TEST REPORT
VDE-AR-N 4105
Power generation systems connected to the low-voltage distribution network

Report Reference No. .....:	211202348SHA-001
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Contents .....:	43 pages
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Address.....:	Building No.86, 1198 Qinzhou Road (North), Shanghai 200233, China.
Testing location / address.....:	Same as above
Applicant's name .....:	Afore New Energy Technology (Shanghai) Co., Ltd.
Address.....:	Build No.7, 333 Wanfang Road, Minhang District, Shanghai, China 201112
Test specification:	
Standard .....:	VDE-AR-N 4105:2018 conjunction with DIN VDE V 0124-100:2020
Test procedure.....:	Testing
Non-standard test method.....:	N/A
Test Report Form/blank test report	
Test Report Form No. .....:	TTRF_VDE_4105_2020_V1.0
TRF Originator.....:	Intertek Shanghai
Master TRF.....:	2020-06

Test item description .....:	Grid-connected PV inverter
Trade Mark .....:	Afore
Manufacturer.....:	Same as applicant
Model/Type reference.....:	See below Specifications table
Rating……..:	See below Specifications table

Specifications table					
Model	HNS3000TL	HNS3600TL-1	HNS3600TL	HNS4000TL	HNS5000TL
Input:					
Vmax PV (Vdc)	600	600	600	600	600
Isc PV (absolute Max.) (A)	18 x 2	18	18 x 2	18 x 2	18 x 2
Number MPP trackers	2	1	2	2	2
Number input strings	1/1	1	1/1	1/1	1/1
Max. PV input current(A)	14 x 2	14	14 x 2	14 x 2	14 x 2
MPPT voltage range (Vdc)	70-550	70-550	70-550	70-550	70-550
Vdc range @ full power (Vdc)	110-550	265-550	130-550	145-550	180-550
Output					
Normal Voltage(V)	L/N/PE, 220Vac, 230Vac, 240Vac				
Frequency (Hz)	50 / 60				
Current (normal) (A)	13.1	15.7	15.7	17.4	21.8
Current (Max. continuous) (A)	15	17.5	17.5	20	24
Power rating (W)	3000	3600	3600	4000	5000
Power Rating (VA)	3000	3600	3600	4000	5000
Power factor /rated	1 (-0,8~+0,8 adjustable)	1 (-0,8~+0,8 adjustable)	1 (-0,8~+0,8 adjustable)	1 (-0,8~+0,8 adjustable)	1 (-0,8~+0,8 adjustable)
others					
Protective class	Class I				
Ingress protection (IP)	IP 65				
Temperature (°C)	-25°C to +60°C (up 45°C derating)				
Inverter Isolation	Non-isolated				
Overvoltage category	OVC III (AC Main), OVC II (PV)				
Weight (kg)	10				
Dimensions (WxHxD) (mm)	358x360x142				

Specifications table					
Model	HNS6000TL	HNS7000TL	HNS8000TL	HNS9000TL	HNS10000TL
Input:					
Vmax PV (Vdc)	600	600	600	600	600
Isc PV (absolute Max.) (A)	18 x 2	18+35	18+35	35 x 2	35 x 2
Number MPP trackers	2	2	2	2	2
Number input strings	1/1	1/2	1/2	2/2	2/2
Max. PV input current(A)	14 x 2	14+26	14+26	26 x 2	26 x 2
MPPT voltage range (Vdc)	70-550	70-550	70-550	70-550	70-550
Vdc range @ full power (Vdc)	220-550	220-550	220-550	220-550	220-550
Output					
Normal Voltage(V)	L/N/PE, 220Vac, 230Vac, 240Vac				
Frequency (Hz)	50 / 60				
Current (normal) (A)	26.1	30.5	34.8	39.2	43.5
Current (Max. continuous) (A)	28.7	33.6	38.3	45	50
Power rating (W)	6000	7000	8000	9000	10000
Power Rating (VA)	6000	7000	8000	9000	10000
Power factor /rated	1 (-0,8~+0,8 adjustable)	1 (-0,8~+0,8 adjustable)	1 (-0,8~+0,8 adjustable)	1 (-0,8~+0,8 adjustable)	1 (-0,8~+0,8 adjustable)
others					
Protective class	Class I				
Ingress protection (IP)	IP 65				
Temperature (°C)	-25°C to +60°C (up 45°C derating)				
Inverter Isolation	Non-isolated				
Overvoltage category	OVC III (AC Main), OVC II (PV)				
Weight (kg)	17			18	
Dimensions (WxHxD) (mm)	510 x 370 x 192			535x370x192	

Test item particulars..... :	
PGU connect to Grid System	☒ 1/N/PE ☐ 3/PE ☐ 3/N/PE
PGS(kVA)	☐≤3.68 ☒ ≤13.8 ☐ >13.8
Default cos ϕ- reactive power adjusted	☒ No adjusted ☐ a fixed displacement factor cos φ. ☐ Standard characteristic curve for cos φ (*P*) ☐ non-Standard characteristic curve for cos φ (*P*)
Function of cos ϕ- reactive power adjusted	☒ No adjusted ☒ a fixed displacement factor cos φ. ☒ Standard characteristic curve for for cos φ (*P*) ☒ non-Standard characteristic curve for cos φ (*P*)
NS protection	☐Central NS protection ☒ Integrated NS protection
Voltage –Line to line	☐arithmetically from the three line-to-neutral voltages ☐measured separately ☒N/A
IP protection class .....:	IP65
Remark PGS: Power Generation System, PGU: Power Generation unit.	
Possible test case verdicts:	
- test case does not apply to the test object.....:	N/A
- test object does meet the requirement .....:	P(Pass)
- test object does not meet the requirement .....:	F(Fail)
Testing.....:	
Date of receipt of test item.....:	2021-04-29
Date (s) of performance of tests.....:	2021-04-29 to 2021-12-15

General remarks:

The test results presented in this report relate only to the object (single PV inverter unit) tested. The testing voltage is 230Vac single phase or 400V three phase. The information about Generating Plant is not considered and tested.

The inverter is with a power relay at AC output. There are two CPU in inverter. And is constructed redundantly protection.

The inverter also has integrated NS protection.

Installer and relevant persons shall comply with VDE-AR-N4105 and relevant standard and Grid Code in this standard.

This report shall not be reproduced, except in full, without the written approval of the Issuing testing laboratory.
"(see Enclosure #)" refers to additional information appended to the report.
"(see appended table)" refers to a table appended to the report.
Throughout this report a point is used as the decimal separator.

Determination of the test result includes consideration of measurement uncertainty from the test equipment and methods.

Determination of the test conclusion is based on IEC Guide 115 in consideration of measurement

uncertainty.

The test results presented in this report relate only to the item tested. See general product information next for details information.

The test does not include the faults inside the CPU and software evaluation as agreed with client.

All the tests are performed on single unit.

PF<0 is under-excited condition, PF>0 is over-excited condition

In the report the testing data of inter-harmonics and high frequency harmonics is only for reference to installation.

The clause number in first is about VDE-AR-N 4105 The clause number in bracket is about DIN V VDE V 0124-100

The report 211202348SHA-001 supersede 210403960SHA-002

General product information:

The test results presented in this report relate only to the object (single PV inverter unit) tested. The testing voltage is 230Vac, 50Hz. single phase. The information about Generating Plant is not considered and tested.

Password protection is for parameter setting by Screen, And not available for operators.

The testing item is a grid-connected type inverter for indoor or outdoor installation.
The Inverter is single-phase type and non-isolated between input and output.
The inverter is connected to the DC input and AC output by connectors.

The inverter has double channels DC input whose MPPT is independent. Please see Rating table

The inverter has adjustable power factor function.

All Mode are same except for output power and enclosure. The function was achieved by software.

The testing performed on typical model of Max. Power.

Part testing (5.4.4.3 Harmonics, 5.7.4.2.3 Active power feed-in at over-frequency) were performed on model of Min. power.

Model difference:
All models have same circuit diagram, PWB layout and software. Only different enclosure and fan. And different power devices and ratings. HNS3000TL, HNS3600TL-1, HNS3600TL, HNS4000TL, HNS5000TL have same enclosure, heatsink, circuit diagram and PWB layout. And with AC connector.
HNS6000TL, HNS7000TL, HNS8000TL, HNS9000TL, HNS10000TL have same enclosure, heatsink, circuit diagram and PWB layout. And with AC terminal, outlet bushing.

HNS6000TL, HNS7000TL, HNS8000TL have internal fan, HNS9000TL, HNS10000TL with internal and external fan.

The software version used for the testing is:

CPU	Part Name	Version
CPU1	DSP	V06
CPU2	HMI	V06
CPU3	CPLD	V06

The PV inverter default setting is PGU<13.8kVA and PGS < 13.8kVA.

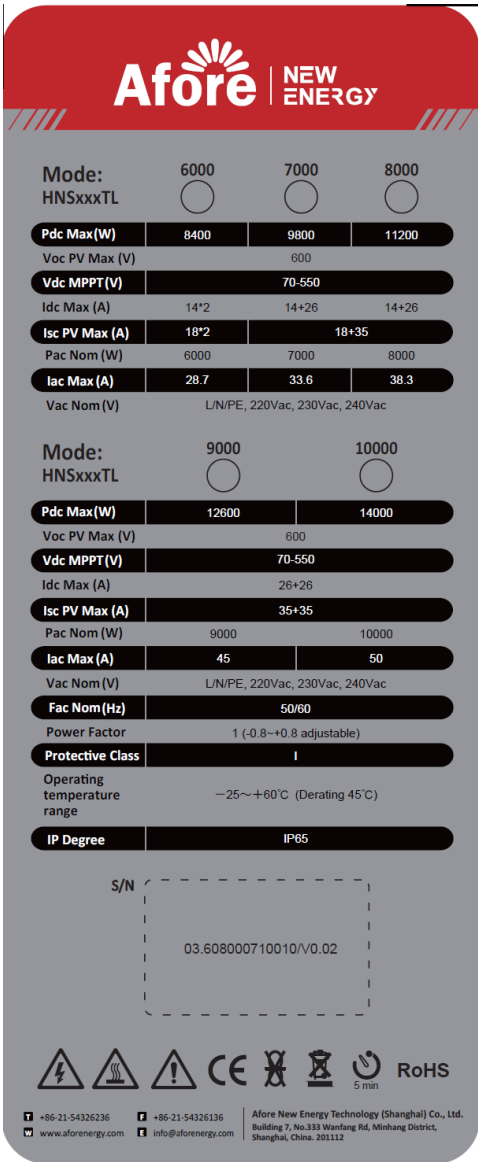
The inverter don’t provide the reactive power. And the PF is default value.

Abbreviations used in the report:

PGU: Power Generation unit. PGS: Power Generation System

In: Rated current of power generation unit.

Copy of marking plate:



Remark:

1.The other model labels are same with above except model number and technical data.

VDE-AR-N 4105			
Clause	Requirement - Test	Result - Remark	Verdict
4	General framework conditions		
4.1	Provisions and regulations	NA for PGU testing	N/A
4.2	Application procedure and connection relevant documents	NA for PGU testing	N/A
4.3	Initial start-up of the power generation system	NA for PGU testing	N/A
5	Network connection		
5.1	Principles for determination of the network connection point	NA for PGU testing	N/A
5.2	Rating of the network equipment	NA for PGU testing	N/A
5.3	Permissible voltage change	NA for PGU testing	N/A
5.4	Network interactions		N/A
5.5	Connection criteria		
5.5.1	General		P
	When connecting a power generation system or a storage unit, the technical connection conditions of the network operator shall be observed.	Shall be considered full feed-in that in accordance with VDE-AR-N 4100 in the power system	P
5.5.2	PAV, E monitoring (feed-in limitation)	No such functional	N/A
5.5.3	Power generation systems ready for connection		N/A
5.6	Three-phase inverter systems	PV single-phase inverter	N/A
5.7	Behaviour of the power generation system at the network		
5.7.1	General		
	For frequencies between 47,5 Hz and 51,5 Hz, automatic disconnection from the network due to a frequency deviation is not permitted. The actual operating principle and the associated exceptions are detailed in 5.7.4.3. Frequency-dependent active power control is implemented in the open-loop control of the power generation units.		P
5.7.2	Steady-state voltage stability/reactive power supply		P
5.7.2.1	General boundary conditions		P
5.7.2.2	Reactive power supply at ΣSEmax		P
5.7.2.2.1	General		P
	It is permissible in certain cases described in 5.7.2.2.2 and 5.7.3 to reduce the active power supply to the benefit of the reactive power supply. This is not considered a reduction of the active power supply in thecontext of network security management. Power generation systems shall comply with the reactive power supply irrespective of the number of feed-inphases under normal operating conditions in the voltage tolerance band Un ± 10 %.		P
5.7.2.2.2	Type 2 systems – inverters only		P

VDE-AR-N 4105			
Clause	Requirement - Test	Result - Remark	Verdict
5.7.2.2.3	Type 2 systems – Asynchronous generators (directly connected to the network and principally not able to control any reactive power)	Inverter only	N/A
5.7.2.2.4	Type 1 systems and type 2 systems – stirling generators and fuel cells	Inverter only	N/A
5.7.2.3	Reactive power supply smaller than PEmax		P
5.7.2.4	Methods for reactive power supply	(See appended table)	P
	a) reactive power voltage characteristic curve Q(U); or		P
	b) displacement factor/active power characteristic curve cos ϕ (P); or		P
	c) fixed displacement factor cos ϕ.		P
	The Q(U) rule applies only to three-phase power generation units connected to the three-phase current system.		P
5.7.2.5	Requirements for reactive power methods of type 2 systems (inverters only) and type 1 systems		P
	In the delivery state, none of the three reactive power methods specified in 5.7.2.4 is set as default. During the commissioning of power generation units, the method specified by the network operator shall be set by the system installer. Without the setting of the method specified by the network operator, power generation units shall not feed in any power.		P
5.7.2.6	Special aspects regarding the extension of power generation systems		P
5.7.3	Dynamic network stability		P
5.7.3.1	General	(See appended table)	P
5.7.3.2	Dynamic network stability for type 1 units Transient stability – Reaction to network faults		N/A
5.7.3.3	Dynamic network stability for type 2 units and storage units		P
	The following conditions apply to all type 2 power generation units and storage units: As long as the line-neutral-voltages at the generator terminals of the power generation unit or storage unit do not exceed the limit curves shown in Figure 12 (red for the under-voltage limit curve, blue for the over-voltage limit curve), both the power generation unit and the storage unit shall neither become unstable nor disconnect from the network throughout the operating range.		P

VDE-AR-N 4105			
Clause	Requirement - Test	Result - Remark	Verdict
	For evaluating the curves, the smallest respective value of the line-neutral-voltages at the power generation unit or the storage unit shall be used in case of a voltage drop, and the highest respective value of the line-neutral- voltages at the power generation unit or the storage unit shall be used in case of a voltage rise. As far as the set values for the NS protection given in Table 2 (column “Inverter(s)”) anticipate the requirements given in Figure 12 in certain working points, merely the checking of the set values for NS protection is required for the verification procedure.		P
	If the voltage at the generator terminals falls below < 0,8 Un or exceeds > 1,15 Un (onset of fault), type 2 power generation units and storage units shall ride through voltage drops without feeding current into the network of the network operator (limited dynamic network stability).		P
	This requirement is deemed to be met, if the current fed in by the power generation unit(s) and/or the storage unit in any line conductor does not exceed 20 % of the rated current Ir within 60 ms and 10 % of Ir within 100 ms upon a voltage drop below 0,8 Un or a voltage rise above 1,15 Un.		P
	Behaviour after the end of a fault If, after the end of a fault, the network voltage resumes a value within the voltage band from –15 % Un to +10 % Un and the active current of the power generation unit and/or the storage unit has been reduced during the network fault, it shall, immediately after the end of the fault, be increased to its pre-fault value as quickly as possible. The transient period shall not exceed a maximum of 1 s. The reactive power supply follows 5.7.2.5 in its time-related behaviour. In case of rotating machinery, the transient period shall not exceed a maximum of 6 s. At voltages of 1,15 Un, the power generation units and storage units shall not disconnect from the network for a period of up to 60 s after the onset of the fault. If the tripping of the self-protection of the power generation units and/or the storage unit is imminent, these units can adjust their reactive power behaviour such as to prevent self-protection tripping.		P
5.7.4	Active power output		P
5.7.4.1	General		P
	In cases where set-points are specified by a third party (e. g. direct marketing) and of network security management in accordance with 5.7.4.2, the new set-point shall be approached with the customer installation’s power gradients listed below in relation to the network connection point. Implementation of those power gradients directly at the power generation units or storage units is sufficient for meeting the requirement.	The active power can be remote-controlled on the communication interface	P
5.7.4.2	Network security management		P
5.7.4.2.1	Types of power generation systems and storage units	The active power can be remote-controlled on the communication interface	P

VDE-AR-N 4105			
Clause	Requirement - Test	Result - Remark	Verdict
	Photovoltaic systems		P
	Cogeneration of power and heat (CHP) systems, wind, biogas, hydroelectric power as well as landfill and sewage gas systems		N/A
	Storage units buffering EEG or KWKG systems		N/A
	Any EEG and KWKG systems with an intelligent measurement system		N/A
	Any power generation systems and storage units other than those indicated above		N/A
5.7.4.2.2	Implementation of network security management		P
5.7.4.2.3	Active power adjustment at over-frequency and under-frequency	(See appended table) The starting frequency can be set from 50.2 to 50.5Hz, And, power gradient S=2%-12% adjustable Default 50.2 and power gradient S=5% setting.	P
5.7.4.4	Voltage-dependent active power reduction		N/A
5.7.5	Short-circuit contribution Due to the operation of a power generation system, the short-circuit current of the low-voltage network is increased by the short-circuit current of the power generation system. Therefore, the short-circuit current of the power generation system to be expected at the network connection point shall be indicated in accordance with 4.2. For the determination of the initial short-circuit AC current contribution IkA of a power generation system, the following roughly estimated values can be assumed: – for synchronous generators: 8 times the rated current; – for asynchronous generators: 6 times the rated current; – for generators and storage units with inverters: the rated current. If the power generation system causes a short-circuit current increase in the network operator's network in excess of the rated value, then connection owner and network operator shall agree upon appropriate measures limiting the short-circuit current from the power generation system accordingly.		P
6	Construction of the power generation system/network and system protection (NS protection)		P
6.1	General requirements	PV Inverter	N/A
	The network and system protection (NS protection) is a type-tested protective device with a NS protection certificate (see Form E.6) wherein all protective functions specified in 6.5 are installed. The NS protection acts on the interface switch in accordance with 6.4. Depending on the sum of the maximum apparent powers of all power generation systems and storage units connected to the same network connection pointΣSAmax , the following conditions apply to the NS protection:		P

VDE-AR-N 4105			
Clause	Requirement - Test	Result - Remark	Verdict
6.2	Central NS protection	Integrated NS protection	N/A
6.3	Integrated NS protection		P
6.4	Interface switch	The PSU include integrated interface switch and is type tested in the report	P
6.4.1	General	PGU with integrated NS protection.	P
	For the connection of the power generation system to the network operator's low-voltage network or to the remaining customer installation, an interface switch shall be used. The interface switch is controlled by the NS protection and automatically triggers if at least one protective function responds.	Integrated interface switch has been type tested in compliance with DIN EN 62109	P
	The functional check of the interface switch shall be carried out according to a) or b) or c): a) by using an interface switch which, in its active state, requires a control voltage to be applied continuously and which disconnects automatically when this voltage is no longer applied. The operational connection and disconnection processes shall be monitored; b) by connection and disconnection of the interface switch via the NS protection and monitoring its proper functioning (e. g. break contact of a monitoring contact) at least once daily; c) by using the integrated interface switch and the integrated NS protection for PV and battery inverters in compliance		P
6.4.2	Central interface switch		NA
6.4.3	Integrated interface switch		P
	In the case of integrated NS protection, the NS protection can be integrated in the programmable system control of the power generation units (e.g. in the inverter control). If so, then both the test button and the sealing may be omitted, however, password protection is required, if the protective function U > is adjustable. The integrated NS protection acts on an integrated interface switch (see 6.4.3).	Unadjustable for U	P
6.5	Protective devices and protection settings		P
6.5.1	General		P
	The purpose of NS protection is to disconnect the power generation system from the network in the event of inadmissible voltage and frequency values (also refer to DIN VDE 0100-551 (VDE 0100-551)). This is meant to prevent inadvertent feed-in from the power generation system into a partial network separated from the main distribution network.		P
6.5.2	Protective functions		P

VDE-AR-N 4105			
Clause	Requirement - Test	Result - Remark	Verdict
	The NS protection shall be provided with a means for preventing unauthorised access (z. B. sealable, password protection). The rise-in-voltage protection U > shall be designed such as to be adjustable in the NS protection (see Table 2, Footnote b). Additionally, the time delay of the voltage drop protection U < and U << for directly coupled synchronous and asynchronous generators with Pn > 50 kW shall also be designed such as to be adjustable in the NS protection (see Table 2, Footnote d). Any other protective functions listed in 6.5.1 are either to be installed permanently, i. e. not adjustable, in the NS protection or to be provided with an additional separate protection against unauthorised access (e. g. password protection) for preventing modifications.	(See appended table)	P
6.5.3	Islanding detection	(See appended table)	P
6.6	Further requirements for power generation systems	Shall be considered in PGS	NA
7	Metering for billing purposes		NA
8	Operation of the system		P
8.1	General		P
8.2	Special aspects of the management of the network operator’s network		NA
8.3	Connection conditions and synchronisation		P
8.3.1	General		P
	Power generation systems and storage units shall be connected to the network operator’s network only if a suitable device determines that both the mains voltage and the mains frequency are within the tolerance range of 85 % *U*n to 110 % *U*n or 47,5 Hz to 50,1 Hz, respectively, for a period of at least 60 seconds. Additionally, the delay times for the reconnection of a generator and the staggered times applicable when connecting several generators shall be sufficient for safely finishing any control and adjustment processes within the power generation system and/or the storage unit caused by the connection. In case of power generation systems and storage units being reconnected to the network operator’s network at the tripping of the NS protective device or the *P*AV, E monitoring, the active power of controllable power generation systems and storage units supplied to the network operator’s network shall not exceed the gradient of 10 % of the active power *P*Amax per minute. Non-controllable power generation systems and storage units can connect after 1 min to 10 min (random generator) or later.	(See appended table)	P
8.3.2	Connection of synchronous generators		N/A
8.3.3	Connection of asynchronous generators		N/A

VDE-AR-N 4105			
Clause	Requirement - Test	Result - Remark	Verdict
8.3.4	Connection of power generation units and storage units with inverters Power generation units with inverters (such as photovoltaic systems) and storage units with inverters shall only be connected with kimax ≤ 1,2.		P
8.4	Special aspects regarding the planning, installation and operation of power generation systems and storage units each with PAmax ≥ 135 kW		NA
9	Verification of electrical properties		P
	Annex A: Explanations (informative)		---
	Annex B: Connection examples and measurement strategies (informative)		---
	Annex C: Examples of meter panel configurations (informative)		---
	Annex D: Examples for the connection evaluation of power generation systems -Connection of a 20 kW PV system (informative)		---

Appendix table1

5.4.4.1(5.2.2) Rapid voltage changes

Operation type1:	Switching on at any power level (without default to primary energy source)		
Operation type2:	start-up at Pn (reference condition) with circuit breaker reclosing		
Operation type3:	Switching on at any power level (without default to primary energy source)		
	Ki (limit <1.2)		
Test condition	Test 1: cosφ=1	Test 2: cosφ=0.90over-excited	Test 3: cosφ=0.90under-excited
Operation type1	0.322	0.306	0.333
Operation type2	0.311	0.312	0.318
Operation type3	0.316	0.321	0.316

Switching actions	Ki
Marking operation without default (to primary energy carrier)	0.136
Worst case at switch over of generator sections	0.142
Marking operation at reference conditions (of primary energy carrier)	0.141
Breaking operation at nominal power	0.303
Worst case value of all switching operations Ki max	0.314

Remark: Max. Power model can represent the other model

5.4.4.2 (5.2.3) Flicker

Remark: only test Max. Power

Flicker	Angle of network impedance Ψ_k:	32°
L1	Long-term flicker strength P_{lt}:	0.15
L2	Long-term flicker strength P_{lt}:	--
L3	Long-term flicker strength P_{lt}:	--

	Result			
Parameter	**Limit value**	**L1 result**	**L2 result**	**L3 result**
Plt	0.65(12)	0.15	--	--
Pst	1.00	0.18	--	--
dc(%)	3.3%	0.28	--	--
d max (%)	4%	0.59	--	--
d(t)%	3.3%(500ms)	0	--	--

Remark: Max. Power model can represent the other model

5.4.4.3(5.2.4) Harmonics and inter-harmonics

Testing at one inverter condition

	TABLE: Harmonic current limit test (EN 61000-3-2)						**P**
Model	HNS3000TL						
Harmonic	L1		L2		L3		Limits -%
	Magnitude (A)	% of Fundamental	Magnitude (A)	% of Fundamental	Magnitude (A)	% of Fundamental	
0	0.002	0.015	--	--	--	--	0.5% I
01	13.038	--	--	--	--	--	--
02	0.031	0.239	--	--	--	--	1.08
03	0.155	1.185	--	--	--	--	2.3
04	0.008	0.060	--	--	--	--	0.43
05	0.068	0.519	--	--	--	--	1.14
06	0.007	0.051	--	--	--	--	0.30
07	0.023	0.173	--	--	--	--	0.77
08	0.008	0.058	--	--	--	--	0.23
09	0.026	0.200	--	--	--	--	0.40
10	0.016	0.123	--	--	--	--	0.184
11	0.033	0.253	--	--	--	--	0.33
12	0.012	0.093	--	--	--	--	0.153
13	0.028	0.215	--	--	--	--	0.21
14	0.012	0.091	--	--	--	--	0.131
15	0.045	0.344	--	--	--	--	0.15
16	0.010	0.074	--	--	--	--	0.115
17	0.011	0.084	--	--	--	--	0.132
18	0.005	0.038	--	--	--	--	0.102
19	0.021	0.163	--	--	--	--	0.118
20	0.008	0.065	--	--	--	--	0.092
21	0.014	0.107	--	--	--	--	0.107
22	0.005	0.038	--	--	--	--	0.084
23	0.005	0.040	--	--	--	--	0.098
24	0.005	0.038	--	--	--	--	0.077
25	0.010	0.077	--	--	--	--	0.09
26	0.007	0.054	--	--	--	--	0.071
27	0.006	0.049	--	--	--	--	0.083
28	0.007	0.050	--	--	--	--	0.066
29	0.007	0.051	--	--	--	--	0.078
30	0.005	0.036	--	--	--	--	0.061
31	0.007	0.054	--	--	--	--	0.073
32	0.005	0.040	--	--	--	--	0.058
33	0.005	0.036	--	--	--	--	0.068
34	0.006	0.049	--	--	--	--	0.054
35	0.008	0.062	--	--	--	--	0.064
36	0.004	0.030	--	--	--	--	0.051
37	0.005	0.040	--	--	--	--	0.061
38	0.004	0.034	--	--	--	--	0.048
39	0.004	0.033	--	--	--	--	0.058
40	0.006	0.043	--	--	--	--	0.046
THD	--	1.83	--	--	--	--	5
PWHD	--	--	--	--	--	--	22%

	TABLE: Harmonic current limit test **(**EN 61000-3-12)						**P**
Model	HNS10000TL						
Harmonic	L1		L2		L3		Limits -%
	Magnitude (A)	% of Fundamental	Magnitude (A)	% of Fundamental	Magnitude (A)	% of Fundamental	
0	0.011	0.025	--	--	--	--	0.5% I
01	43.209	--	--	--	--	--	--
02	0.123	0.284	--	--	--	--	8%
03	0.850	1.967	--	--	--	--	Not stated
04	0.033	0.077	--	--	--	--	4%
05	0.340	0.786	--	--	--	--	10.7%
06	0.019	0.043	--	--	--	--	2.67%
07	0.159	0.369	--	--	--	--	7.2%
08	0.018	0.042	--	--	--	--	2%
09	0.078	0.181	--	--	--	--	Not stated
10	0.020	0.046	--	--	--	--	1.6%
11	0.076	0.176	--	--	--	--	3.1%
12	0.038	0.088	--	--	--	--	1.33%
13	0.080	0.184	--	--	--	--	2%
14	0.023	0.054	--	--	--	--	---
15	0.054	0.125	--	--	--	--	---
16	0.027	0.062	--	--	--	--	---
17	0.057	0.131	--	--	--	--	---
18	0.016	0.038	--	--	--	--	---
19	0.040	0.093	--	--	--	--	---
20	0.019	0.045	--	--	--	--	---
21	0.015	0.035	--	--	--	--	---
22	0.013	0.030	--	--	--	--	---
23	0.014	0.032	--	--	--	--	---
24	0.016	0.036	--	--	--	--	---
25	0.036	0.084	--	--	--	--	---
26	0.012	0.027	--	--	--	--	---
27	0.015	0.035	--	--	--	--	---
28	0.018	0.043	--	--	--	--	---
29	0.018	0.042	--	--	--	--	---
30	0.009	0.021	--	--	--	--	---
31	0.016	0.036	--	--	--	--	---
32	0.010	0.022	--	--	--	--	---
33	0.010	0.023	--	--	--	--	---
34	0.013	0.030	--	--	--	--	---
35	0.025	0.058	--	--	--	--	---
36	0.015	0.034	--	--	--	--	---
37	0.015	0.035	--	--	--	--	---
38	0.009	0.022	--	--	--	--	---
39	0.030	0.069	--	--	--	--	---
40	0.020	0.046	--	--	--	--	---
THD	--	2.307	--	--	--	--	13%
PWHD		1.378	--	--	--	--	22%

5.4.4.8(5.2.6) I dc -Direct current injection

5.4.4.8+5.2.6 TABLE: Direct current injection								**P**
Model	**HNS3000TL**							
Rated output current (A)	Power P/Pn [%]	**Measured DC output current**						**Limit [%]**
		L1 [A]	**L1 [%]**	**L2 [A]**	**L2 [%]**	**L3 [A]**	**L3 [%]**	
13.04	100%	0.009	0.07%	--	--	--	--	0.5%
13.04	66%	0.008	0.06%	--	--	--	--	0.5%
13.04	33%	0.008	0.06%	--	--	--	--	0.5%
Supplementary information: Main voltage 230V								

5.4.4.8+5.2.6 TABLE: Direct current injection								
Model	**HNS10000TL**							
Rated output Current （A）	Power P/Pn [%]	**Measured DC output current**						**Limit [%]**
		L1 [A]	**L1 [%]**	**L2 [A]**	**L2 [%]**	**L3 [A]**	**L3 [%]**	
43.48	100%	0.008	0.02%	--	--	--	--	0.5%
43.48	66%	0.006	0.01%	--	--	--	--	0.5%
43.48	33%	0.009	0.02%	--	--	--	--	0.5%
Supplementary information:Main voltage 230V								

5.6+5.3.2 Asymmetry calculation for three-phase inverter

5.6+5.3.2	TABLE: Asymmetry calculation for three-phase inverter						**NA**
Model							
Three-phase inverter							
Test voltage: 230 V. 50 Hz							
NO.	Test condition		Power asymmetry [VA]				
	$\cos\varphi$	P/PEmax	I	II	III	IV	VI
1	1.00	100%	---	---	---	---	---
2	1.00	50%	---	---	---	---	---
3	max. under-excited	100%	---	---	---	---	---
4		50%	---	---	---	---	---
5	max. over-excited	100%	---	---	---	---	---
6		50%	---	---	---	---	---
Max. Power Asymmetry [VA]			---		Limitation [VA]		---

5.7.2 Power Factor

Limit:

Default ： 1±0.01

0.90 to 0.90 20% P to 100%

Model	**HNS3000TL**							
step	U_n				1.09U_n			
	Voltage (P to N.V)	S (VA)	P (W)	cosφ	Voltage (P to N. V)	S (VA)	P (W)	cosφ
a) noraml	230.16	3014	3002	0.996	250.71	3025	3016	0.997
b) before	230.20	2949	2810	0.953	250.74	2955	2819	0.954
c) after	230.29	3026	2869	0.948	250.69	3041	2886	0.949
$S_{Emax600}$ (VA)					3041			
$P_{Emax600}$ (W)					3016			

Model	HNS10000TL							
step	U_n				1.09U_n			
	Voltage (P to N.V)	S (VA)	P (W)	cosφ	Voltage (P to N. V)	S (VA)	P (W)	cosφ
a) noraml	230.13	10018	9988	0.997	250.74	9992	9972	0.998
b) before	230.08	9986	8967	0.898	250.71	9975	8948	0.897
c) after	230.12	10042	9028	0.899	250.67	10025	9002	0.898
$S_{Emax600}$ (VA)					10042			
$P_{Emax600}$ (W)					9988			

	Power factor test								
Model	HNS3000TL								
Power Level (% of VA)	20%	30%	40%	50%	60%	70%	80%	90%	100%
U=Un	230V								
P(W)	598	901	1203	1499	1799	2102	2399	2703	3000
S(VA)	651	936	1229	1520	1817	2117	2412	2715	3011
PF	0.991	0.992	0.992	0.993	0.993	0.993	0.993	0.995	0.996
0.91 Un	0.91 Un								
P(W)	604	902	1199	1497	1802	2103	2401	2698	3004
S(VA)	645	929	1219	1514	1816	2114	2411	2708	3013
PF	0.992	0.992	0.992	0.993	0.993	0.994	0.995	0.996	0.996
1.09Un	1.09Un								
P(W)	607	904	1206	1499	1799	2095	2404	2696	3004
S(VA)	674	949	1241	1527	1822	2114	2421	2712	3017
PF	0.990	0.990	0.990	0.991	0.992	0.993	0.993	0.993	0.994
Remark: PF<0 is under-excited condition, PF>0 is over-excited condition									

	Power factor test								
Model	HNS10000TL								
Power Level (% of VA)	20%	30%	40%	50%	60%	70%	80%	90%	100%
U=Un	230V								
P(W)	2015	2999	4005	4993	5994	6991	7988	9002	10030
S(VA)	2027	3017	4025	5018	6018	7012	8012	9020	10050
PF	0.994	0.994	0.995	0.995	0.996	0.997	0.997	0.998	0.998
0.91 Un	0.91 Un								
P(W)	2010	3000	3999	4998	5989	6999	7997	8994	9995
S(VA)	2022	3015	4015	5018	6013	7020	8013	9012	10015
PF	0.994	0.995	0.996	0.996	0.996	0.997	0.998	0.998	0.998
1.09Un	1.09Un								
P(W)	2018	3014	3998	4987	5988	6984	7981	8995	9995
S(VA)	2032	3032	4022	5012	6018	7012	8013	9022	10025
PF	0.993	0.994	0.994	0.995	0.995	0.996	0.996	0.997	0.997
Remark: PF<0 is under-excited condition, PF>0 is over-excited condition									

5.7.2.2 The Default is a fixed displacement factor cosφ

limit +0.95 to -0.95. time <10S

Model	HNS3000TL								
Set Value	100% of S			50% of S			20% of S		
	Un 230V	1.09Un 250V	0.91Un 209V	Un 230V	1.09Un 250V	0.91Un 209V	Un 230V	1.09Un 250V	0.91Un 209V
+0.90	--	--	--	--	--	--	--	--	--
+0.91	--	--	--	--	--	--	--	--	--
+0.92	--	--	--	--	--	--	--	--	--
+0.93	--	--	--	--	--	--	--	--	--
+0.94	--	--	--	--	--	--	--	--	--
+0.95	0.946	0.947	0.948	0.950	0.953	0.949	0.948	0.950	0.951
+0.96	0.958	0.958	0.958	0.963	0.964	0.961	0.956	0.957	0.960
+0.97	0.967	0.970	0.967	0.971	0.971	0.969	0.967	0.966	0.967
+0.98	0.978	0.980	0.978	0.982	0.982	0.980	0.978	0.979	0.976
+0.99	0.991	0.988	0.989	0.989	0.989	0.988	0.988	0.987	0.986
1	0.999	0.997	0.998	0.998	0.997	0.998	0.997	0.996	0.996
-0.99	-0.989	-0.986	-0.987	-0.987	-0.986	-0.986	-0.991	-0.990	-0.986
-0.98	-0.979	-0.976	-0.978	-0.976	-0.976	-0.977	-0.979	-0.976	-0.978
-0.97	-0.968	-0.966	-0.969	-0.966	-0.966	-0.968	-0.966	-0.969	-0.970
-0.96	-0.957	-0.956	-0.959	-0.957	-0.958	-0.956	-0.957	-0.957	-0.958
-0.95	-0.946	-0.946	-0.950	-0.946	-0.947	-0.946	-0.946	-0.947	-0.948
-0.94	--	--	--	--	--	--	--	--	--
-0.93	--	--	--	--	--	--	--	--	--
-0.92	--	--	--	--	--	--	--	--	--
-0.91	--	--	--	--	--	--	--	--	--
-0.90	--	--	--	--	--	--	--	--	--
settling time(s)	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2
Remark: PF<0 is under-excited condition, PF>0 is over-excited condition									

Model	HNS10000TL								
Set Value	100% of S			50% of S			20% of S		
	Un 230V	1.09Un 250V	0.91Un 209V	Un 230V	1.09Un 250V	0.91Un 209V	Un 230V	1.09Un 250V	0.91Un 209V
+0.90	0.897	0.896	0.897	0.896	0.898	0.901	0.898	0.898	0.901
+0.91	0.914	0.906	0.914	0.911	0.910	0.911	0.911	0.914	0.908
+0.92	0.917	0.918	0.921	0.918	0.922	0.921	0.921	0.919	0.920
+0.93	0.932	0.934	0.933	0.933	0.932	0.929	0.926	0.928	0.931
+0.94	0.938	0.936	0.938	0.938	0.939	0.939	0.942	0.939	0.941
+0.95	0.948	0.947	0.949	0.951	0.948	0.949	0.952	0.949	0.950
+0.96	0.959	0.956	0.962	0.962	0.961	0.959	0.959	0.961	0.962
+0.97	0.974	0.973	0.972	0.971	0.973	0.969	0.968	0.969	0.969
+0.98	0.977	0.978	0.982	0.979	0.983	0.983	0.981	0.979	0.981
+0.99	0.988	0.993	0.987	0.992	0.993	0.988	0.987	0.992	0.992
1	0.997	0.997	0.998	0.998	0.997	0.999	0.998	0.999	0.999
-0.99	-0.994	-0.994	-0.989	-0.989	-0.988	-0.988	-0.993	-0.993	-0.991
-0.98	-0.978	-0.977	-0.982	-0.981	-0.976	-0.978	-0.982	-0.983	-0.980
-0.97	-0.974	-0.970	-0.970	-0.966	-0.974	-0.971	-0.969	-0.973	-0.969
-0.96	-0.962	-0.956	-0.961	-0.961	-0.958	-0.964	-0.964	-0.957	-0.959
-0.95	-0.946	-0.946	-0.949	-0.950	-0.954	-0.947	-0.954	-0.953	-0.951
-0.94	-0.937	-0.938	-0.941	-0.939	-0.938	-0.939	-0.944	-0.944	-0.941
-0.93	-0.934	-0.934	-0.933	-0.926	-0.932	-0.928	-0.933	-0.928	-0.931
-0.92	-0.924	-0.921	-0.921	-0.919	-0.919	-0.920	-0.918	-0.920	-0.919
-0.91	-0.913	-0.909	-0.909	-0.911	-0.908	-0.908	-0.906	-0.913	-0.909
-0.90	-0.896	-0.901	-0.898	-0.899	-0.901	-0.899	-0.897	-0.904	-0.899
settling time(s)	3.2	3.2	3.4	3.0	3.4	3.2	3.4	3.2	3.4
Remark: PF<0 is under-excited condition, PF>0 is over-excited condition									

5.7.2 COS Φ(P)

Point1		Point2		Point3		Point4	
P/P_{-EMax}	cos ϕ	P/P_{-EMax}	cos ϕ	P/P_{-EMax}	cos ϕ	P/P_{-EMax}	cos ϕ
0.2	1	0.5	1	1	0.90	---	---

P_{Emax}		10000 W					
% of P_{Emax}	set-value of cosφ	First time		Second time		Third time	
		P	cosφ	P	cosφ	P	cosφ
20%	1.00	2011	0.993	2012	0.993	2011	0.993
30%	1.00	2977	0.994	2977	0.994	2985	0.994
40%	1.00	3986	0.996	3990	0.997	3991	0.996
50%	1.00	4993	0.996	4982	0.996	4996	0.996
60%	-0.98	5991	0.976	5969	0.977	5991	0.977
70%	-0.96	6986	0.957	6982	0.958	6986	0.958
80%	-0.94	7992	0.938	7998	0.938	8000	0.938
90%	-0.92	8988	0.919	8982	0.919	8986	0.918
100%	-0.90	9003	0.908	9008	0.907	9010	0.907
90%	-0.92	8882	0.920	8924	0.920	8984	0.919
80%	-0.94	7999	0.938	7998	0.938	8002	0.938
70%	-0.96	6977	0.957	6974	0.958	6981	0.957
60%	0.98	5974	0.977	5994	0.976	5996	0.976
50%	1.00	4998	0.996	4993	0.996	4999	0.996
40%	1.00	3987	0.997	3988	0.996	3995	0.997
30%	1.00	2986	0.994	2986	0.994	2992	0.994
20%	1.00	2008	0.993	2002	0.993	2010	0.993
PF<0 is under-excited condition, PF>0 is over-excited condition							

5.7.2 PF Q (U)

Voltage			VAR		
Rated Voltage		230Vac (400V)	Rated Power		10KVA
Voltage	% Vrated	Voltage (V)	VAR	% P	
V1	93%	213.9	Q1-capacitive	-43.58%	-4358Var
V2	97%	223.1	Q2	0	-
V3	103%	236.9	Q3	0	-
V4	107%	246.1	Q4- inductive	43.58%	4358Var
Remark:					

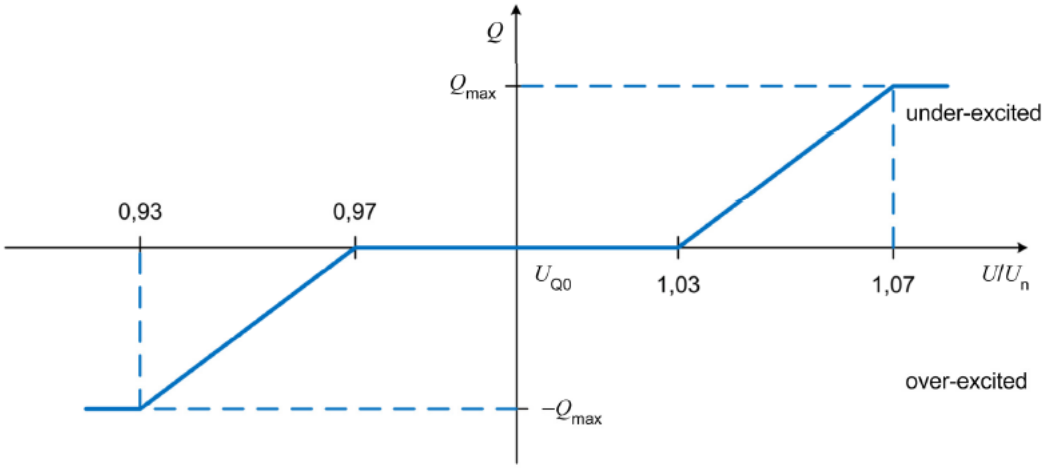
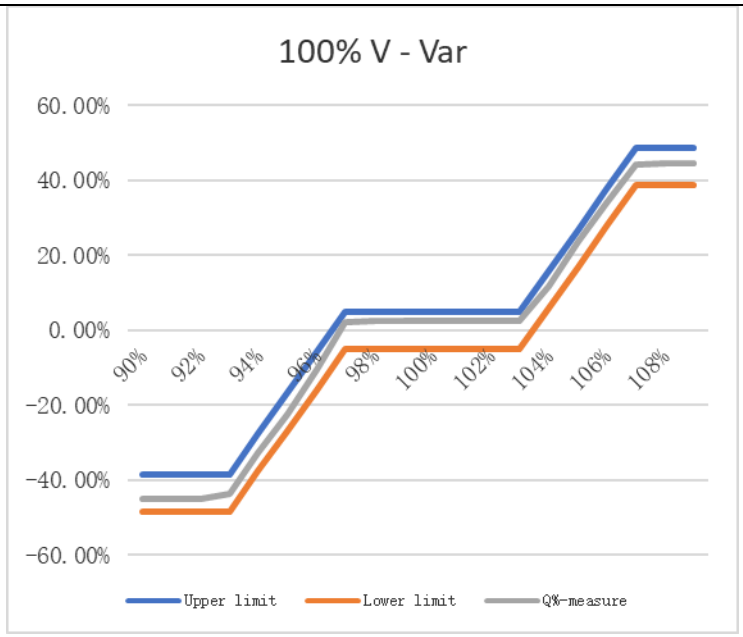
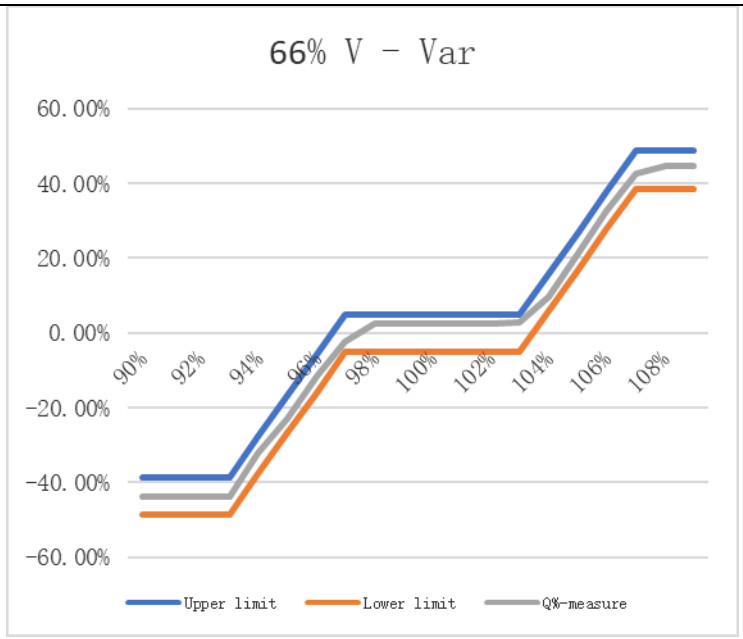
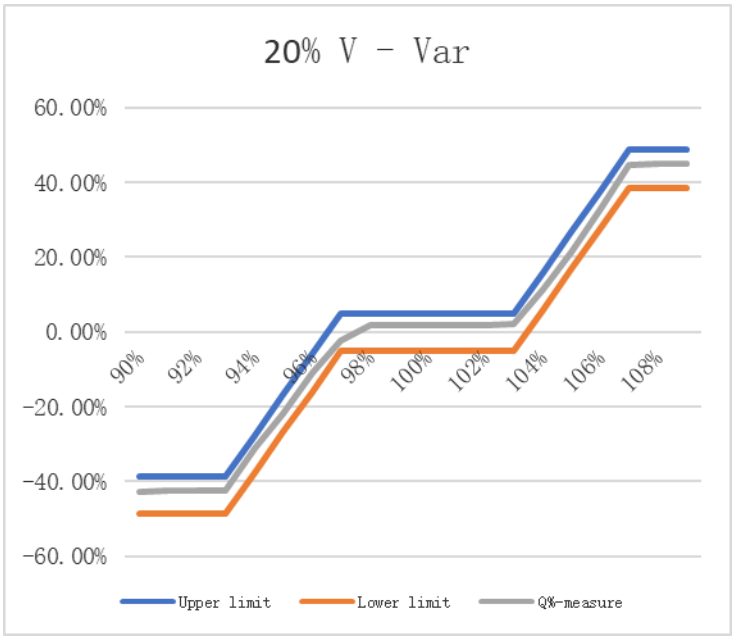


Figure 7 – Standard $Q(U)$ characteristic curve

Curve V-Var




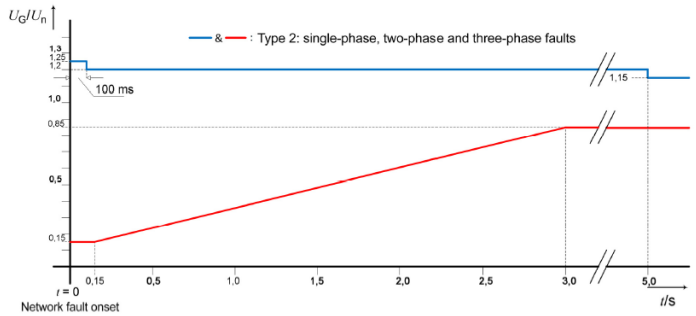


5.7.2 PF – Power Factor(Reactive power response time)

	Q(U) condition						
	Voltage Setting U_{PGU}	Target Q	Measurement Q_{SOll} [Var]	Measurement Q_{Start} [Var]	Response time T_{MESS} [s]	Parameterized response time T (s)	Dynamic as PT1
1.	Un+ $\Delta U_{ind.Y}$	Inductive. 0.90Qmax	-4360	-148	6.8	10 s	Pass
2.	Un+ $\Delta U_{cap.Y}$	Capacitive. 0.9Qmax	4322	-161	6.6	10 s	Pass

	Displacement factor cos ϕ condition						
	Voltage Setting U_{PGU}	Target Q	Measurement Q_{SOll} [Var]	Measurement Q_{Start} [Var]	Response time T_{MESS} [s]	Parameterized response time T (s)	Dynamic as PT1
1.	Un	Inductive. 0.90Qmax	-4382	-201	6.9	10 s	Pass
2.	Un	Capacitive. 0.9Qmax	4376	-171	6.4	10 s	Pass

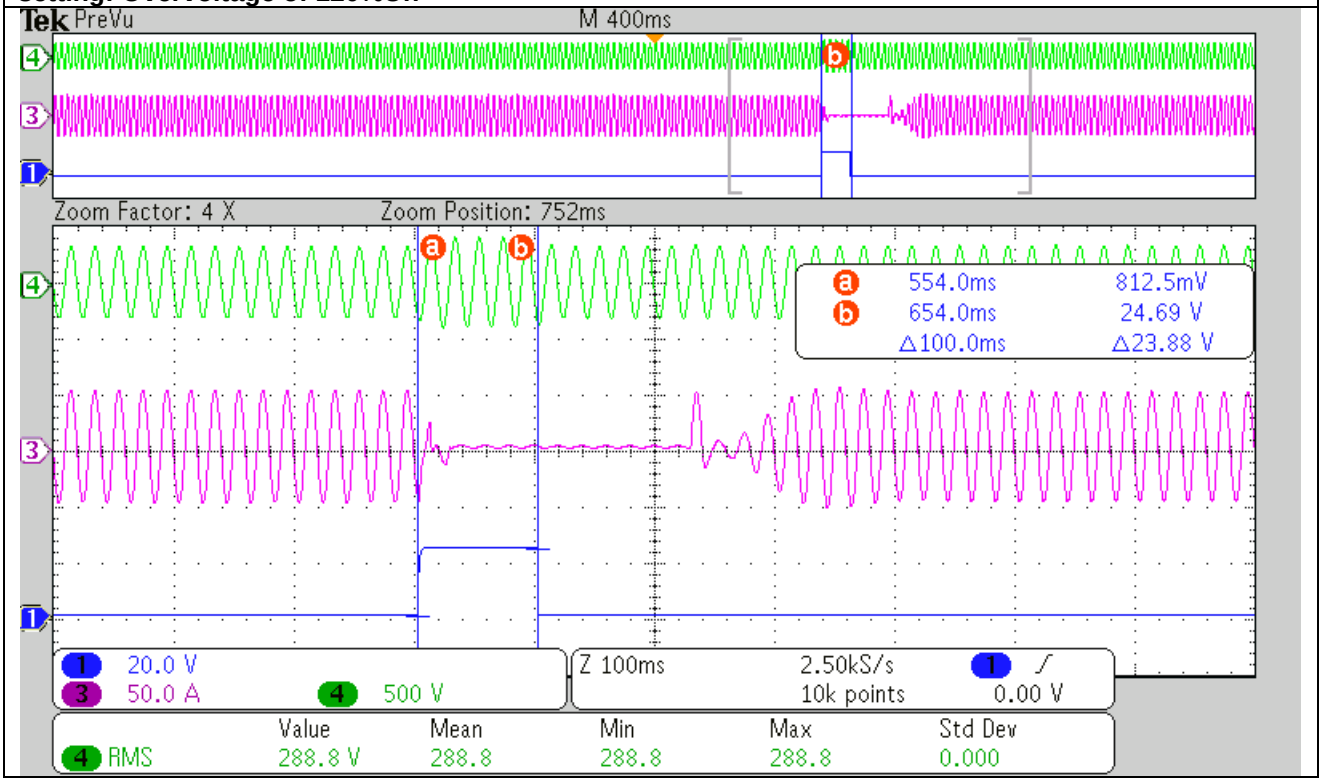
5.7.3.3 Dynamic network stability for type 2 units and storage units（OUVRT）

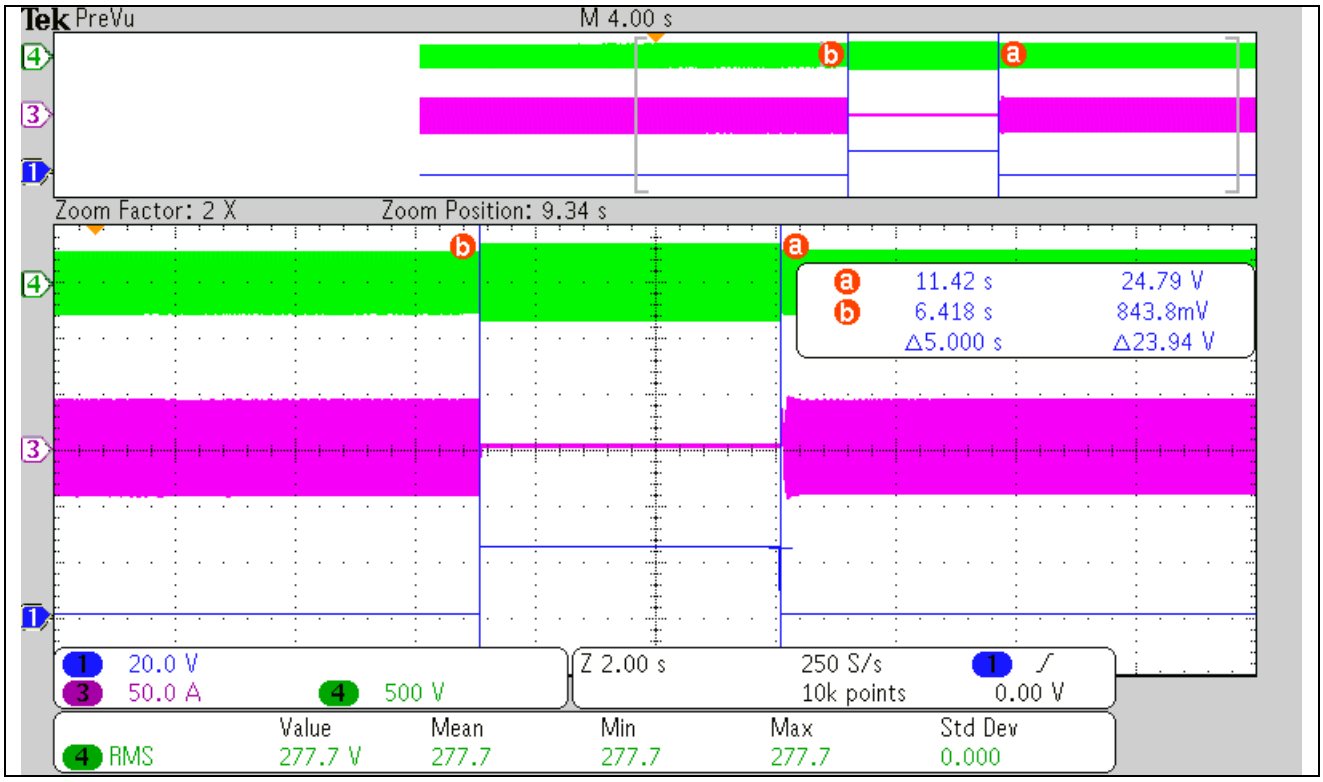
5.7.3.3 Dynamic network stability for type 2 units and storage units（OVRT）	
Requirement:  	
Note: For LV3 or HV1 the EUT shall cease to energize in not more than 0.16 s (and not trip). Renew to normal model when 88%-110%. And back to Max power	

Test at partial load (100%Pn)

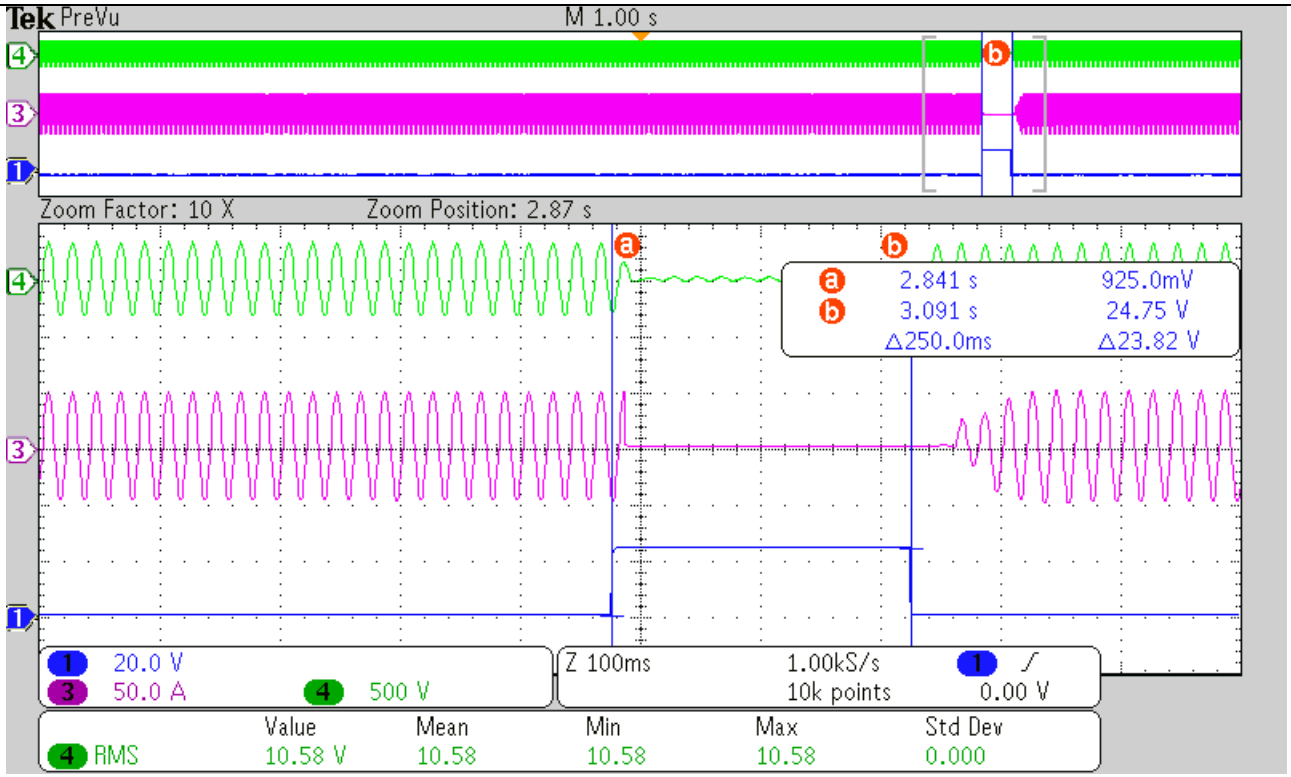
Udip	Type	t min (ms)	U meas. (V)	T meas. (ms)	P recover (s)
125%	1 ph	100	288.80	100	0.210
120%	1 ph	5000	277.70	5000	0.115

Remark:
The tests are performed together with clause 4.7.4.2.2 Zero current mode and enabling of default setting: Overvoltage of 120%Un

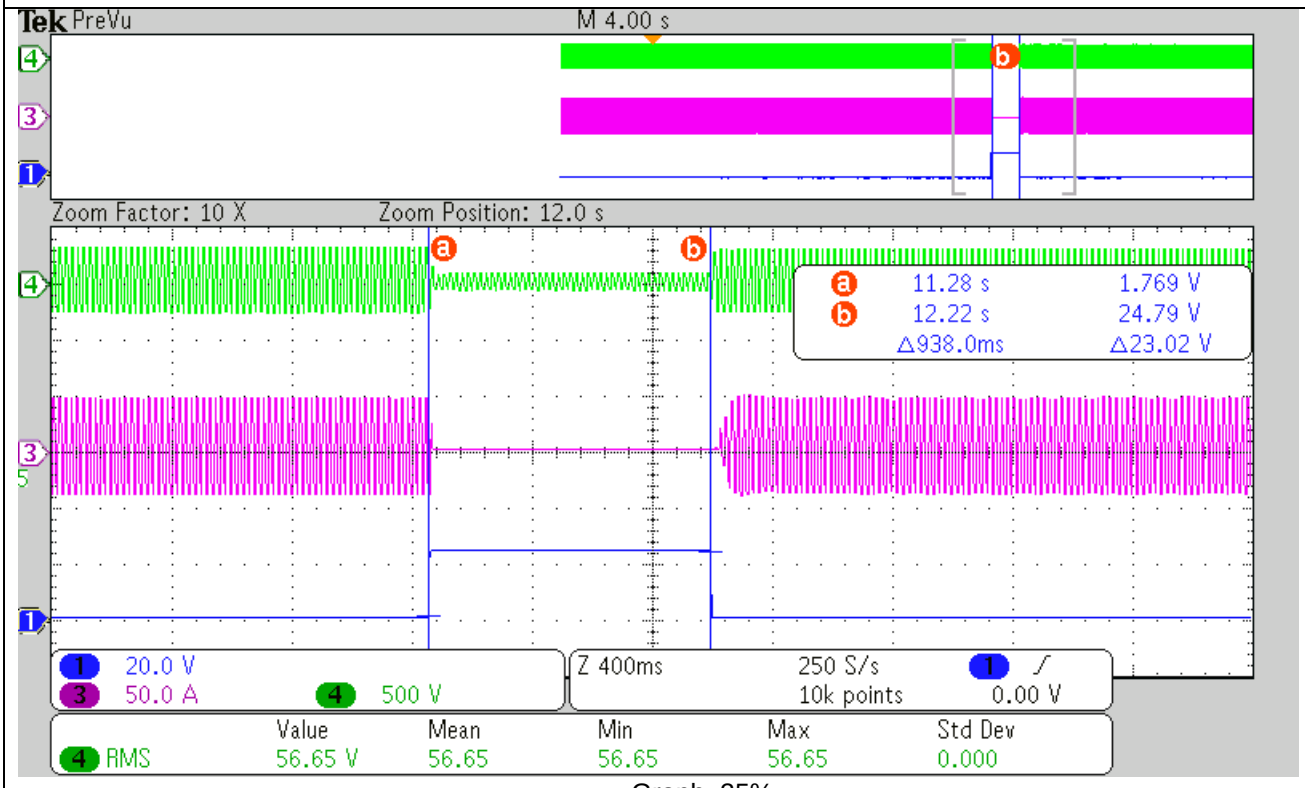




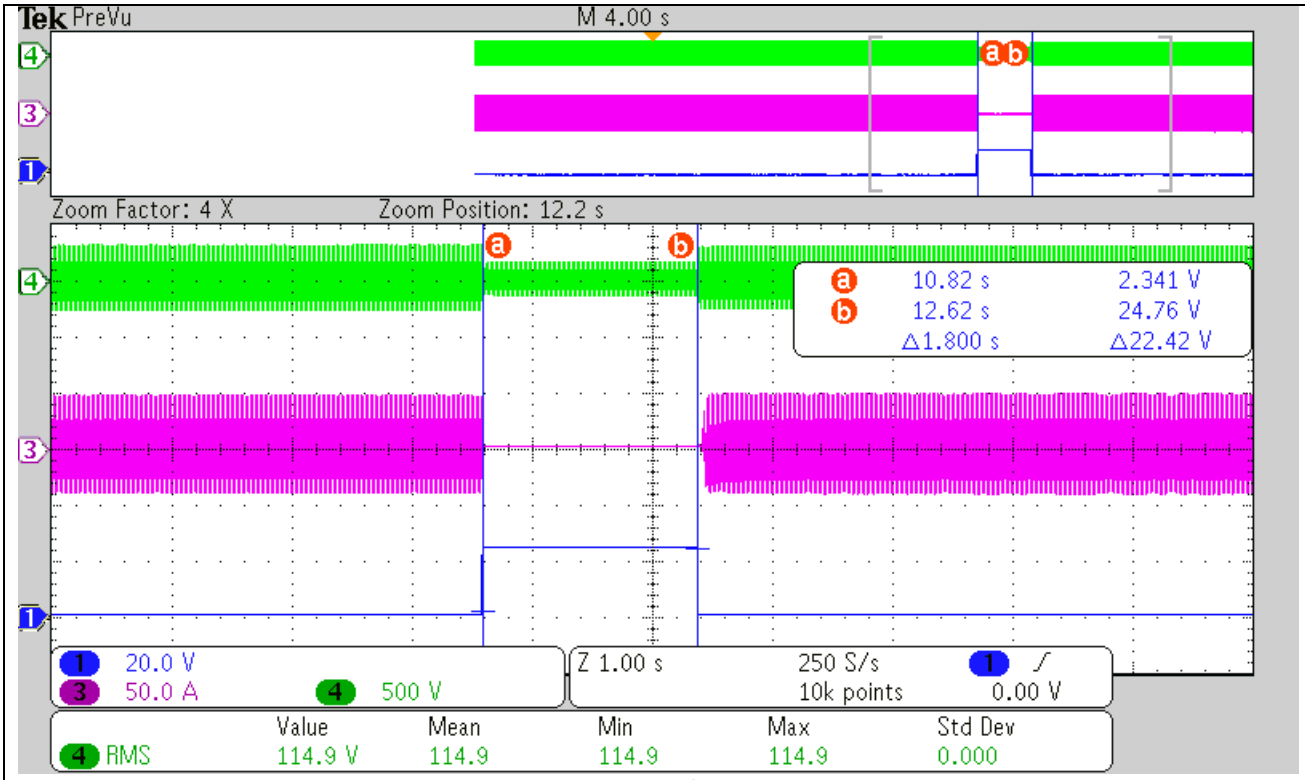
Test at full load (>90%Pn)				
Udip	**T min (ms)**	**U meas. (%)**	**T meas. (ms)**	**P recover (s)**
5%	250	4.60%	250	0.080
25%	938	24.63%	938	0.080
50%	1797	49.96%	1800	0.081
75%	2656	74.65%	2656	0.081
Remark: The tests are performed together with clause 4.7.4.2.2 Zero current mode and enabling of default setting: Undervoltage of 50%Un.				



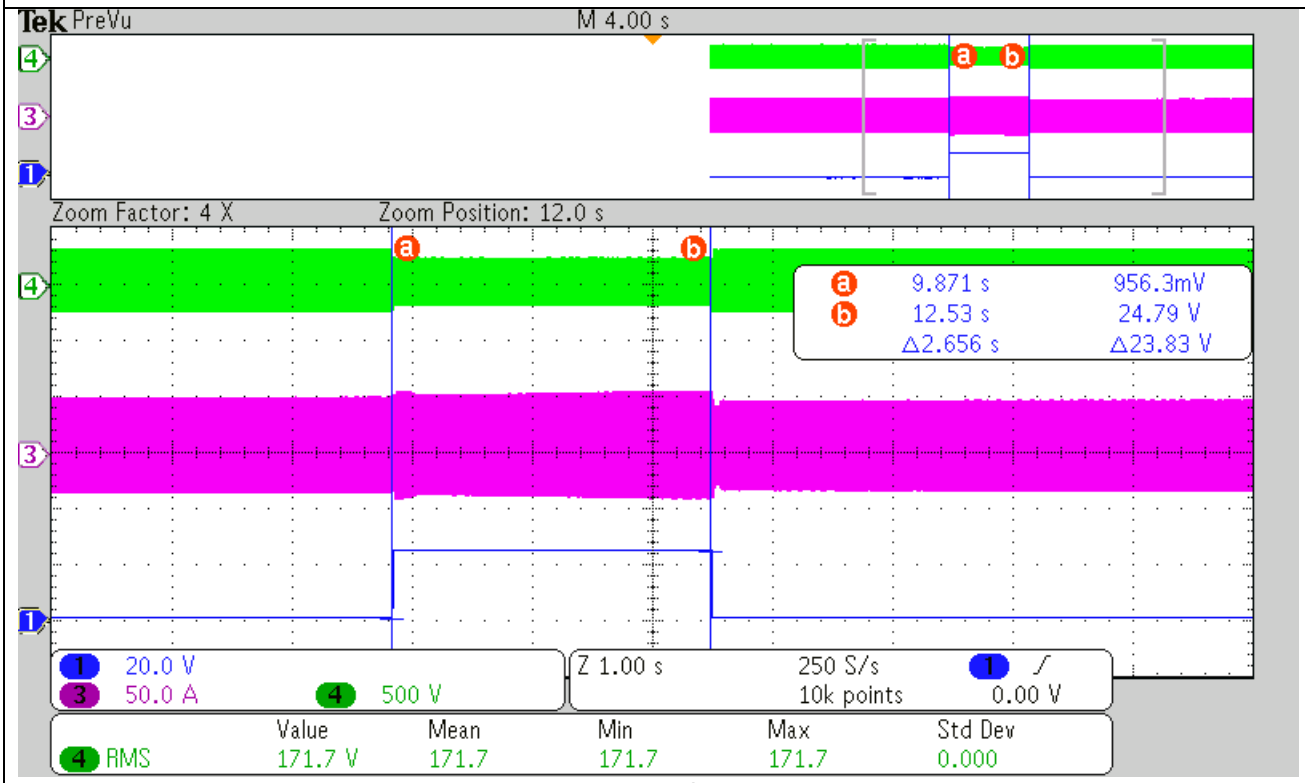
Graph_5%



Graph_25%



Graph_50%



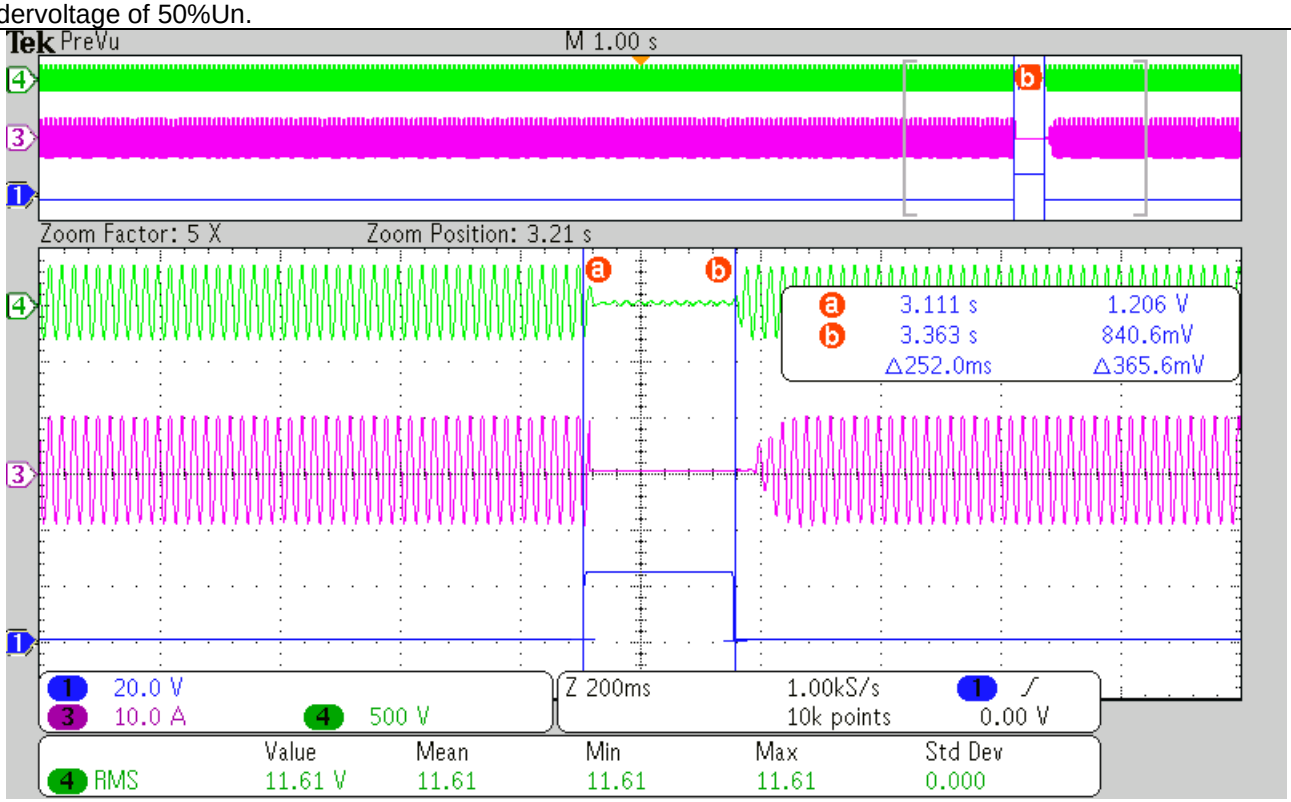
Graph_75%

Test at partial load (>20%Pn)

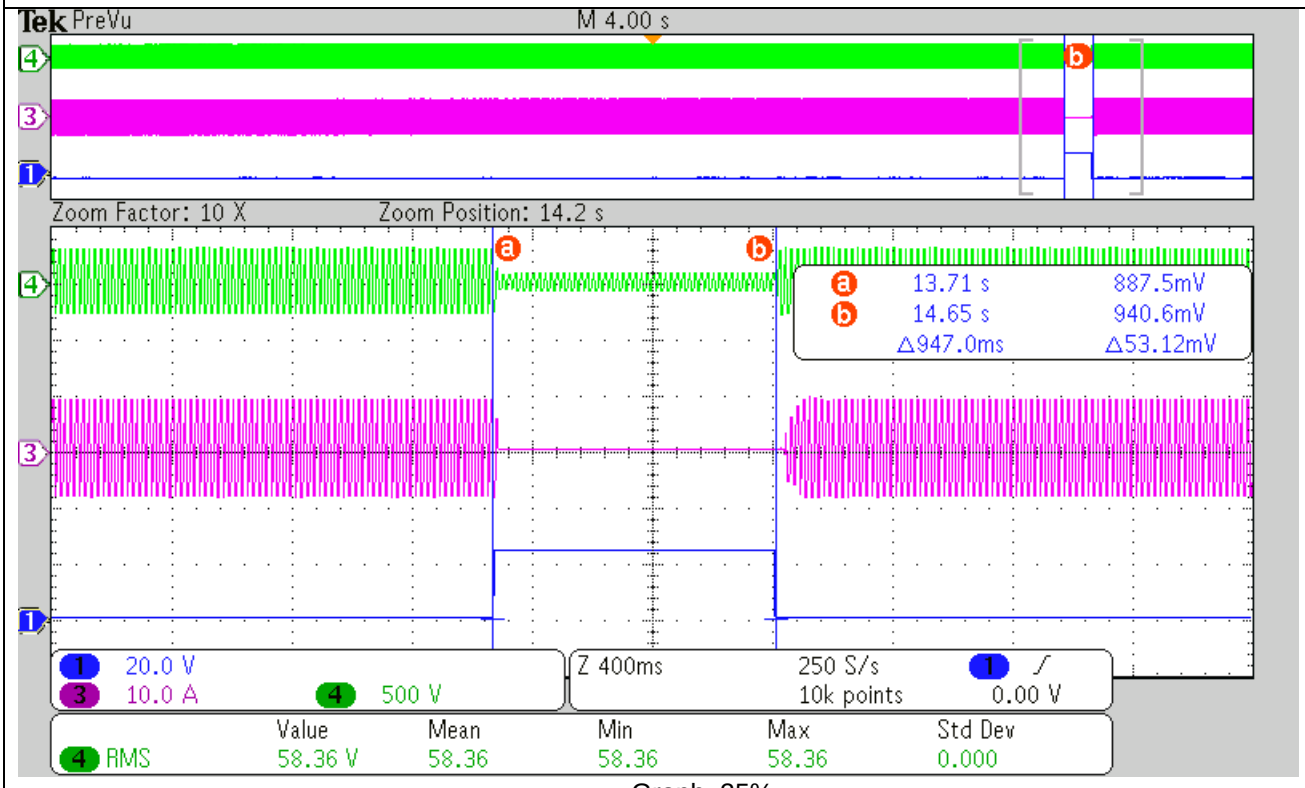
Udip	T min (ms)	U meas. (%)	T meas. (ms)	P recover (s)
5%	250	5.05%	252	0.080
25%	938	25.37%	947	0.068

50%	1797	50.39%	1800	0.083
75%	2656	74.61%	2660	0.125

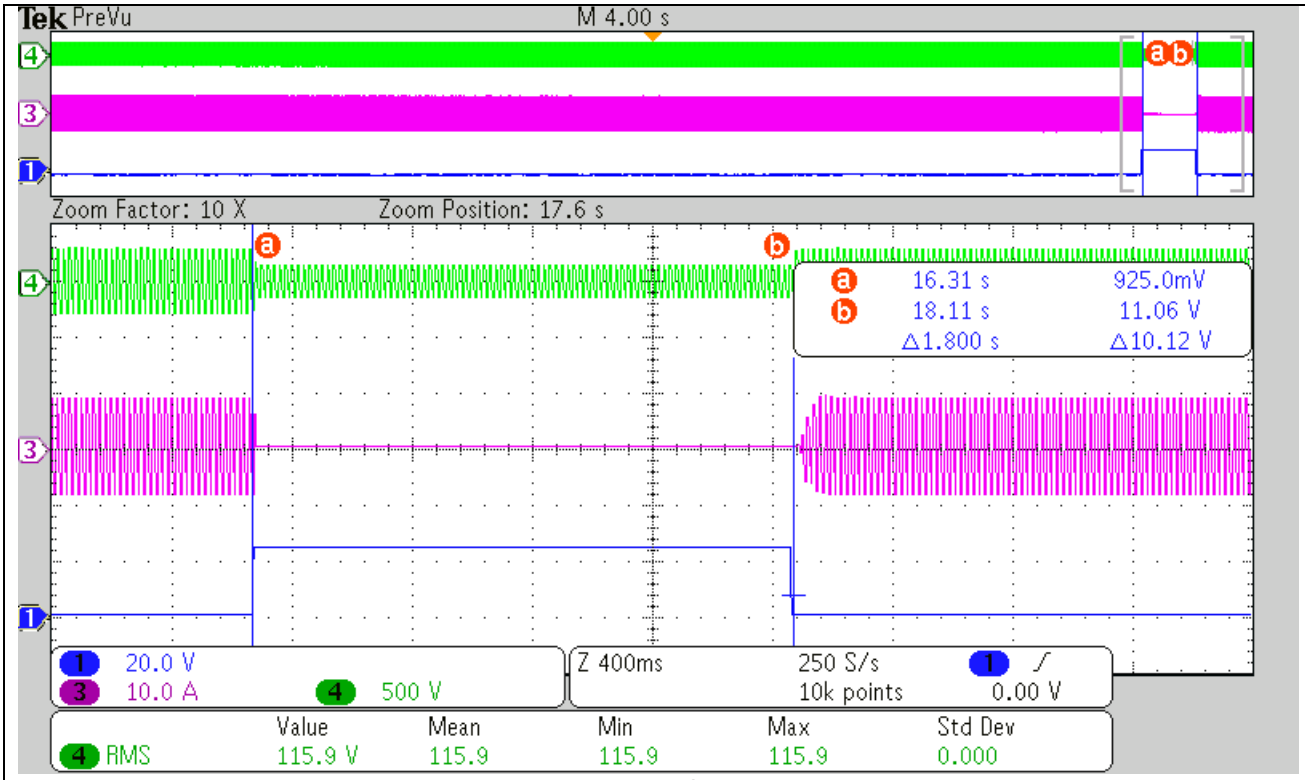
Remark:
The tests are performed together with clause 4.7.4.2.2 Zero current mode and enabling of default setting: Undervoltage of 50%Un.



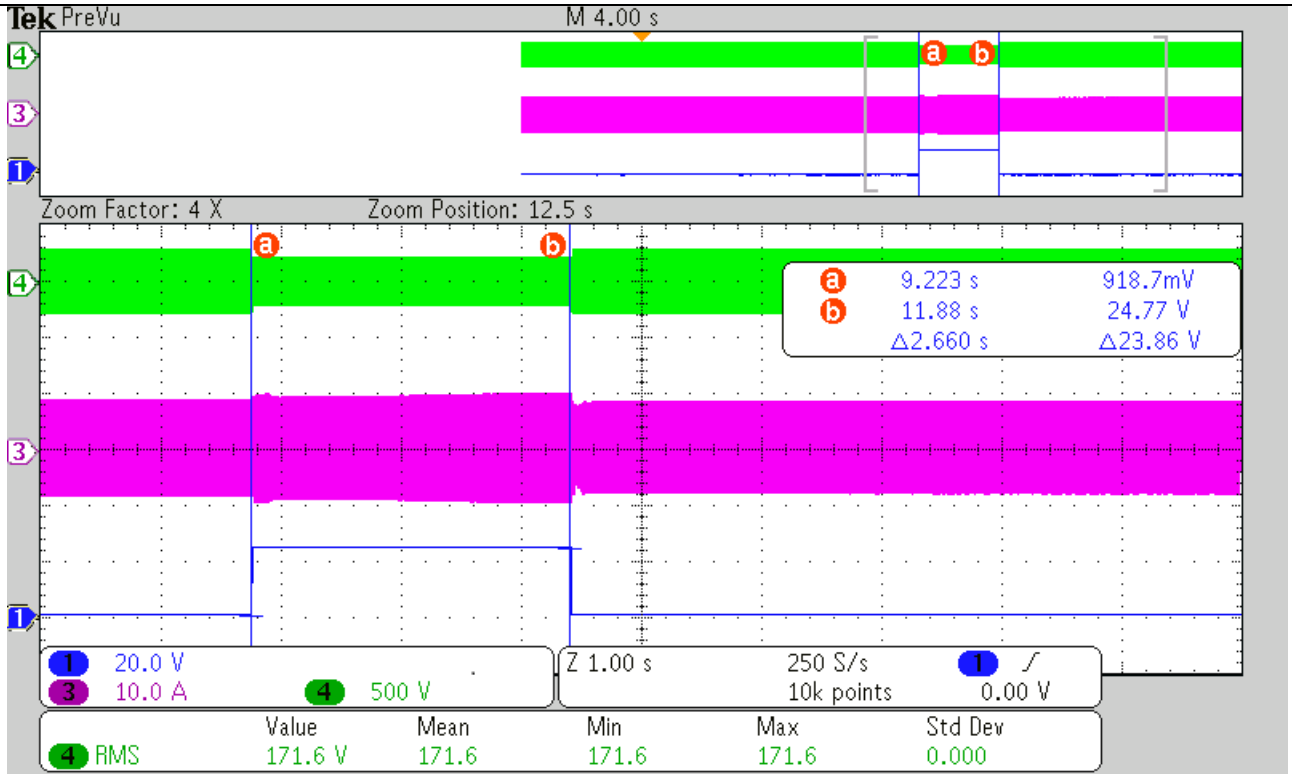
Graph_5%



Graph_25%



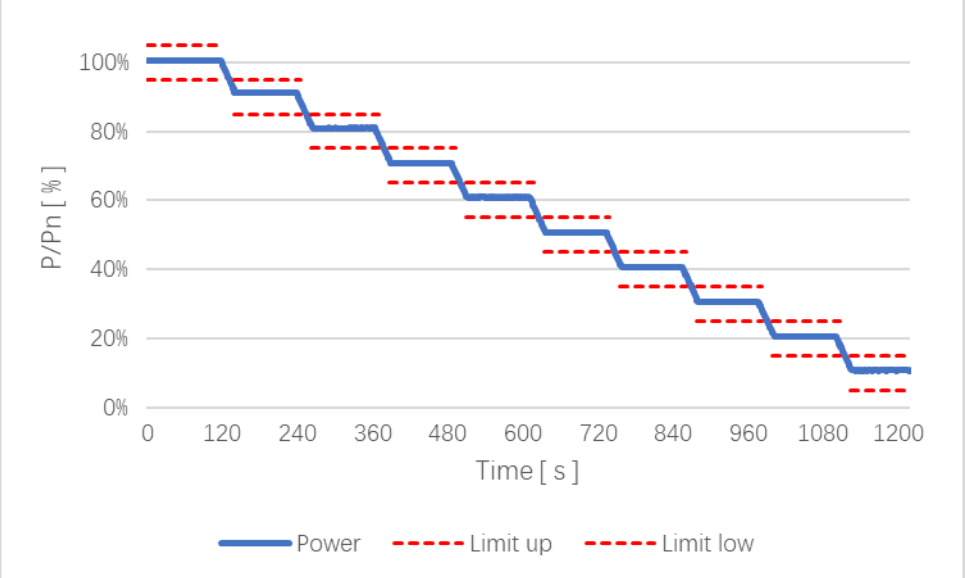
Graph_50%



Graph_75%

5.7.4.2.1(5.4.3) Active power reduction through setpoint specification

Model	HNS8000TL			
Measurement Item	Power Setting [W]	Actual Power [W]	Tolerance of power [%]	Δ P/ Pn [%]
100%	10000	10007	7	0.07
90%	9000	9084	84	0.84
80%	8000	8065	65	0.65
70%	7000	7060	60	0.60
60%	6000	6072	72	0.72
50%	5000	5039	39	0.39
40%	4000	4037	37	0.37
30%	3000	3036	36	0.36
20%	2000	2049	49	0.49
10%	1000	1088	88	0.88
Limitation of Δ P/ Pn	± 5%			



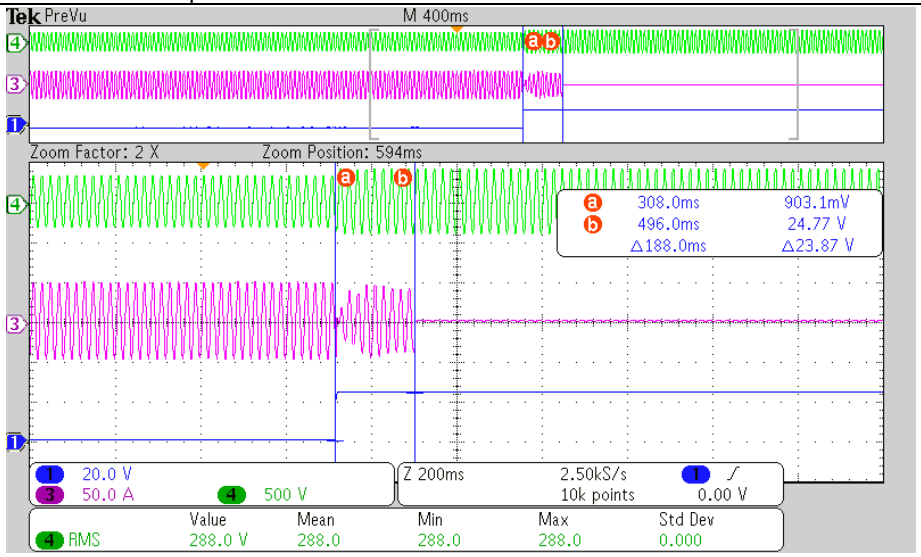
Power gradient (100%Pn ->5%Pn) [W/s]:	39.02W/s
Power gradient (5%Pn ->100%Pn) [W/s]:	42.69W/s
Limitation of gradient [W/s]	0.33%Pn – 0.66%Pn

5.7.4.2.3(5.4.4) Active power adjustment at over-frequency

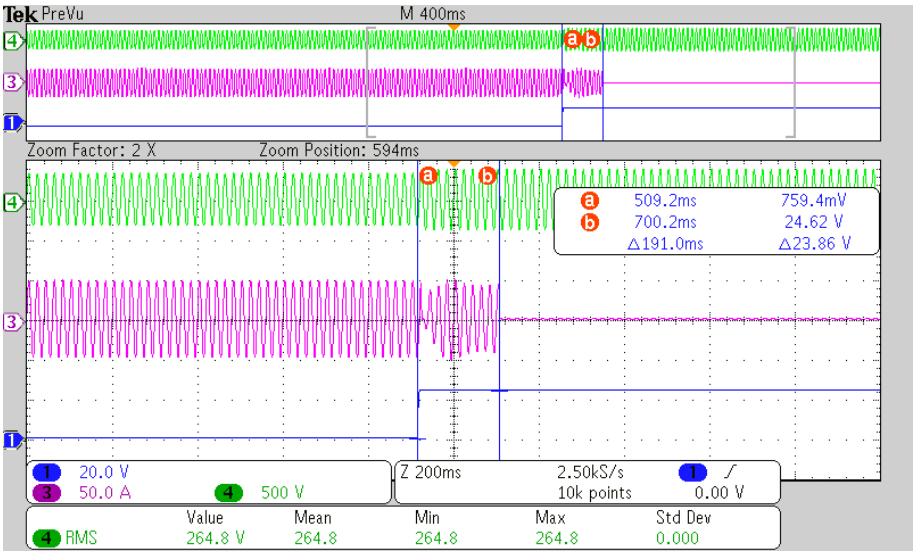
Model	HNS8000TL				
Frequency (Hz)	P (%)	Upper limit	Lower limit	W%-measure	P(w)
50.00	100.00%	105.00%	95.00%	100.02%	10002
50.20	100.00%	105.00%	95.00%	100.00%	10000
50.40	96.60%	101.60%	91.60%	96.59%	9659
50.60	93.20%	98.20%	88.20%	92.64%	9264
50.80	89.80%	94.80%	84.80%	88.65%	8865
51.00	86.40%	91.40%	81.40%	84.72%	8472
51.20	83.00%	88.00%	78.00%	80.54%	8054
51.40	79.60%	84.60%	74.60%	76.53%	7653
51.60	76.20%	81.20%	71.20%	72.73%	7273
51.80	72.80%	77.80%	67.80%	68.15%	6815
51.95	70.25%	75.25%	65.25%	66.16%	6616
51.80	72.80%	77.80%	67.80%	68.04%	6804
51.60	76.20%	81.20%	71.20%	72.10%	7210
51.40	79.60%	84.60%	74.60%	75.30%	7530
51.20	83.00%	88.00%	78.00%	79.06%	7906
51.00	86.40%	91.40%	81.40%	83.06%	8306
50.80	89.80%	94.80%	84.80%	86.96%	8696
50.60	93.20%	98.20%	88.20%	91.05%	9105
50.40	96.60%	101.60%	91.60%	95.25%	9525
50.20	100.00%	105.00%	95.00%	98.65%	9865
50.00	100.00%	105.00%	95.00%	99.09%	9909

6.5.2 Interface protection

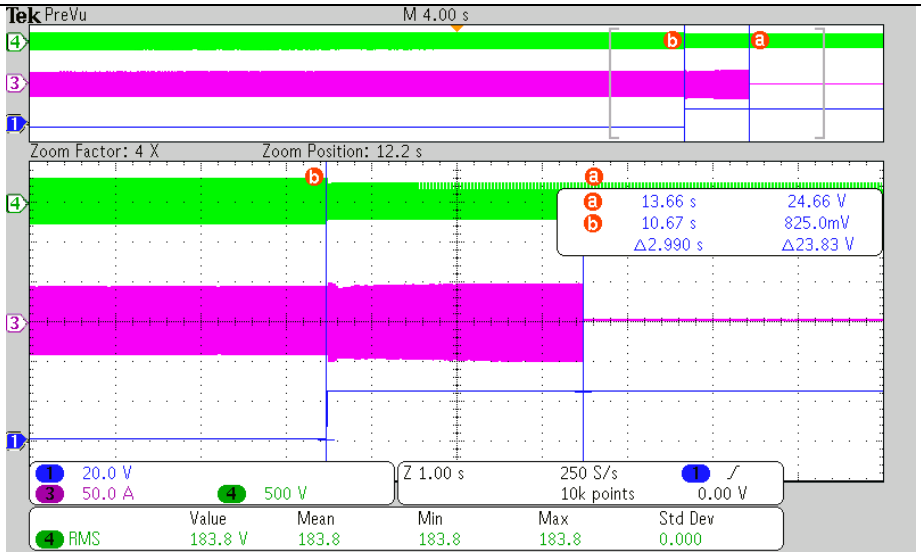
Interface protection- OV and UV						
Shall trip function	Default settings			Measure value		
	Voltage %	Voltage (V)	time (s)	Voltage (V)	Clearing time (s)	Result
OV2	1.25	287.5	0.2	1.25	0.188	Pass
OV1	1.15	264.5	0.2	1.15	0.191	Pass
UV1	0.80	184	3s	0.80	2.990	Pass
UV2	0.45	103.5	0.3	0.45	0.295	Pass
Remark: Max. Power model can represent the others model						



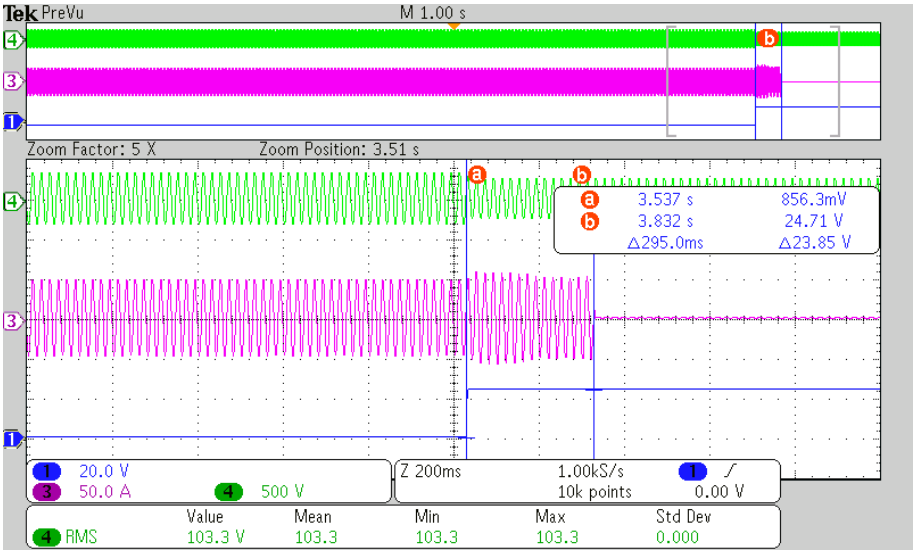
OV2



OV1



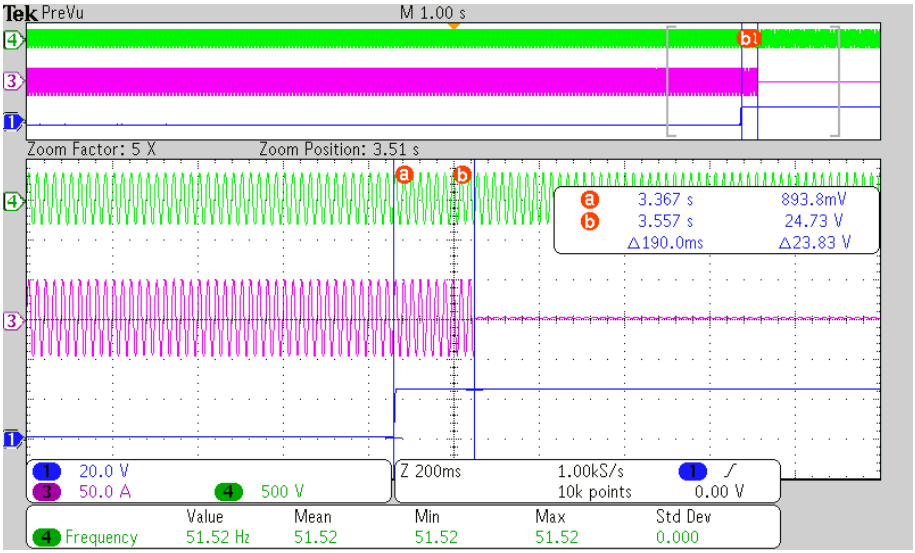
UV1



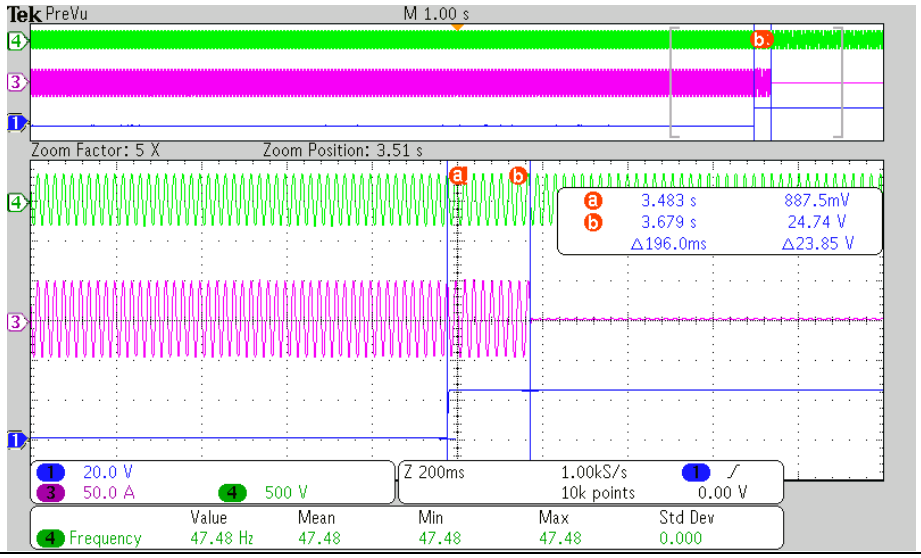
UV2

Interface protection- OF and UF						
Shall trip function	Default settings			Measure value		
	-	Frequency (Hz)	Limit time (s)	Frequency (Hz)	Clearing time (s)	Result
OF2	-	-	-	-	-	-
OF1	-	51.5Hz	200ms	51.52	0.190	Pass
UF1	-	47.5Hz	200ms	47.48	0.196	Pass
UF2	-	-	-	-	-	-
Remark: Max. Power model can represent the others model						

OF



UF



6.5.2 Interface protection （Overvoltage 10 min mean protection）

Overvoltage 10 min mean protection- setting 110%						
	V	Hold time (S)	On/Off state Finally		Trip time(S)	Limit time(S)
100% Un	230.0	600	☒On	☐Off	---	---
112% Un	257.6	>600	☐On	☒Off	499	600
100% Un	230.0	600	☒On	☐Off	---	---
108% Un	248.4	>600	☒On	☐Off	---	---
106% Un	243.8	>600	☒On	☐Off	---	---
114% Un	262.2	600	☐On	☒Off	237	375
Remark: the disconnect time within 600s & 300s is pass.						

6.5.3 Islanding detection

tested condition and run on time

Model		HNS10000TL							
No.	*P*EUT[1] (% of EUT rating)	Reactive load (% of QL in 6.1.d)1)	PAC [2] (% of nominal)	QAC [3] (% of nominal)	Run on time (ms)	P_{EUT} (W)	Actual Qf	V_{DC}	Remarks [4]
1.	100	100	0	0	224	10000	1.00	385	Test A at BL
2.	66	66	0	0	171	6600	0.99	330	Test B at BL
3.	33	33	0	0	246	3300	1.00	264	Test C at BL
4.	100	100	-5	-5	118	10000	1.02	385	Test A at IB
5.	100	100	-5	0	178	10000	1.05	385	Test A at IB
6.	100	100	-5	+5	152	10000	1.08	385	Test A at IB
7.	100	100	0	-5	121	10000	0.97	385	Test A at IB
8.	100	100	0	+5	167	10000	1.02	385	Test A at IB
9.	100	100	+5	-5	175	10000	0.93	385	Test A at IB
10.	100	100	+5	0	153	10000	0.95	385	Test A at IB
11.	100	100	+5	+5	148	10000	0.97	385	Test A at IB
12.	66	66	0	-5	137	6600	0.96	330	Test B at IB
13.	66	66	0	-4	150	6600	0.97	330	Test B at IB
14.	66	66	0	-3	145	6600	0.97	330	Test B at IB
15.	66	66	0	-2	156	6600	0.98	330	Test B at IB
16.	66	66	0	-1	149	6600	0.98	330	Test B at IB
17.	66	66	0	1	159	6600	0.99	330	Test B at IB
18.	66	66	0	2	165	6600	1.00	330	Test B at IB
19.	66	66	0	3	161	6600	1.00	330	Test B at IB
20.	66	66	0	4	163	6600	1.01	330	Test B at IB
21.	66	66	0	5	151	6600	1.01	330	Test B at IB
22.	33	33	0	-5	135	3300	0.97	264	Test C at IB
23.	33	33	0	-4	141	3300	0.98	264	Test C at IB
24.	33	33	0	-3	152	3300	0.98	264	Test C at IB
25.	33	33	0	-2	141	3300	0.99	264	Test C at IB
26.	33	33	0	-1	169	3300	0.99	264	Test C at IB
27.	33	33	0	1	191	3300	1.00	264	Test C at IB
28.	33	33	0	2	172	3300	1.01	264	Test C at IB
29.	33	33	0	3	173	3300	1.01	264	Test C at IB
30.	33	33	0	4	168	3300	1.02	264	Test A at BL
31.	33	33	0	5	165	3300	1.02	264	Test B at BL

Remark:
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

Model		HNS10000TL							
No.	*P*EUT[1] (% of EUT rating)	Reactive load (% of QL in 6.1.d)1)	PAC [2] (% of nominal)	QAC [3] (% of nominal)	Run on time (ms)	P_{EUT} (W)	Actual Qf	V_{DC}	Remarks [4]
condition value. 4) BL: Balance condition. IB: Imbalance condition.									

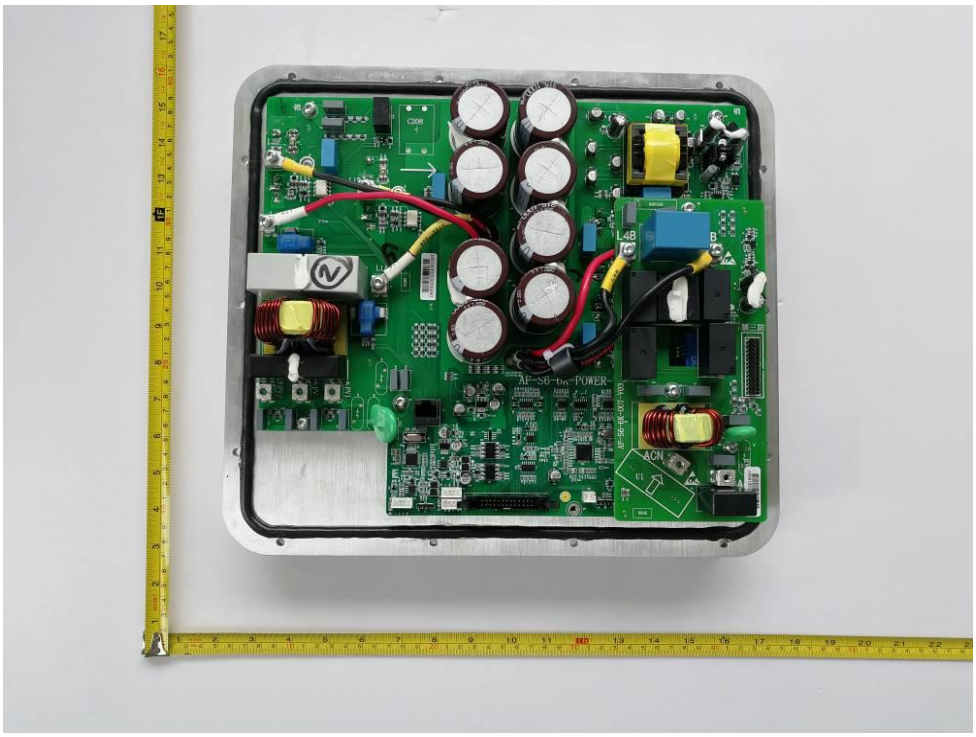
8.3 Connection conditions and synchronisation

Requirement	**Table 3 — Automatic reconnection after tripping**	
	Parameter	**Default setting**
	Lower frequency	49.5Hz
	Upper frequency	50.1Hz
	Lower voltage	85 % Un
	Upper voltage	110 % Un
	Observation time	60s
	Active power increase gradient	10%/min

8.3 Connection conditions and synchronisation				
Parameter			Default setting	Re-connection or time
Lower frequency	49.5Hz		49.45Hz	☐ Yes ☒ No
			49.55Hz	☒ Yes ☐ No
Upper frequency	50.1Hz		50.15Hz	☐ Yes ☒ No
			50.05Hz	☒ Yes ☐ No
Lower voltage	85 % Un		84%	☐ Yes ☒ No
			86%	☒ Yes ☐ No
Upper voltage	110 % Un		111%Un	☐ Yes ☒ No
			109%Un	☒ Yes ☐ No
Observation time			90s	60.3
Active power increase gradient			10% /min	9.98%/min

Appendix table 2 -Photos of the product

Overview-HNS5000TL

Overview-HNS5000TL


Appendix table3 -Photos of the product

Overview-HNS10000TL

Internal View-HNS10000TL