126 Issue 03, Rev. 00, Assy rev. 04
   Hardware ID. Grid RFI filter Board: 139b3118 Issue 02, Rev. 00, Assy rev. 01
   Hardware ID. PV RFI filter Board: 139b3122 Issue 02, Rev. 00, Assy rev. 00

2. The radiated emission measurement was performed at rated power. Other working conditions were measured with a short measurement and verified manually. We have noticed a low dependency of the perturbation level and the working status. (delivered power and input voltage)

3. The device passed the tests if following two conditions are fulfilled
   For the fulfillment of the disturbance current requirement on LAN line (between the inverter and the inverter manager) it is necessary to use a shielded LAN cable and ground the metal frame of the inverter manager. This bonding has to be done with a short wire. It is recommended that the conductive connection must have an reasonable diameter and build with a fine wire..
   Likewise on the inverter side the shield from the LAN connector must be connected to the inverter enclosure.

4. At customers request Harmonics and Flicker was tested according to
   EN 61000-3-12 and EN61000-3-11 although the nominal current is greater than 75 A
   For fulfillment of the flicker requirement according to EN61000-3-11 it is necessary to connect the device to a mains with a reduced impedance $|Z|_{max}$=88 mΩ

5. The surge measurement on LAN line isn´t applicable, because the normal function in test setup according EN 61000-4-5 cannot be achieved. (See table 2 remark e in EN 61000-6-2)

6. Because the ownership of the company has changed, the brand name and device name was changed.. The initial name under Danfoss was MLX 60 and becomes under SMA brand STP 60-10.
   The new manufacturer (company SMA) has attested: The device remains structural the same only the labelling will be changed.

7. This device was tested against the EN 61000-6-2:2005 (Immunity Industry) and EN 61000-6-3:2007 (Radiation residential).
   This combination is the most demanding combination for EMC test of these kinds of products.
   Note: There are two combinations of generic EMC tests available. The test procedure for both variants is similar, but the demanded limit has variations depending on the expected environment.

   The common used combination is:
   EN 61000-6-2:2005 and EN 61000-6-4:2007+A1:2011 Industry environment (weak radiation limits, strong immunity requirement)

   EN 61000-6-1:2007 and EN 61000-6-3:2007+A1:2011 > Residential environment (strong radiation limits and weak immunity requirement)

   In order to fulfil the worst criteria of this combination it is possible to choose the strongest requirement from these variants.

   EN 61000-6-3:2007+A1:2011 covers the EN 61000-6-4:2007+A1:2011 (Radiation)
   EN 61000-6-2:2005 covers the EN 61000-6-1:2007.(Immunity)

Report Index:

Possible test case verdicts:	
- test case does not apply to the test object . :	N/A
- test not ordered by customer	N/O
- test object does meet the requirement ..... :	P (Pass)
- test object does not meet the requirement . :	F (Fail)
Testing ..... :	
Date of receipt of test item ..... :	12-October-2014
Date (s) of performance of tests..... :	4- to 20 November -2014

General remarks:

The test results presented in this report relate only to the object tested.

The results contained in this report reflect the results for this particular model and serial number. It is the responsibility of the manufacturer to ensure that all production models meet the intent of the requirements detailed within this report.

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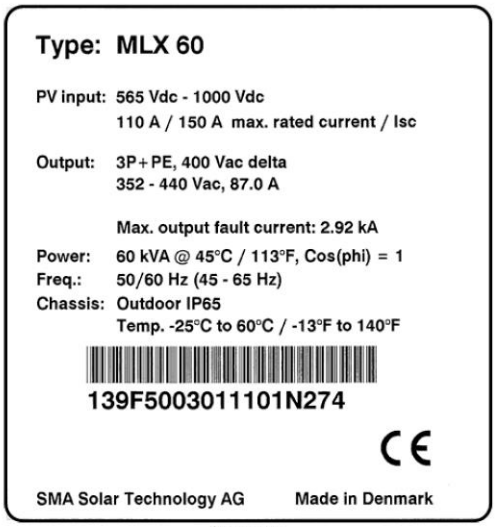
Throughout this report a comma (point) is used as the decimal separator.

1. General information

1.1. Equipment Description

Grid connected photovoltaic inverter

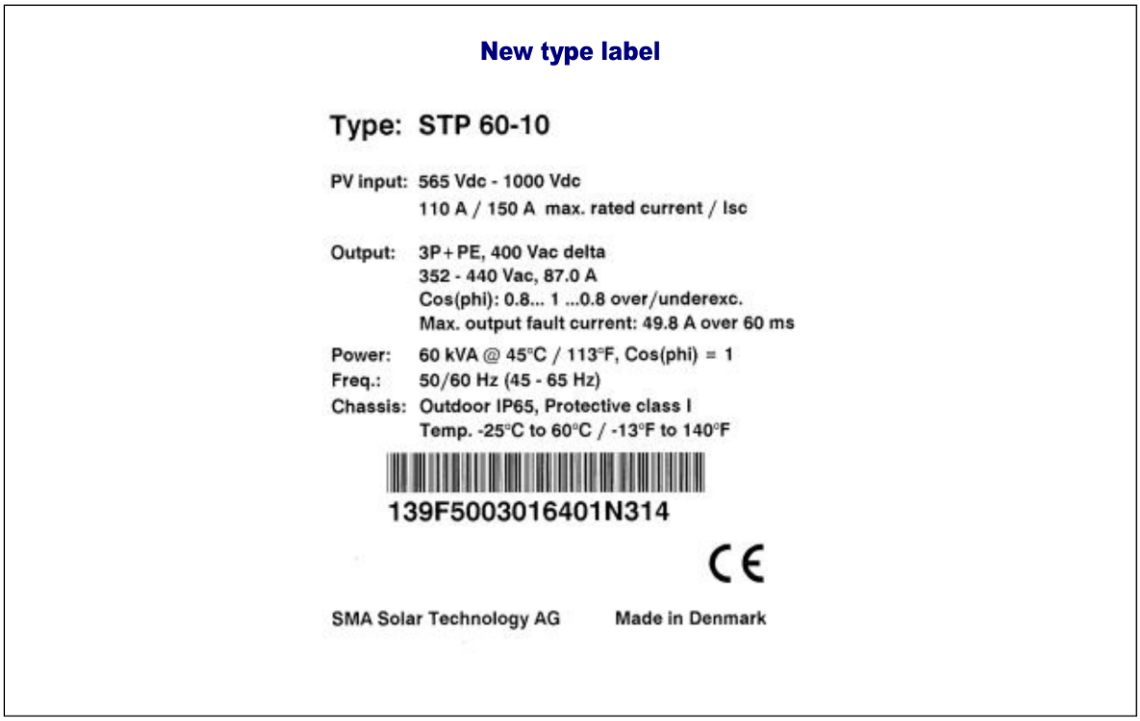
1.2. Equipment Marking Plate



inverter

Power supply

New type label



1.3. Equipment Used During Test

Use*	Product Type	Manufacturer	Model	Comments
EUT	Solar Inverter	SMA Solar Technology	MLX 60	3 Phases without neutral

Note:

* Use = EUT - Equipment Under Test,
AE - Auxiliary/Associated Equipment, or
SIM - Simulator (Not Subjected to Test)

1.4. Input/Output Ports

Port #	Name	Type*	Cable Max. >3m	Cable Shielded	Comments
0	Enclosure	N/E	—	—	—
1	Mains	AC	yes	no	—
2	Output	DC	yes	no	—
3	LAN	Data	yes	yes	—

*Note: AC = AC Power Port DC = DC Power Port N/E = Non-Electrical
I/O = Signal Input or Output Port (Not Involved in Process Control)
TP = Telecommunication Ports

1.5. EUT Internal Operating Frequencies

Frequency (MHz)	Description
>108 MHz	Switching frequency, all other frequencies

Power Interface

Mode #	Voltage (V)	Current (A)	Power (W)	Frequency (DC/AC-Hz)	Phases (#)	Comments
Output	3 x 400	87	60000	50/60	3	without neutral
Input	565 - 1000	max 150		DC		

1.6. EUT Operation Modes

Mode #	Description
1	Continuous operation, 680 V-in rated load
2	Continuous operation, 680 V-in 20 kW
3	Continuous operation, 760 V-in 20 kW
4	Continuous operation, 650 V-in 6 kW
5	Continuous operation, 680 V-in 6 kW
6	Continuous operation, 720 V-in 40 kW
7	Continuous operation, 680 V-in 12 kW
8	
9	

1.7. EUT Configuration

Mode #	Description
General	☒ wall hanging equipment ☐ table top equipment ☐ combined floor standing / table top equipment
1	Testing in setup according to relevant basic standard.

1.8. Immunity performance criteria

Criterion	Description
A	As defined in EN 61000-6-2 Further definition provided by the manufacturer: none
B	As defined in EN 61000-6-2 Further definition provided by the manufacturer: none
C	As defined in EN 61000-6-2 Further definition provided by the manufacturer: none

1.9. Deviations from standards

Standard	Deviation
EN 61000-6-2	none
EN 61000-6-3	none
EN 61000-3-12	none
EN 61000-3-11	none

2. Result Summary

EN 61000-6-3:2007			
Cl.	Requirement – Test	Remark	Verdict
7 Table 1.1	Limits of radiated disturbance in the frequency range 30 MHz to 6000 MHz		**P**
7 Table 1.2	Limits of harmonics currents, voltage changes, voltage fluctuations and flicker		**P**
7 Table 1.2	Limits of disturbance voltages in the frequency range 150 kHz to 30 MHz *(AC mains)*		**P**
7 Table 1.2	Limits of discontinuous disturbances in the frequency range 150 kHz to 30 MHz		**N/A**
7 Table 1.3	Limits of disturbance voltages in the frequency range 150 kHz to 30 MHz *(DC supply)*		**N/A**
7 Table 1.4	Limits of terminal disturbance voltages in the frequency range 150 kHz to 30 MHz *(signal lines)*	See summary of testing	**P**

EN 61000-6-2:2005			
Cl	Requirement – Test	Remark	Verdict
8 Table 1.1	Power-frequency magnetic field *according to IEC 61000-4-8*		**N/A**
8 Tab. 1.2-4	Radio frequency electromagnetic field *according to IEC 61000-4-3*		**P**
8 Table 1.5	Electrostatic discharge *according to IEC 61000-4-2*		**P**
8 Table 2.1	Radio-frequency common mode (signal lines) *according to IEC 61000-4-6*		**P**
8 Table 2.2	Fast transients (signal lines) *according to IEC 61000-4-4*		**P**
8 Table 3.1	Radio-frequency common mode (DC power ports) *according to IEC 61000-4-6*		**P**
8 Table 3.2	Surges (DC power ports) *according to IEC 61000-4-5*		**N/A**
8 Table 3.3	Fast transients (DC power ports) *according to IEC 61000-4-4*		**P**
8 Table 4.1	Radio-frequency common mode (AC power ports) *according to IEC 61000-4-6*		**P**
8 Table 4.2	Voltage dips (AC power ports) *according to IEC 61000-4-11*		**P**
8 Table 4.3	Voltage interruptions (AC power ports) *according to IEC 61000-4-11*		**P**
8 Table 4.4	Surges (AC power ports) *according to IEC 61000-4-5*		**P**
8 Table 4.5	Fast transients (AC power ports) *according to IEC 61000-4-4*		**P**

TRF No. EN61000-6-2_6-3_G

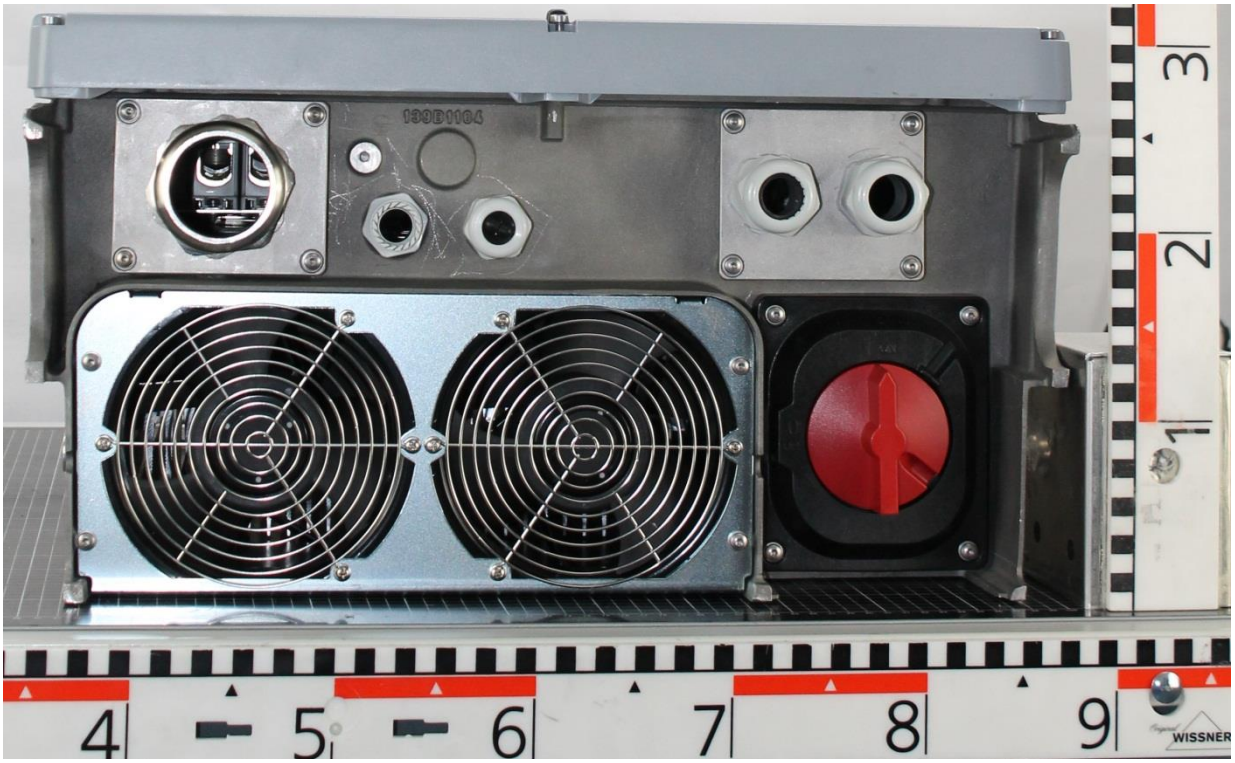
EN 61000-3-12:2011			
Cl.	Requirement - Test	Remark	Verdict
6	General requirements		P
7	Harmonic current limits (equipment >16A)		P

EN 61000-3-11:2000			
Cl.	Requirement – Test	Remark	Verdict
5	Limits of voltage changes, voltage fluctuations and flicker (equipment >16A)		P

Annex No. 2
Pictures of the unit

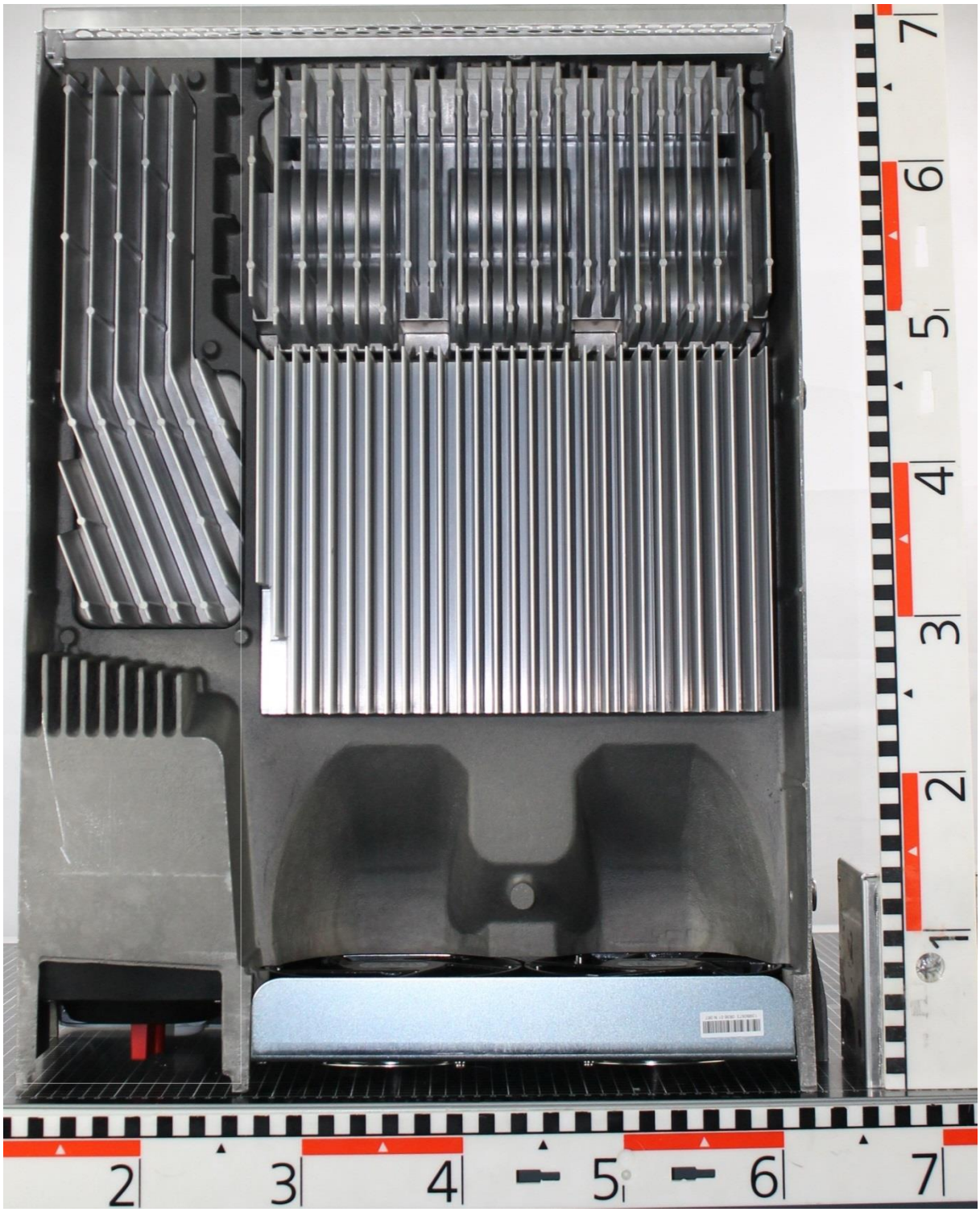
Inverter SHP75-10
Enclosure front view

Enclosure bottom view



Side view

Enclosure rear view



Annex No. 3
Test Equipment list

Equipment	Internal No.	Manufacturer	Type	Serial No.	Last Calibration
Current transducer	1096	LEM Danfysik	IT 400-S	1131010011	Aug. 16
Current transducer	1097	LEM Danfysik	IT 400-S	1131010012	Aug. 16
Current transducer	1098	LEM Danfysik	IT 400-S	1131010013	Aug. 16
Current Transducer	1099	LEM Danfysik	IT 200-S	1131480016	Dez. 17
Current Transducer	1100	LEM Danfysik	IT 200-S	1131480017	Jan. 18
Current Transducer	1101	LEM Danfysik	IT 200-S	1131480018	Dez. 17
Current Transducer	1102	LEM Danfysik	IT 700-S	1131540009	Dez. 17
Spitzenberger & Spies Test system for PV-inverter	1091	Spitzenberger & Spies	PVS 127500 / EMV D 75000/PAS / PRU 12750 / Mobile box / RLC 3500/2.5	A5191 00 / A5192 00 / A5193 00 / A5194 00 / A5195 00	N/A
Dewetron Multi Channel Data Acquisition System	1092	Dewetron	DEWE-800 / DEWE-30-16 with voltage and current modules	12130573, 56121690	Mai. 16
Hygro- /Thermo-/Barometer	1073	Greisinger	GFTB 100	90258040	Mrz. 18
Oscilloscope	943	Yokogawa	DLM2000	91K53064	Apr. 17
Current Probe	947	Chauvin Arnoux	E3N	129676HDV	Jun. 17
Universal Measuring Instrument	747	Ahlborn GmbH	Almemo 2590-3S	H08090697	Feb. 17
Differential Probe	1077	Sapphire Instruments	SI-9002	83751	Dez. 17

Date(s) of performance of test 2018-08-03 to 2018-08-05

Equipment	Internal No.	Manufacturer	Type	Serial No.	Last Calibration
Current Transducer	1099	LEM Danfysik	IT 400-S	1131010013	Dez. 17
Current Transducer	1100	LEM Danfysik	IT 400-S	1131010012	Jan. 18
Current Transducer	1101	LEM Danfysik	IT 400-S	1131010011	Dez. 17
Current transducer	1102	LEM Danfysik	IT 200-S	1131480016	Dez. 17
Dewetron Multi Channel Data Acquisition System	1043	Dewetron	DEWE-2600 with Voltage and Current Modules	28110299	Mrz. 18
Spitzenberger & Spies Test System for PV-Inverter	1091	Spitzenberger & Spies	PVS 127500 / EMV D 75000/PAS / PRU 12750 / Mobile box / RLC 3500/2.5	A5191 00 / A5192 00 / A5193 00 / A5194 00 / A5195 00	N/A
Hygro- /Thermo-/Barometer	1073	Greisinger	GFTB 100	90258040	Apr. 17

Date(s) of performance of test 2019-04-05 to 2019-04-10

Equipment	Internal No.	Manufacturer	Type	Serial No.	Last Calibration
Spitzenberger & Spies Test System for PV-Inverter	1091	Spitzenberger & Spies	PVS 127500 / EMV D 75000/PAS / PRU 12750 / Mobile box / RLC 3500/2.5	A5191 00 / A5192 00 / A5193 00 / A5194 00 / A5195 00	N/A
Dewetron Multi Channel Data Acquisition System	1092	Dewetron	DEWE-800 / DEWE-30-16 with Voltage an Current Modules	12130573, 56121690	N/A
Current Transducer	1096	LEM Danfysik	IT 400-S	1131010011	Aug-18
Current Transducer	1097	LEM Danfysik	IT 400-S	1131010012	Aug-18
Current Transducer	1098	LEM Danfysik	IT 400-S	1131010013	Aug-18
Hygro-/Thermo-/Barometer	449	Greisinger	GFTB 100	1507001	Oct-18

Equipment	Internal No.	Manufacturer	Type	Serial No.	Last Calibration
Spitzenberger & Spies Test System for PV-Inverter	1091	Spitzenberger & Spies	PVS 127500 / EMC D 75000/PAS / PRU 12750 / Mobile box / RLC 3500/2.5	A5191 00 / A5192 00 / A5193 00 / A5194 00 / A5195 00	N/A
PV Simulator	1091.1	Spitzenberger & Spies	PVS 127500	A5191 00	N/A
PV Simulator (Compartment 1)	1091.1.1	Spitzenberger & Spies	PVS 42500	A5191 00/1	N/A
PV Simulator (Compartment 2)	1091.1.2	Spitzenberger & Spies	PVS 42500	A5191 00/2	N/A
PV Simulator (Compartment 3)	1091.1.3	Spitzenberger & Spies	PVS 42500	A5191 00/3	N/A
PV Simulator (Compartment 4)	1091.1.4	Spitzenberger & Spies	PVS 42500	A5191 00/4	N/A
PV Simulator (Compartment 5)	1091.1.5	Spitzenberger & Spies	PVS 42500	A5191 00/5	N/A
PV Simulator (Compartment 6)	1091.1.6	Spitzenberger & Spies	PVS 42500	A5191 00/6	N/A
EMC Basic System	1091.2	Spitzenberger & Spies	EMC D 75000/PAS	A5192 00	N/A
EMC Basic System (L1)	1091.2.1	Spitzenberger & Spies	PAS 25000	A5192 00/1	N/A
EMC Basic System (L2)	1091.2.2	Spitzenberger & Spies	PAS 25000	A5192 00/2	N/A
EMC Basic System (L3)	1091.2.3	Spitzenberger & Spies	PAS 25000	A5192 00/3	N/A
EMC Basic System (Control System)	1091.2.4	Spitzenberger & Spies	SyCore 2M4	A5192 00/4	N/A
Laboratory Connection Box	1091.2.5	Spitzenberger & Spies	Laboratory Connection Box	A5192 00/5	N/A
Power Recovering System	1091.3	Spitzenberger & Spies	PRU 12750	A5193 00	N/A
Mobile Box	1091.4	Spitzenberger & Spies	Mobile Box	A5194 00	N/A
Resonant Circuit Load	1091.5	Spitzenberger & Spies	3 x RLC 35000/2.5	A 5715 00/1 0416 A 5715 00/2 0416 A 5715 00/3 0416	N/A
Dewetron Multi Channel Data Acquisition System	1092	Dewetron	DEWE-800 / DEWE-30-16 with Voltage an Current Modules	12130573, 56121690	N/A

Multi Channel Data Acquisition System, Part 1	1092.1	Dewetron	DEWE-800	12130573	Aug-18
Voltage Module	1092.1.0	Dewetron	DAQP-HV	429391	Aug-18
Current Module	1092.1.1	Dewetron	DAQP-LA	410873	Aug-18
Voltage Module	1092.1.2	Dewetron	DAQP-HV	429388	Aug-18
Current Module	1092.1.3	Dewetron	DAQP-LA	410874	Aug-18
Voltage Module	1092.1.4	Dewetron	DAQP-HV	429392	Aug-18
Current Module	1092.1.5	Dewetron	DAQP-LA	410865	Aug-18
Voltage Module	1092.1.6	Dewetron	DAQP-HV	429395	Aug-18
Current Module	1092.1.7	Dewetron	DAQP-LA	412956	Aug-18
Voltage Module	1092.1.8	Dewetron	DAQP-HV	429393	Aug-18
Current Module	1092.1.9	Dewetron	DAQP-LA	410869	Aug-18
Voltage Module	1092.1.10	Dewetron	DAQP-HV	429394	Aug-18
Current Module	1092.1.11	Dewetron	DAQP-LA	410870	Aug-18
Voltage Module	1092.1.12	Dewetron	DAQP-HV	429390	Aug-18
Current Module	1092.1.13	Dewetron	DAQP-LA	410871	Aug-18
Voltage Module	1092.1.14	Dewetron	DAQP-HV	429387	Aug-18
Current Module	1092.1.15	Dewetron	DAQP-LA	410872	Aug-18
Multi Channel Data Acquisition System, Part 2	1092.2	Dewetron	DEWE-30-16	56121690	Aug-18
Voltage Module	1092.2.16	Dewetron	DAQP-HV	429386	Aug-18
Current Module	1092.2.17	Dewetron	DAQP-LA	412967	Aug-18
Current Module	1092.2.18	Dewetron	DAQP-LV	492893	Aug-18
Current Module	1092.2.19	Dewetron	DAQP-LA	412961	Aug-18
Current Module	1092.2.20	Dewetron	DAQP-LV	385057	Mar-18
Current Module	1092.2.21	Dewetron	DAQP-LV	385044	Mar-18
Hygro- /Thermo-/Barometer	1073	Greisinger	GFTB 100	90258040	Mar-19

End of Test report